APPENDIX A
QUALITY ASSURANCE PROJECT PLAN

Quality Assurance Project Plan
Upland Remedial Investigation/Feasibility Study
March Point, Anacortes, Washington
File No. 0504-037-00

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TITLE AND APPROVAL PAGE
QUALITY ASSURANCE PROJECT PLAN
RI/FS - UPLAND SOIL AND GROUNDWATER
MARCH POINT LANDFILL

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UPLAND REMEDIAL INVESTIGATION/FEASIBILITY STUDY
MARCH POINT, ANACORTES, WASHINGTON
FOR
WASHINGTON STATE DEPARTMENT OF ECOLOGY

1.0 BACKGROUND

1.1 INTRODUCTION AND SITE HISTORY

March Point Landfill (landfill, aka Whitmarsh Landfill) is a high priority for cleanup under the Puget Sound Initiative, based on potential impact to Padilla Bay. The abandoned landfill is approximately 14 acres. The site is on tidelands at the base of a bluff, at the west-end head of Padilla Bay Lagoon. The landfill is bounded by South March Point Road and Highway 20 to the southwest, Padilla Bay and Padilla Bay Lagoon to the northeast, and the Swinomish Reservation and Swinomish Channel to the east .

Information is limited, related to the contents and fill history of the landfill and no soil and/or groundwater chemical analytical testing has been completed in the upland portion of the landfill. The landfill was an unregulated public dump from 1950 to 1973 and operated by Skagit County from 1961 to 1973. Skagit County used this Landfill as the primary disposal area from 1969 to 1973. The specific types and quantities of waste that has been buried at the Landfill are unknown. The waste that was dumped at the Landfill included household and commercial solid waste, and industrial waste from the Shell and Texaco refineries located within two miles of the Landfill. In addition, Allied Chemicals and Northwest Petrochemicals may also have contributed to the waste dumped at the Landfill. Large quantities of asbestos-containing materials may have been dumped at the Landfill.

According to previous investigations, 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 (PCB), and dioxins and furans.

1.2 SUMMARY OF EXISTING INFORMATION AND DATA GAP ANALYSIS

For a comprehensive discussion of site history and past data collection activities, refer to the Summary of Existing Information and Identification of Upland Data Gaps, March Point (aka Whitmarsh Landfill), Anacortes, Washington (GeoEngineers, 2007). This report, dated April 11, 2007 was submitted to Washington State Department of Ecology.

2.0 PROJECT DESCRIPTION

The purpose of the RI/FS for the upland area is to define the nature and extent of contamination in soil, groundwater, surface water and leachate, and to determine the feasibility of appropriate remedies. The RI/FS must be completed so that upland and sediment/aquatic remedies are addressed systematically and cohesively.

This Quality Assurance Project Plan (QAPP) was developed for the upland RI/FS activities at the March Point Landfill. The QAPP serves as the primary guide for the integration of quality assurance (QA) and quality control (QC) functions into project activities. The QAPP compiles the organization, objectives, and specific quality assurance and quality control activities required for project implementation and assessment This QAPP is based on guidelines specified in Washington Administrative Code (WAC) 173, Chapter 173-340 and Ecology guidance (February 2001).

Throughout the project, environmental measurements will be conducted to produce data that are scientifically valid, of known and acceptable quality, and meet established objectives. QA/QC procedures will be implemented so that precision, accuracy, representativeness, completeness, and comparability (PARCC) of data generated meet the specified data quality objectives.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The key project personnel are described in this section. Descriptions of the responsibilities, lines of authority and communication for the team members, with regard to quality assurance and quality control, are provided below. This organization facilitates the efficient production of project work, allows for an independent quality review, and permits resolution of any QA issues before submittal.

3.1 PROJECT LEADERSHIP AND MANAGEMENT

Within GeoEngineers there are two levels of project responsibility; the Principal-in-Charge and the Project Manager. The Principal-in-Charge is ultimately responsible for technical quality, schedule, budge, and staff resources for the project. This person is responsible to Ecology for fulfilling contractual and administrative control of the project, providing technical oversight, and providing overall review of project deliverables. Dave Cook is the Principle-in-Charge.

The Project Manager's duties consist of providing concise technical work statements for project tasks, selecting project team members, determining and coordinating subcontractor participation, providing technical direction to and supervising the field staff, establishing budgets and schedules, adhering to budgets and schedules, allocating resources for field tasks, supervising field personnel, providing technical oversight, and providing overall production and review of project deliverables. Neil Morton is the Project Manager for activities at the site.

3.2 FIELD COORDINATOR

The Field Manager is responsible for the daily management of activities in the field. Specific responsibilities include the following:

- Coordinate data collection activities to be consistent with information requirements.
- Supervise the compilation of field data and laboratory analytical results.
- Assure that data are correctly and completely reported.
- Implement and oversee field sampling in accordance with project plans.
- Coordinate work with on-site subcontractors.
- Schedule sample shipment with the analytical laboratory.
- Monitors that appropriate sampling, testing, and measurement procedures are followed.
- Coordinate the transfer of field data, sample tracking forms, and log books to the Project Manager for data reduction and validation.
- Participate in QA corrective actions as required.

3.3 QUALITY ASSURANCE LEADER

The GeoEngineers project QA Leader is Rob Smith. The Project QA Leader is responsible for coordinating QA/QC activities as they relate to the acquisition of field data. The QA Leader has the following responsibilities:

- Responds to laboratory data, QA needs, resolves issues, and answers requests for guidance and assistance.
- Reviews the implementation of the QAPP and the adequacy of the data generated from a quality perspective.
- Maintains the authority to implement corrective actions as necessary.
- Reviews and approves the laboratory QA Plan.
- Evaluates the laboratory's final QA report for any condition that adversely impacts data generation.
- Ensures that appropriate sampling, testing, and analysis procedures are followed and that correct quality control checks are implemented.
- Monitors subcontractor compliance with data quality requirements.

3.4 Data Validation Contractor

In addition, the Data Validation Contractor (EcoChem, Inc.) is responsible for QA oversight for analytical data quality evaluation and validation.

The Data Validation Contractor provides coordination of the QA/QC activities as they relate to Analytical data quality. Specific responsibilities include the following:

- Serve as the official contact for laboratory data quality control (QC) concerns.
- Respond to laboratory data QC issues, resolves chemistry data quality issues, and answers requests for guidance and assistance.
- Prepare the QAPP and then evaluates the adequacy of the data generated from a quality perspective.
- Implement corrective actions as necessary.
- Evaluate and validate the laboratory analytical data and applies qualifiers as necessary.
- Ensure that correct quality control checks for sampling, testing, and analysis procedures are implemented and documented.

3.5 Laboratory Project Management

The subcontracted laboratory (laboratories) conducting sample analyses for this project is (are) required to obtain approval from the QA Leader or Data Validation Contractor before the initiation of sample analysis to assure that the laboratory QA plan complies with the project QA objectives. The Laboratory's QA Coordinator will ensure that the Laboratory QA Plan is followed and is responsible for project quality control (QC). Specific responsibilities of this position include:

- Ensure implementation of the Laboratory *Quality Assurance Plan*.
- Serve as the laboratory point of contact.
- Activate corrective action for out-of-control events.
- Issue the final laboratory data reports, both hardcopy and EDD.
- Comply with the specifications established in the project plans as related to laboratory services.
- Participate in QA audits and compliance inspections (as applicable).

4.0 QUALITY ASSURANCE OBJECTIVES

The overall quality objective for the data used to support RI/FS activities is that the data are of known, acceptable, and documented quality. This objective can be achieved by establishing the following goals for data quality:

- Implement the procedures outlined in this QAPP for field sampling, sample custody, equipment operation and calibration, laboratory analysis, and data reporting so that consistency and thoroughness of data generation are facilitated.
- Achieve the acceptable level of quality required so that data generated are scientifically valid and of known and documented quality. This will be accomplished by establishing measurement quality objectives (MQO) for the key quality indicators i.e., precision, bias (accuracy), representativeness, completeness, and comparability, and by evaluating data against these MQO.

4.1 MEASUREMENT QUALITY OBJECTIVES (MQO)

Usability of the data will be based on both quantitative (precision, accuracy/bias, and completeness) and qualitative (representativeness and comparability) quality assurance objectives. The measurement goals for the project data, based on the data quality indicators discussed in the following sections. A summary of the project MQO is provided in Table 1. The MQOs presented in Table 1 are estimates. Laboratory MQOs will be appended to the QAPP when laboratory selection and contracting is complete.

4.1.1 Precision

Precision is a measure of the variability in the results of replicate measurements due to random error. Random errors are always present because of normal variability in the many factors that affect measurement results. Precision can also be affected by the variations of the actual concentrations in the media being sampled (Ecology, 2004). The closer the measured values are to each other, the more precise the measurement process. Precision error may affect data usefulness. Good precision is indicative of relative consistency and comparability between different samples.

Field precision will be assessed through the collection and measurement of field duplicates at a rate of one duplicate per 20 field samples, or a minimum of 1 per day. These analyses measure both field and Laboratory precision. The results, therefore, may have more variability than Laboratory duplicates that measure only Laboratory performance. It is expected that soil duplicate results will have a greater variance than water matrices due to difficulties associated with collecting identical field duplicate samples.

Laboratory precision is assessed through analysis of duplicate spiked and/or unspiked samples, as specified by the analytical method. Specific discussion of the different types of laboratory duplicate samples is found in Section 10.1.

The RPD value will be calculated according to the following formula:

$$RPD\ (\%) = \frac{|D_1 - D_2|}{(D_1 + D_2)/2} X\ 100,$$

Where:

D_1=Concentration of analyte in sample.

D_2=Concentration of analyte in duplicate sample.

The calculation applies to split samples, replicate analyses, duplicate spiked environmental samples (matrix spike duplicates), and laboratory control duplicates. The RPD will be calculated for samples and compared to the applicable criteria. Precision may also be expressed as the percent difference (%D) between replicate analyses. During data validation, DV Contractor will evaluate all RPD values and take action as described in *National Functional Guidelines for Organic Data Review* (USEPA 1999) and *National Functional Guidelines Inorganic Data Review* (USEPA 2002).

4.1.2 Bias (Accuracy)

Accuracy is a measure of bias in the analytic process. The closer the measurement value is to the true value, the greater the accuracy. This measure is defined as the difference between the reported values versus the actual values and is often measured with the addition of a known compound to a sample. The amount of known compound reported in the sample, or percent recovery, assists in determining the performance of the analytical system in correctly quantifying the compounds of interest. Since most environmental data collected represent one point spatially and temporally rather than an average of values, accuracy plays a greater role than precision in assessing the results. In general, if the percent recovery is low, non-detect results may indicate that compounds of interest are not present when in fact these compounds are present. Detected compounds may be biased low or reported at a value less than actual environmental conditions. The reverse is true when recoveries are high. Non-detect values are considered accurate while detected results may be higher than the true value.

Accuracy will be expressed as the percent recovery of a surrogate compound (also know as "system monitoring compound"), a matrix spike result, or from a standard reference material where:

$$Recovery\ (\%) = \frac{Sample\ Result}{Spike\ Amount} X\ 100$$

The DV Contractor will evaluate all %R values and take action as described in *National Functional Guidelines for Organic Data Review* (USEPA 1999) and *National Functional Guidelines Inorganic Data Review* (USEPA 2002).

4.1.3 Sensitivity

Analytical methods have quantitative limitations at a given statistical level of confidence that are often expressed as the method detection limit (MDL). Although results reported near the MDL provide insight to site conditions, quality assurance requires that analytical methods achieve a consistently reliable level

of quantitation known as the practical quantitation limit (PQL). The Laboratory will provide numerical results for all analytes and report them as detected above the PQL or undetected at the PQL.

Analytical detection limits for the target analytes are helpful in providing statistically useful data. Intended data uses, such as comparison to regulatory criteria or risk assessment, usually dictate specific target reporting levels necessary to fulfill stated objectives. The analytical methods and processes selected should provide a PQL lower than the target reporting level (e.g., lowest regulatory cleanup level) under ideal conditions. The reporting limit listed in Tables 2 through 15 are considered "target" reporting limits because several factors may influence laboratory practical quantitation limits and individual sample quantitation limits. First, physical conditions of soil (e.g., moisture, compaction, composition) affect detection limits. Second, analytical procedures may require sample dilutions and/or clean up and reanalysis to accurately quantify a particular analyte at concentrations above the range of the instrument. The effect is that other analytes may be reported as undetected at a PQL much higher than a specified regulatory cleanup level. Data users must be aware that high non-detect values, although correctly reported, can bias statistical summaries and careful interpretation is required to correctly characterize site conditions. During data validation, evaluation will be made and the most appropriate result for each analyte will be reported.

4.1.4 Representativeness, Completeness And Comparability

To be considered representative, a data set should accurately and precisely represent the actual site conditions. The determination of the representativeness of the data will be performed by completing the following:

- Comparing actual sampling procedures to those prescribed within the Field Sampling Plan (FSP) and this QAPP.
- Comparing analytical results from field duplicates to determine variation in the analytical results.
- Invalidating non-representative data or identifying data that is questionable or qualitative. Only representative data will be used in subsequent data reduction, validation, and reporting activities.

Completeness will establish whether a sufficient amount of valid measurements were obtained to meet project goals. The number of samples and results expected establishes the comparative basis for completeness and is defined as a ratio of acceptable measurements (including estimated data) obtained to the total number of planned measurements for an activity. Completeness (C) can be calculated as follows:

$$\%C = \frac{\text{(number of acceptable data points)} \times 100}{\text{(total number of data points)}}$$

The completeness goal is 95 percent useable data for samples/analyses planned. If the completeness goal is not achieved an evaluation will be made to determine if the data are adequate to meet study objectives.

Comparability expresses the confidence with which one set of data can be compared to another. Since numeric goals do not exist for comparability, a statement of comparability will be prepared to determine overall usefulness of data sets, following the determination of both precision and accuracy. This statement will be included in RI/FS final reports.

5.0 SAMPLING PROCESS DESIGN

Section 6.0 of the Draft Upland RI/FS Work Plan presents design of the proposed sampling program for the collection of chemical and physical data at March Point. The data are intended to augment existing data for use in the current RI/FS. The quality of data collected depends critically on the quality of the sampling process and field activities. Field activities and practices must be planned and implemented to ensure the integrity of the samples and resulting data.

6.0 SAMPLE COLLECTION, HANDLING AND CUSTODY

6.1 Sample Containers And Labeling

The Field Coordinator will establish field protocols to manage field sample collection, handling, and documentation. Samples obtained during this study will be placed in appropriate pre-cleaned containers Sample containers, preservation and holding times are listed in Table 16.

Holding times are defined as the time between sample collection and extraction, sample collection and analysis, or sample extraction and analysis. Some analytical methods specify a holding time for analysis only. If a sample exceeds a holding time, then the results may be biased low. During data validation, DV Contractor will evaluate all holding time values and take action as described in *National Functional Guidelines for Organic Data Review* (USEPA 1999) and *National Functional Guidelines Inorganic Data Review* (USEPA 2002).

6.1.1 Sample Designation

Each sample collected during the field activities will be identified by a unique sample designation. The sample designation will be included on the sample label. For soil samples, the designation will also be included with the corresponding sample information on the appropriate boring or test pit log. The following designation system will be used for this project.

Samples collected will be assigned a unique identification code based on a consistent sample designation scheme. The sample designation scheme is designed to suit the needs of the field staff, data management, and data users.

Samples will consist of three components separated by a dash. These components are station code, date, and sample interval. The sample designation is as follows:

Station Code	Date Sample	Number
SSnn	YYMMDD	XX

6.1.1.1 Station Code

The station code component is a four-character code that uniquely identifies each sampling station. The station code component has two parts: a two or three letter station designation "SS" followed by a two number sequential component "nn"; the sequential component will begin at 01 (i.e., 01, 02, 03, etc.).

- HSA – Hollow Stem Auger
- TP – Test Pit
- MW – Monitoring Well
- SW – Surface Water

- LE – Leachate

6.1.1.2 Date

The date component is a six-character code that presents the date that the sample was collected in the following format: year, month, day (YYMMDD).

6.1.1.3 Sample Number

The sample number component is a two digit code that identifies the order that samples were collected from a sample location. For soil samples, the first sequential component will begin at 01 (i.e., 01, 02, 03, etc.) and will start at the most shallow sample collected and will continue down to the last sample collected form a particular boring.

6.1.1.4 Examples

Examples of complete sample numbers with descriptions are as follows:

- HSA05-070715-7.5 = soil sample collected at station HSA05 on July 15, 2007 from a depth of 7.5 feet.
- MW02-070715-W = groundwater sample collected from monitoring well MW02 on July 15, 2007.

Under the sample designation method described above, the identifier will be unique (i.e., no two samples will have the same identifier), and informative (i.e., location, date, and sample interval). This designation will facilitate overall data management and submittal into Ecology's EIMS database.

6.1.2 Sample Labeling

Sample information will be printed legibly onto the sample labels in indelible ink. Field identification will be sufficient to enable cross reference with the project logbook. For chain-of-custody purposes, all QA/QC samples will be subject to the same custodial procedures and documentation as field samples.

To minimize handling of sample containers, labels will be completed before sample collection to the extent possible. The label will be filled out completely in the field and attached firmly to the sample container. The sample label will provide the following information:

- GeoEngineer's job number
- Sample designation
- Date of sample collection (month/day/year)
- Time of sample collection (hours:minutes)
- Chemical analyses to be conducted
- Sample preservation, if applicable
- Initials of sampler

6.1.3 Field Log Books

The sample collection activities will be noted in the field log books. The Field Coordinator will monitor consistency between the FSP, sample containers/labels, field logbooks, and the chain-of-custody.

6.2 Sample Storage On Site

Samples will be placed in a cooler with proper icing immediately after they are collected. The objective of the cold storage will be to attain a sample temperature of 4 degrees Celsius. Field samplers will make every attempt to have the samples delivered to the Laboratory with adequate holding time remaining. Holding times will be observed during sample storage.

6.3 Sampling Equipment Decontamination

The drilling equipment will be decontaminated before use, between drilling each boring and after use, and will include pressure washing. Reusable sampling/monitoring equipment (trowels, groundwater sampling equipment, and water level measurement instruments, etc.) that comes in contact with soil or groundwater will be decontaminated before each use. Decontamination procedures will follow specifications outlined in the work plan (Section 6.4.5).

6.4 Sample Custody Procedures

Chain-of-custody procedures are used to maintain and document sample possession. For the purposes of this project, sample identification must be traceable from collection through data use. The principal documents used are:

- Sample labels
- Sample custody seals
- Field sampling records
- Chain-of-custody forms
- Shipping records
- Laboratory routing records

After collection, samples will be maintained in the sampler's custody until formally transferred to another party. Strict chain-of-custody procedures will be followed to maximize sample integrity and accountability during the project. The chain-of-custody will begin when the sample is collected and will be maintained until final disposal of the sample.

6.4.1 Field Custody And Chain-Of-Custody Forms

The Field Coordinator or designated representative is responsible for the custody of the samples until they are formally transferred to another party or delivered to the analytical laboratory. For purposes of this project, a sample is under a person's custody if the sample meets any of the following criteria:

- In possession of the sampling personnel or Field Manager
- In a person's plain view after being in his/her possession
- Inside a cooler in a person's plain view
- Inside any locked space, such as a cooler or locked vehicle, to which the field representative has the only immediately available key

Any transfer of samples will be accompanied by a properly completed chain-of-custody form. When transferring the possession of samples, both the individuals relinquishing and receiving the samples will sign, date, and record the time on the chain-of-custody form. This form is signed by the sampler and any

others who subsequently hold custody of the sample, including another person, mobile laboratory, permanent laboratory, or secure storage area. A copy of the chain-of-custody form will be retained by the sampler and maintained in the project files. The original form will accompany the samples.

The chain-of-custody forms will contain, at the minimum, the following information:

- Project name and number
- Sample designation
- Signature or initials of the sampler
- Date and time of sample collection
- Sample matrix (soil, water, etc.) and number of containers from each sampling point, including preservatives used, if any.
- Analysis to be performed
- Signatures of all persons involved in the chain of possession, inclusive dates and times of possession

The chain-of-custody form will also be used to indicate which analyses are to be performed on each sample. This enables the laboratory to ascertain at the time of sample receipt whether all of the samples that are expected have arrived.

6.4.2 Sample Transportation

All coolers containing samples will be sealed with a custody seal. Couriers handling sample shipments will not be required to sign off on the chain-of-custody form as long as the custody seals remain intact.

6.4.3 Laboratory Custody And Sample Routing Forms

A designated laboratory sample custodian will accept custody of the samples and verify that the chain-of-custody form matches the samples received. Samples will be logged in and assigned a unique laboratory sample identification number. Samples and sample aliquots, including sample extracts, will be tracked through laboratory analysis using laboratory sampling routing forms. Details of the Laboratory sample control, record-keeping, and document control should be included in the Laboratory *Quality Assurance Manual*.

6.5 Field Documentation

Field documentation provides important information about potential problems or special circumstances surrounding sample collection. Field personnel will maintain daily field logs while on-site. The field logs will be prepared on field report forms or in a bound logbook. . Field forms will become part of the project files at the conclusion of this field exploration. The handling, use, and maintenance of field log books are the field coordinator's responsibilities.

At a minimum, the following information will be recorded during the collection of each sample:

- Sampler's name(s)
- Date and time of sample collection
- Designation of sample as composite or discrete
- Type of sample (soil or water)

- Type of sampling equipment used
- Field instrument readings, if any
- Field observations and details that are pertinent to the integrity/condition of the samples (e.g., weather conditions, performance of the sampling equipment, sample depth control, sample disturbance, etc.)
- Sample preservation, if any
- Shipping arrangements (overnight air bill number), if applicable
- Name of recipient laboratory

In addition to the sampling information, the following specific information also will be recorded in the field log for each day of sampling:

- Time of arrival/entry on Site and time of Site departure
- Other personnel present at the Site
- Summary of pertinent meetings or discussions with regulatory agency or contractor personnel
- Deviations from sampling plans, Site safety plans, and QAPP procedures
- Changes in personnel and responsibilities with reasons for the changes
- Levels of safety protection
- Calibration readings for any equipment used and equipment model and serial number

7.0 MEASUREMENT PROCEDURES

7.1 LABORATORY MEASUREMENT PROCEDURES

Chemical analysis methods were selected on the basis of detection and quantitation limits and the level of analytical quality control needed to meet data quality objectives and intended data uses. Standard EPA and ASTM methods will be used for all analyses. Analytical methods are from the following documents:

- Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd edition. (USEPA, 1986).
- Standard Methods for the Examination of Water and Wastewater, 17th Edition (American Public Health Association, 1989).

The contracted Laboratory will be included in the analytical planning and will provide the Contractor with documented performance characteristics (precision, bias/accuracy and sensitivity) for all requested analytical methods. Where possible, methods will be chosen to provide a method detection limits (MDL) five to tem times below the target reporting limit [aka lowest concentration of interest)]. Additional considerations for specific method selection or modification may be:

- Definition of the parameter and the forms to be measured (i.e., dissolved and/or total metals)
- Concentration ranges
- Number of samples to be analyzed per analytical batch
- Sample size available
- Holding time requirements

- Cost of analysis

Reference methods, analytes, matrices, CAS No., target reporting limits, and reference levels listed in Tables 2 through 15. Soil and surface water reference levels were identified using the following sources:

- Soil: MTCA Method A (unrestricted land use) and Method B soil cleanup levels (Direct Contact).
- Surface Water: Aquatic marine chronic and human health (fish ingestion) water quality criteria (WQC) published in Chapter 1730201A WAC, Section 304 of the Clean Water Act, and the National Toxics Rule. MTCA Method B surface water cleanup levels.

The target reporting limits in Tables 2 through 15 are the lowest soil and surface water reference levels for each analyte, when available. For analytes with no soil or surface water reference levels, standard laboratory reporting limits are included in Tables 2 through 15.

Expected range of results and schedule of sample delivery are not known at the time of QAPP preparation. Laboratory practical quantitation limits (PQL) will be appended to the QAPP when Laboratory selection and contracting is complete.

The selected laboratory will provide a copy of laboratory QA/QC procedures to Ecology for informational purposes and review.

7.2 Field Measurement Procedures

Field equipment will be used in general accordance with the manufacturer's recommendations.

8.0 QUALITY CONTROL

8.1 Analytical Quality Control

Quality control sample types and required frequency are summarized in Table 17.

8.1.1 Laboratory Instrument Calibration

Several types of calibrations are used, depending on the method, to determine whether the linearity of the instrument is in control and to assure that the sample results reflect accurate and precise measurements.

The laboratory calibration procedures will be performed in accordance with the analytical methods cited and laboratory standard operating procedures. Calibration documentation will be retained at the laboratory and readily available for review. Preparing and analyzing calibration standards at appropriate levels for the analytes of interest monitor instrument calibration.

Calibration check standards are analyzed before and after each batch of samples. If recovery is not within acceptable method criteria, the standards and all samples will be reanalyzed.

8.1.2 Laboratory Method Blanks

According to the *National Functional Guidelines for Organic Data Review* (USEPA 1999) and *National Functional Guidelines Inorganic Data Review* (USEPA 2002):

"The purpose of laboratory (or field) blank analyses is to determine the existence and magnitude of contamination resulting from laboratory (or field) activities. The criteria for evaluation of blanks apply to

any blank associated with the samples (e.g., method blanks, instrument blanks, trip blanks, and equipment blanks)".

Method blanks are created in the laboratory during sample preparation and follow samples throughout the analysis process. Frequency of method blanks will be one per 20 or fewer field samples per matrix.

Method blanks are laboratory quality control (QC) samples that consist of either a soil like material having undergone a contaminant destruction process or DI water. Method blanks will be extracted and analyzed at a minimum of 5% or with each batch of 20 samples or fewer for each matrix. If a substance is found in the method blank then one (or more) of the following occurred:

- Measurement apparatus or containers were not properly cleaned and contained contaminants.
- Reagents used in the process were contaminated with a substance(s) of interest.
- Contaminated analytical equipment was not properly cleaned.
- Volatile substances in the air contaminated the samples during preparation or analysis.

Given method blank results, validation guidelines aid in determining which substances in samples are considered "real," and which ones are attributable to the analytical process.

During data validation, DV Contractor will evaluate all method and field blank sample results and take action as described in *National Functional Guidelines for Organic Data Review* (USEPA 1999) and *National Functional Guidelines Inorganic Data Review* (USEPA 2002); professional judgment will be applied as necessary.

8.1.3 Matrix Spike/Spike Duplicates (Ms/Msd)

Laboratory precision will be determined by splitting spiked or unspiked samples. This allows the analyst to determine the precision of the preparation and analytical techniques used to analyze the duplicate sample. Matrix spike samples are prepared by choosing a sample at random from each sample shipment received at the laboratory or is pre-selected by field personnel and labeled accordingly; dividing the sample into equal aliquots, and then spiking each of the aliquots with a known concentration.

Matrix spike/matrix spike duplicate sample analyses are used to determine accuracy and precision and to assess interferences caused by the physical or chemical properties of the sample itself. Matrix spike samples are prepared by spiking a known amount of one or more of the target analytes at a concentration of 5 to 10 times higher than the expected sample result. Matrix spikes will be prepared and analyzed at a minimum of 5% or with each batch of 20 samples or fewer for each matrix.

MS/MSD data are reviewed in combination with other data quality indicators (e.g., LCS/LCSD) to determine matrix effects. In some cases, matrix affects cannot be determined due to dilution and/or high levels of related substances in the sample.

8.1.4 Laboratory Control Spikes/Spike Duplicates (Lcs/Lcsd)

The purpose of the laboratory control spike samples (also known as blank spikes) is to aid in assessment of overall accuracy and precision of the entire analytical process e.g., sample preparation, instrument performance, and analyst performance. LCS will be prepared and analyzed at a minimum of 5% or with each batch of 20 samples or fewer for each matrix. LCS are similar to matrix spikes however, the LCS spike media is "clean" or contaminant free.

8.1.5 Laboratory Replicates/Duplicates

Precision for inorganic analytes is monitored by analysis of sample replicates/duplicates. Laboratory duplicate sample analysis, for inorganic analytes, will be prepared and analyzed at a minimum of 5% or with each batch of 20 samples or fewer for each matrix.

8.1.6 Surrogate Spikes

Surrogate spike compounds are used during analysis for organic analytes in order to verify the accuracy of the instrument being used and assess extraction efficiency. Surrogates are substances similar to, but not one of, the target analytes. A known concentration of surrogate is added to the sample and passed through the instrument, recording the surrogate recovery. Each surrogate used has an acceptable range of percent recovery, listed in Table 1. If a surrogate recovery is low, sample results may be biased low and depending on the recovery value, a possibility of false negatives may exist. Conversely, when recoveries are above the specified range of acceptance a possibility of false positives exist, although non-detected results are considered accurate.

8.2 Field Quality Control

8.2.1 Field Equipment Calibration Procedures

Field equipment requiring calibration will be calibrated to known standards in accordance with manufactures 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.

8.2.2 Equipment (Rinsate) Blanks

Equipment blank samples will be collected once per matrix. Equipment blank samples, collected by routing laboratory-provided deionized water (for inorganic analyses), or organic-free water (for organic analyses) through decontaminated sampling equipment, will be analyzed to check procedural contamination and/or ambient conditions and/or sample container contamination at that may cause sample contamination. If disposable sampling equipment is used, equipment rinsate blanks are not required.

8.2.3 Field Duplicates

Field duplicates serve as measures for precision. Under ideal field conditions, field duplicates are created when a volume of the sample matrix is thoroughly mixed, placed in separate containers, and identified as different samples. This tests both the precision and consistency of laboratory analytical procedures and methods, and the consistency of the sampling techniques used by field personnel.

Groundwater, surface water, and leachate field duplicates will be collected at a rate of 1 per 20 samples.

8.2.4 Trip Blanks

Trip blank samples, consisting of organic-free water poured into 40 ml sample vials at the laboratory under contaminant-free conditions, will be provided by the Laboratory for each sample cooler. Trip blank samples will be handled in a manner consistent with actual field samples, but will not be opened and will be shipped back to the laboratory with the samples. Trip blank samples are analyzed for volatile organic compounds (VOC) and will provide a measure of potential cross-contamination volatile organic compounds during shipment and handling.

8.3 CORRECTIVE ACTION

Corrective action is the process of identifying, recommending, approving and implementing measures to counter unacceptable procedures or QC performance outside established criteria. Corrective action can occur during field activities, laboratory analyses, data validation and data assessment.

Corrective actions should be designed to correct the problem and to minimize the possibility of its recurrence. Examples of corrective actions are modification of nonconforming procedures, forms or worksheets; institution of a quality check, etc. Proposed corrective actions should be reviewed and approved by the QA Manager prior to implementation. An example Corrective Action Report is provided as Figure 1. Significant non-compliance and corrective actions will be discussed in quality assurance reports to Contractor Project Management and Department of Ecology, as appropriate.

8.3.1 Field Corrective Action

Project personnel will be responsible for reporting technical or QA non-conformances or deficiencies of any activity or issued document to the Field Manager. The Field Manager will consult with the Contractor QA Manager to determine whether the situation warrants a reportable nonconformance and subsequent corrective action. If so, a CAR will be initiated by the Contractor QA Manager.

Corrective actions will be implemented and documented in the field record log. No staff member will initiate corrective action without prior communication of findings using the process described above.

8.3.2 Laboratory Corrective Action

Corrective action by the laboratory may occur prior to, during and or initial analyses. Conditions such as broken sample containers, multiple phases, low/high pH readings and potentially high concentration samples may be identified during sample log-in or prior to analysis.

Laboratory corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike and calibration mixes, instrument sensitivity, etc. If the problem persists, or cannot be identified, the problem should be referred to the supervisor, manager and/or Laboratory QA Manager for further investigation and possible formal corrective action.

The contracted Laboratory's *Quality Assurance Plan* should include specific procedures for identification and documentation of nonconformance and implementation and reporting of corrective actions.

8.3.3 Corrective Actions Resulting From Data Validation

If necessary, the DV Contractor will contact the laboratory for further information, clarification, or needed re-submissions and/or corrective actions. All communications will be documented and included with the data validation report as an appendix.

In cases where a deficiency or problem is a recurring nonconformance, requiring more extensive corrective action, it should be documented on a formal CAR. The CAR will be sent to the organization responsible for the corrective action, and a copy routed to the Contractor QA Manager. When the corrective action is complete, the DV Contractor will complete the CAR.

9.0 DATA MANAGEMENT PROCEDURES

9.1 DATA REPORTING

Soil, surface water, groundwater and leachate samples, collected by Contractor will be received by Laboratory as sample delivery groups (SDG). A SDG is defined as all samples received by Laboratory on a given day. The samples are then analyzed as an analytical lot (or QC batch), defined as a group of samples that are analyzed by a specified method and supported by appropriate batch-specific quality control samples. The number of samples in a lot is determined by the rate-delimiting step in the method e.g., 12-hour calibration or extraction batch, etc. Results for each lot are reported using an electronic data deliverable (EDD) compatible with the EIM system, and documented in a hardcopy package consisting of summary tables and supporting data appropriate for the level of review.

9.1.1 Hardcopy Level 3 Data Package

When Level 3 data packages are requested, the laboratory will provide the hardcopy deliverables as listed in Table 18. All items indicated with a "1" or a "2" in the "Required" column are essential to the Level 3 data package. In addition, the following data and information are required:

- Sample results must be associated with appropriate units, must include estimated concentrations for target analytes that are > IDL but < PQL (or LQL) and must identify the appropriate data flags (e.g., "J" for detections below the PQL). Reporting limits should be adjusted for sample dilution and/or initial sample volume or weight.
- The method number, report number, sample matrix, percent solids, collection date, receipt date, extraction date, analysis date and analysis time should be identified on each page of sample results.
- Chain-of-custody documentation should be provided.
- A summary table of percent solids for all solid matrix samples (if applicable).
- A summary table of particle size distribution for all sediment samples (if applicable).
- Method blank results with unique identification of each method blank.
- Trip blank results with unique identification of each trip blank.
- One laboratory duplicate performed per batch. The calculation of the relative percent difference (RPD) should be reported.
- Extraction and run-logs.
- Consistent use of the same calibration and check standards.
- Use of calibration standards that bracket the sample concentrations and quantitation limits.
- Total ion chromatograms for polycyclic aromatic hydrocarbon (PAH), fuel, or other manually integrated analyses.

9.1.2 Hardcopy Level 4 Data Package

When Level 4 data packages are requested, the laboratory will provide the hardcopy deliverables as listed in Table 18. All items indicated with a "1", "2" or "3" in the "Required" column are essential to the Level 4 data package and all raw analytical data must be submitted. All additional data and information listed above is also required.

9.1.3 Electronic Data Deliverable (Edd)

The electronic data deliverable (EDD) provided by Laboratory will be provided in the format compatible EarthSoft's EQuIS system. The list of valid values (e.g. CAS numbers, analytical methods, etc.) will be consistent with codes used in the Department of Ecology's Environmental Information Management System (EIM).

9.2 Submittal Of Data To EIM

The Environmental Information Management System (EIM) is the main database for environmental monitoring data. EIM contains records on physical, chemical, and biological analyses and measurements. Supplementary information about the data (metadata) is also stored, including information about environmental studies, monitoring locations, and data quality. GeoEngineers will provide EIM submittals within 90 days of final Department of Ecology approval of remedial investigation reports.

9.2.1 Application of Qualifiers to EDD

After primary validation and secondary review, the DV Contractor will add useablity qualifiers and final concentrations to the Laboratory EDD. All manual data entry will be verified to the source document (e.g., COC, hardcopy data package and/or qualified Sample Result Summary, etc.).

9.2.2 Submittal to Ecology EIM

Project data will be submitted to the Ecology EIM in three parts: study information, sample location data, analytical result data. The DV Contractor will be responsible for coordination and implementing this effort.

9.3 Records Management

DV Contractor will inventory and store all analytical data, including all re-submissions collected during data validation efforts, worksheets, and original data validation reports.

10.0 QUAITY ASSURANCE AUDITS AND REPORTS

Internal performance audits (aka surveillance) of field, laboratory and validation activities will be conducted to verify that sampling, analysis, data validation and data management are performed in accordance with the procedures established in the March Point FSP and this QAPP.

10.1 Internal Field Audit

10.1.1 Field Audit Responsibility And Frequency

It is the responsibility of the Contractor Field Manager to routinely perform internal system audits of field activities including sampling and field measurements and determine if corrective action verification is required.

10.1.2 Field Audit Procedure

The internal field audits will include examination of field sampling records, field instrument operating records, sample collection, handling, decontamination, and packaging in compliance with the established procedures, QA procedures, COC, etc. Deficiencies and subsequent corrective actions will be documented following corrective action process discussed in Section 8.3 . The results of the audit should be shared with the field team to enhance sampling performance where applicable.

10.2 Internal Laboratory Audits

The Laboratory QA Manager is responsible for conducting internal proficiency and QA system audits in accordance with the Laboratory *Quality Assurance Plan*. The contractor Laboratory will be accredited with the State of Washington and therefore, the *Quality Assurance Plan* has been evaluated and accepted.

10.3 Quality Assurance Reports

Reports will be prepared throughout the course of the project that describe the status and results of the quality assurance review. The types of reports and their expected frequency are as follows:

- Audit findings and correction summary reports will be prepared by the Contractor QA Manager, presented to the Contractor Project Manager and Field Manager, and added to the permanent project files. These reports summarize the results of the field and lab audits and the outcome of any corrective actions.
- Data quality reports (DQR), compiled for designated site areas or sampling events (as requested by the Contractor), will be prepared by the DV Contractor, presented to the Contractor Project Manager, and added to the permanent project files. If additional data qualifiers are recommended based on non-conformance issues in the field, this information will also be included in the report, but the data qualifiers will not be added without the concurrence of the DV Contractor and Contractor Project Manager.

11.0 DATA VERIFICATION AND VALIDATION

Technical data from field and laboratory analyses are combined to characterize the performance of the remediation. Documented verification of this data is crucial. Consistent, documented data reduction techniques, for both hand calculations and computer analyses, and standardized technical data validation are equally important in the verification of the technical data.

11.1 Data Reduction And Peer Review

Procedures for ensuring the correctness of the data reduction process are discussed in this section. Data, both field and laboratory generated, are reduced either manually on calculation sheets or by computer on formatted printouts. Responsibilities for the data reduction process are delegated as follows:

- Technical personnel will document and review their own work and are responsible for the correctness of the work.
- Calculations will receive a method and calculation check by a secondary reviewer prior to reporting (peer review).
- The Contractor QA Manager will be responsible for ensuring that data reduction is performed according to protocols discussed in this QAPP.

11.1.1 Hand and Computer Calculations

Hand calculations will be recorded on calculation sheets, written legibly and in a logical progression. Spreadsheet calculations will be printed out in both equation form and calculation form. Calculations will be reviewed by chemist or scientist of a professional level equal to or higher than that of the originator, and the review will be documented on a checklist or review form. Both the originator and secondary reviewer are responsible for the correctness of the calculations. The calculation sheet and review form will document the following (at a minimum):

- Project title and project number

- Initials and date of originator
- Initials and date of secondary reviewer
- Basis for calculation
- Assumptions made or assumptions inherent in the calculation
- Complete reference for each source of input data
- Methods used for calculation
- Results of calculation

11.1.2 In-Laboratory Data Reduction And Review

Data generated by the laboratory will be reviewed prior to data release. The laboratory will perform three levels of data review:

- Analytical level
- Data section level
- Final quality review

The three-tiered review process should be documented in the Laboratory *Quality Assurance Manual*.

11.2 DATA VALIDATION

The DV Contractor will be responsible for all data validation.

The level of data validation (Level 3 or Level 4) will be determined by the most stringent end-use of the data e.g., any data that may be associated with risk assessment (human health and ecological) will receive a Level 4 validation; data from the samples collected for the remedial investigation/feasibility only will receive Level 3 validation with 10% receiving Level 4.

11.2.1 Validation Process

The Laboratory will fax copies of the chain-of-custody to Contractor and DV Contractor as the samples are received. This will enable Contractor to track all samples collected and DV Contractor to verify the sample IDs for content and format prior to data receipt.

Validation will include evaluation of all appropriate QC elements including, but not limited to:

- Holding times
- Instrument tuning and analytical system performance
- Initial and continuing calibrations
- Preparation of analytical standards and samples
- Analytical results from internal standards, method blanks, spiked samples (matrix, surrogate), replicate samples; interference check samples
- Laboratory and sample detection and reporting limits
- Analyte identification and quantification (including tentatively identified compounds) **Level 4 only**

- Data reduction (transcription check and recalculation of results) **Level 4 only**

A system of primary data validation and secondary/peer review will be used by the DV Contractor. All primary data validation and subsequent quality control reviews will be documented on a series of worksheets and checklists. In addition, final review and approval by the DV Contractor Project Manager will be documented and maintained in the project files.

DV Contractor will follow a documented Quality Assurance program, implemented by a comprehensive set of standard operating procedures (SOPs). The SOPs will cover all technical facets of the data validation as well as auxiliary processes e.g., data log-in and tracking, database security and archive, document control, quality control, software use and verification, algorithm verification, verification of manually input data, corrective action and training.

11.3 Field Measurement Evaluation

Field data will be reviewed at the end of each day by following the quality control checks outlined below and procedures in the FSP. Field data documentation will be checked against the applicable criteria as follows:

- Sample collection information.
- Field instrumentation and calibration.
- Sample collection protocol.
- Sample containers, preservation and volume.
- Field QC samples collected at the frequency specified.
- Sample documentation and chain-of-custody (COC) protocols.
- Sample shipment.

Cooler receipt forms and sample condition forms provided by the laboratory will be reviewed by the Field Manager for out-of-control incidents. Sample collection information will be reviewed for correctness before inclusion in the RI/FS final report.

12.0 DATA QUALITY ASSESSMENT

After the data have been verified and validated a usability assessment will be performed. The project data are only meaningful by relating the data to the intended use of the data. If the MQO have been met, the quality of the data should be useable for to study and design remedial alternatives and ecological health.

The assessment will include evaluation of representativeness, comparability and a comparison of actual completeness to the 95% criteria. Also, the sampling design will be evaluated to determine whether the design produced the information that was needed to meet the project objectives.

TABLE 1
MEASURMENT QUALITY OBJECTIVES
DRAFT UPLAND RI/FS WORK PLAN, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

		Check Standard (LCS) %R Limits[3,4]		Matrix Spike (MS) %R Limits3,4		Surrogate Standards (SS) %R Limits [2,3,4]	Duplicate Samples MSD or Lab Duplicate RPD Limits[5]		Field Duplicate Samples RPD Limits[5]	
Laboratory Analysis	Reference Method	Soil	Water	Soil	Water		Soil	Water	Soil	Water
VOC	SW-846 8260B	30%-150%	30%-150%	50%-150%	50%-150%	50%-140%	35%	20%	50%	35%
SVOC	SW-846 8270C	30%-150%	40%-150%	50%-150%	50%-150%	20%-135%	35%	20%	50%	35%
PCDD/PCDF	SW-846 8290	50%-150%	50%-150%	50%-150%	50%-150%	50%-150%	35%	20%	50%	35%
Herbicides	SW-846 8151	50%-150%	50%-150%	50%-150%	50%-150%	50%-150%	35%	20%	50%	35%
PCB	SW-846 8082	50%-150%	50%-150%	50%-150%	50%-150%	30%-140%	35%	20%	50%	35%
Organochlorine Pesticides	SW-846 8081	30%-150%	30%-150%	50%-150%	50%-150%	20%-140%	35%	20%	50%	35%
Organophosphorous Pesticides	SW-846 8141	30%-150%	30%-150%	50%-150%	50%-150%	30%-150%	35%	20%	50%	35%
Diesel Range Hydrocarbons	NWTPH-Dx	50%-150%	50%-150%	50%-150%	50%-150%	50%-150%	35%	20%	50%	35%
Gas Range Hydrocarbons	NWTPH-G	50%-150%	50%-150%	50%-150%	50%-150%	50%-150%	35%	20%	50%	35%
Metals/Mercury	SW-846 6010/6020	80%-120%	80%-120%	75%-125%	75%-125%	NA	35%	20%	50%	35%
pH [1]	SW-846 9045C	±0.1 pH units	±0.1 pH units	NA	NA	NA	±0.5 pH units	±0.5 pH units	±0.5 pH units	±0.5 pH units

Notes:

[1] pH is measured in the field and accuracy is ensured by calibration of the instrument before and after use.

[2] Individual surrogate recoveries are compound specific

[3] Recovery Ranges are estimates. Actual ranges will be provided by the laboratory when contracted.

[4] Percent Recovery Limits are expressed as ranges based on laboratory control limits. Limits will vary for individual analytes

[5] RPD contol limits are only applicable if the concentration are greater than 5 times the method reporting limit (MRL). For results less than 5 times the MRL, the difference between the sample and duplicate must be less than 2X the MRL for soils and 1X the MRL for waters.

VOC = Volatile Organic Compounds
SVOC = Semivolatile Organic Compound
PCDD = Polychlorinated Dibenzo-p-dioxins
PCDF = Polychlorinated Dibenzofurans
PCB = Polychlorinated Biphenyls
LCS = Laboratory Control Sample
MS/MSD = Matrix Spike/Matrix Spike Duplicate
RPD = Relative Percent Difference
NA = Not Applicable

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TABLE 2
Analytes and Target Reporting Limits
Metals by SW846 6010B/6020/7470/7471, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Soil

Analyte	CAS RN	PQL (mg/kg)	Target ReportingLimit (mg/kg)	MTCA Method A, Unrestricted Land Use (mg/kg)	MTCA Method B, Carcinogen (mg/kg)	MTCA Method B, Non-carcinogen (mg/kg)
arsenic	7440-38-2	TBD	0.7	20.0	0.7	24
beryllium	7440-41-7	TBD	160	--	--	160
cadmium	7440-43-9	TBD	2.0	2.0	--	80
chromium	7440-47-3	TBD	19	19	--	240
copper	7440-50-8	TBD	3000	--	--	3000
iron	7439-89-6	TBD	2.0	--	--	--
lead	7439-92-1	TBD	250	250	--	--
manganese	7439-96-5	TBD	11000	--	--	11000
mercury	7439-97-6	TBD	2.0	2.0	--	24
nickel	7440-02-0	TBD	1600	--	--	1600
selenium	7782-49-2	TBD	400	--	--	400
silver	7440-22-4	TBD	400	--	--	400
thallium	7440-28-0	TBD	5.6	--	--	5.6
zinc	7440-66-6	TBD	24000	--	--	24000

Water

Analytes	CAS RN	PQL (µg/L)	Target Reporting Limit (µg/L)	Aquatic Life - Marine/Chronic - Ch. 173-201A WAC (µg/L)	Aquatic Life - Marine/Chronic - Clean Water Act §304 (µg/L)	Aquatic Life - Marine/Chronic - National Toxics Rule, 40 CFR 131 (µg/L)	Human Health – Marine – Clean Water Act §304 (µg/L)	Human Health – Marine – National Toxics Rule, 40 CFR 131 (µg/L)	MTCA Method B, Carcinogen (µg/L)	MTCA Method B, Non-Carcinogen (µg/L)
arsenic	7440-38-2	TBD	0.098	36	36	36	0.14	0.14	0.098	18
beryllium	7440-41-7	TBD	270	--	--	--	--	--	--	270
cadmium	7440-43-9	TBD	41	--	--	--	--	--	--	41
chromium	7440-47-3	TBD	50	50	50	50	--	--	--	490
copper	7440-50-8	TBD	2.4	3.1	3.1	2.4	--	--	--	2700
iron	7439-89-6	TBD	20	--	--	--	--	--	--	--
lead	7439-92-1	TBD	8.1	8.1	8.1	8.1	--	--	--	--
manganese	7439-96-5	TBD	100	--	--	--	100	--	--	--
mercury	7439-97-6	TBD	0.025	0.025	0.94	0.025	0.3	0.15	--	--
nickel	7440-02-0	TBD	8.2	8.2	8.2	8.2	4600	4600	--	1100
selenium	7782-49-2	TBD	71	71	71	71	4200	--	--	2700
silver	7440-22-4	TBD	26000	--	--	--	--	--	--	26000
thallium	7440-28-0	TBD	0.47	--	--	--	0.47	6.3	--	1.6
zinc	7440-66-6	TBD	81	81	81	81	26000	--	--	17000

Note: Target Reporting Limit is the lowest value from the listed regulatory levels (see Section 7.1 of QAPP for a discussion of how regulatory levels were chosen).
There is no regulatory limit for iron. A typical laboratory reporting limit was used for this analyte.
PQL = Practical Quantitation Limit. This should be less than the Target Reporting Limit.
TBD = To Be Determined. PQLs will be supplied by laboratory. There may be cases where the laboratory can not meet the Target Reporting Limit.

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TABLE 3
Analytes and Target Reporting Limits
VOCs by SW846 8260B, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

SOIL

Analyte	CAS RN	PQL (mg/kg)	Target ReportingLimit (mg/kg)	MTCA Method A, Unrestricted Land Use (mg/kg)	MTCA Method B, Carcinogen (mg/kg)	MTCA Method B, Non-carcinogen (mg/kg)
1,1,1,2-tetrachloroethane	630-20-6	TBD	38	--	38	2400
1,1,1-trichloroethane	71-55-6	TBD	2.0	2.0	--	72000
1,1,2,2-tetrachloroethane	79-34-5	TBD	5.0	--	5.0	--
1,1,2-trichloro-1,2,2-trifluoroethane	76-13-1	TBD	--	--	--	--
1,1,2-trichloroethane	79-00-5	TBD	18	--	18	320
1,1-dichloroethane	75-34-3	TBD	8000	--	--	8000
1,1-dichloroethene	75-35-4	TBD	1.7	--	1.7	4000
1,2,3-trichlorobenzene	87-61-6	TBD	--	--	--	--
1,2,3-trichloropropane	96-18-4	TBD	0.14	--	0.14	480
1,2,4-trichlorobenzene	120-82-1	TBD	800	--	--	800
1,2,4-trimethylbenzene	95-63-6	TBD	4000	--	--	4000
1,2-dibromo-3-chloropropane	96-12-8	TBD	0.71	--	0.71	--
1,2-dibromoethane	106-93-4	TBD	0.005	0.005	0.012	--
1,2-dichlorobenzene	95-50-1	TBD	7200	--	--	7200
1,2-dichloroethane	107-06-2	TBD	11	--	11	1600
1,2-dichloropropane	78-87-5	TBD	15	--	15	--
1,3,5-trimethylbenzene	108-67-8	TBD	4000	--	--	4000
1,3-dichlorobenzene	541-73-1	TBD	--	--	--	--
1,4-dichlorobenzene	106-46-7	TBD	42	--	42	--
2-butanone	78-93-3	TBD	48000	--	--	48000
2-chloroethyl vinyl ether	110-75-8	TBD	--	--	--	--
2-hexanone	591-78-6	TBD	--	--	--	--
4-chlorotoluene	106-43-4	TBD	--	--	--	--
4-methyl-2-pentanone	108-10-1	TBD	6400	--	--	6400
acetone	67-64-1	TBD	8000	--	--	8000
acrylonitrile	107-13-1	TBD	1.9	--	1.9	80
benzene	71-43-2	TBD	0.03	0.03	18	320
bromobenzene	108-86-1	TBD	--	--	--	--
bromodichloromethane	75-27-4	TBD	16	--	16	1600
bromoform	75-25-2	TBD	130	--	130	1600
bromomethane	74-83-9	TBD	110	--	--	110
carbon disulfide	75-15-0	TBD	8000	--	--	8000
carbon tetrachloride	56-23-5	TBD	7.7	--	7.7	56
chlorobenzene	108-90-7	TBD	1600	--	--	1600
chloroethane	75-00-3	TBD	350	--	350	32000
chloroform	67-66-3	TBD	160	--	160	800
chloromethane	74-87-3	TBD	77	--	77	--
cis-1,2-dichloroethene	156-59-2	TBD	800	--	--	800
cis-1,3-dichloropropene	10061-01-5	TBD	--	--	--	--
cyclohexane	110-82-7	TBD	--	--	--	--
dibromochloromethane	124-48-1	TBD	12	--	12	1600
dichlorodifluoromethane	75-71-8	TBD	16000	--	--	16000

TABLE 3
Analytes and Target Reporting Limits
VOCs by SW846 8260B, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

SOIL

Analyte	CAS RN	PQL (mg/kg)	Target ReportingLimit (mg/kg)	MTCA Method A, Unrestricted Land Use (mg/kg)	MTCA Method B, Carcinogen (mg/kg)	MTCA Method B, Non-carcinogen (mg/kg)
ethylbenzene	100-41-4	TBD	6	6	–	8000
hexachlorobutadiene	87-68-3	TBD	13	–	13	16
hexachloroethane	67-72-1	TBD	71	–	71	80
isopropylbenzene	98-82-8	TBD	8000	–	–	8000
m,p-xylenes	1330-20-7	TBD	160000	–	–	160000
methyl acetate	79-20-9	TBD	–	–	–	–
methyl acrylate	96-33-3	TBD	2400	–	–	2400
methyl tert-butyl ether	1634-04-4	TBD	0.1	0.1	560	69000
methylcyclohexane	108-87-2	TBD	–	–	–	–
methylene chloride	75-09-2	TBD	0.02	0.02	130	4800
n-butylbenzene	104-51-8	TBD	–	–	–	–
n-propylbenzene	103-65-1	TBD	–	–	–	–
o-chlorotoluene	95-49-8	TBD	1600	–	–	1600
o-xylene	95-47-6	TBD	160000	–	–	160000
p-isopropyltoluene	99-87-6	TBD	–	–	–	–
sec-butylbenzene	135-98-8	TBD	–	–	–	–
styrene	100-42-5	TBD	33	–	33	16000
tert-butylbenzene	98-06-6	TBD	–	–	–	–
tetrachloroethene	127-18-4	TBD	0.05	0.05	1.9	800
toluene	108-88-3	TBD	7	7	–	6400
trans-1,2-dichloroethene	156-60-5	TBD	1600	–	–	1600
trans-1,3-dichloropropene	10061-02-6	TBD	–	–	–	–
trichloroethene	79-01-6	TBD	0.03	0.03	2.5	24
trichlorofluoromethane	75-69-4	TBD	24000	–	–	24000
vinyl chloride	75-01-4	TBD	0.67	–	0.67	240

Note: Target Reporting Limit is the lowest value from the listed regulatory levels (see Section 7.1 of QAPP for a discussion of how regulatory levels were chosen).
PQL = Practical Quantitation Limit. This should be less than the Target Reporting Limit.
TBD = To Be Determined. PQLs will be supplied by laboratory. There may be cases where the laboratory can not meet the Target Reporting Limit.

SEAT:\00\Working\050403700QAPP Table 2-15

TABLE 4
Analytes and Target Reporting Limits
VOC by SW846 8260B, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Water

Analyte	CAS RN	PQL (µg/L)	Target Reporting Limit (µg/L)	Human Health – Marine – Clean Water Act §304 (µg/L)	Human Health – Marine – National Toxics Rule, 40 CFR 131 (µg/L)	Method B, Carcinogen (µg/L)	Method B, Non-Carcinogen (µg/L)
1,1,1,2-tetrachloroethane	630-20-6	TBD	1	--	--	--	--
1,1,1-trichloroethane	71-55-6	TBD	420000	--	--	--	420000
1,1,2,2-tetrachloroethane	79-34-5	TBD	4	4	11	6.5	--
1,1,2-trichloro-1,2,2-trifluoroethane	76-13-1	TBD	1	--	--	--	--
1,1,2-trichloroethane	79-00-5	TBD	16	16	42	25	2300
1,1-dichloroethane	75-34-3	TBD	1	--	--	--	--
1,1-dichloroethene	75-35-4	TBD	1.9	7100	3.2	1.9	23000
1,2,3-trichlorobenzene	87-61-6	TBD	1	--	--	--	--
1,2,3-trichloropropane	96-18-4	TBD	1	--	--	--	--
1,2,4-trichlorobenzene	120-82-1	TBD	70	70	--	--	230
1,2,4-trimethylbenzene	95-63-6	TBD	1	--	--	--	--
1,2-dibromo-3-chloropropane	96-12-8	TBD	2	--	--	--	--
1,2-dibromoethane	106-93-4	TBD	1	--	--	--	--
1,2-dichlorobenzene	95-50-1	TBD	1300	1300	17000	--	4200
1,2-dichloroethane	107-06-2	TBD	37	37	99	59	43000
1,2-dichloropropane	78-87-5	TBD	15	15	--	23	--
1,3,5-trimethylbenzene	108-67-8	TBD	1	--	--	--	--
1,3-dichlorobenzene	541-73-1	TBD	10	960	2600	--	--
1,4-dichlorobenzene	106-46-7	TBD	4.9	190	2600	4.9	--
2-butanone	78-93-3	TBD	10	--	--	--	--
2-chloroethyl vinyl ether	110-75-8	TBD	1	--	--	--	--
2-hexanone	591-78-6	TBD	10	--	--	--	--
4-chlorotoluene	106-43-4	TBD	1	--	--	--	--
4-methyl-2-pentanone	108-10-1	TBD	10	--	--	--	--
acetone	67-64-1	TBD	10	--	--	--	--
acrylonitrile	107-13-1	TBD	0.25	0.25	0.66	0.4	86
benzene	71-43-2	TBD	23	51	71	23	2000
bromobenzene	108-86-1	TBD	1	--	--	--	--
bromodichloromethane	75-27-4	TBD	17	17	22	28	14000
bromoform	75-25-2	TBD	140	140	360	220	14000
bromomethane	74-83-9	TBD	970	1500	4000	--	970
carbon disulfide	75-15-0	TBD	1	--	--	--	--
carbon tetrachloride	56-23-5	TBD	1.6	1.6	4.4	2.7	97
chlorobenzene	108-90-7	TBD	1600	1600	21000	--	5000
chloroethane	75-00-3	TBD	1	--	--	--	--
chloroform	67-66-3	TBD	280	470	470	280	6900
chloromethane	74-87-3	TBD	130	--	--	130	--
cis-1,2-dichloroethene	156-59-2	TBD	1	--	--	--	--
cis-1,3-dichloropropene	10061-01-5	TBD	1	--	--	--	--
cyclohexane	110-82-7	TBD	1	--	--	--	--
dibromochloromethane	124-48-1	TBD	13	13	34	21	14000
dichlorodifluoromethane	75-71-8	TBD	1	--	--	--	--

TABLE 4
Analytes and Target Reporting Limits
VOC by SW846 8260B, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Water

Analyte	CAS RN	PQL (µg/L)	Target Reporting Limit (µg/L)	Human Health – Marine – Clean Water Act §304 (µg/L)	Human Health – Marine – National Toxics Rule, 40 CFR 131 (µg/L)	Method B, Carcinogen (µg/L)	Method B, Non-Carcinogen (µg/L)
ethylbenzene	100-41-4	TBD	2100	2100	29000	--	6900
hexachlorobutadiene	87-68-3	TBD	18	18	50	30	190
hexachloroethane	67-72-1	TBD	3	3	9	5	30
isopropylbenzene	98-82-8	TBD	1	--	--	--	--
m,p-xylenes	1330-20-7	TBD	1	--	--	--	--
methyl acetate	79-20-9	TBD	10	--	--	--	--
methyl acrylate	96-33-3	TBD	10	--	--	--	--
methyl tert-butyl ether	1634-04-4	TBD	5	--	--	--	--
methylcyclohexane	108-87-2	TBD	1	--	--	--	--
methylene chloride	75-09-2	TBD	590	590	1600	960	170000
n-butylbenzene	104-51-8	TBD	1	--	--	--	--
n-propylbenzene	103-65-1	TBD	1	--	--	--	--
o-chlorotoluene	95-49-8	TBD	1	--	--	--	--
o-xylene	95-47-6	TBD	1	--	--	--	--
p-isopropyltoluene	99-87-6	TBD	1	--	--	--	--
sec-butylbenzene	135-98-8	TBD	1	--	--	--	--
styrene	100-42-5	TBD	1	--	--	--	--
tert-butylbenzene	98-06-6	TBD	1	--	--	--	--
tetrachloroethene	127-18-4	TBD	0.39	3.3	8.9	0.39	840
toluene	108-88-3	TBD	15000	15000	200000	--	19000
trans-1,2-dichloroethene	156-60-5	TBD	1000	1000	--	--	33000
trans-1,3-dichloropropene	10061-02-6	TBD	1	--	--	--	--
trichloroethene	79-01-6	TBD	1.5	30	81	1.5	71
trichlorofluoromethane	75-69-4	TBD	1	--	--	--	--
vinyl chloride	75-01-4	TBD	2.4	2.4	530	3.7	6600

Note: Target Reporting Limit is the lowest value from the listed regulatory levels (see Section 7.1 of QAPP for a discussion of how regulatory levels were chosen).
Regulatory levels were not available for all compounds. Standard laboratory reporting limits were stated for these analytes.
PQL = Practical Quantitation Limit. This should be less than the Target Reporting Limit.
TBD = To Be Determined. PQLs will be supplied by laboratory. There may be cases where the laboratory can not meet the Target Reporting Limit.

SEAT:\00\Working\050403700QAPP Table 2-15

TABLE 5
Analytes and Target Reporting Limits
SVOC by SW846 8270C, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Soil

Analyte	CAS RN	PQL (mg/kg)	Target ReportingLimit (mg/kg)	MTCA Method A, Unrestricted Land Use (mg/kg)	MTCA Method B, Carcinogen (mg/kg)	MTCA Method B, Non-carcinogen (mg/kg)
1-methylnaphthalene	90-12-0	TBD	5	5	--	24
2,4,5-trichlorophenol	95-95-4	TBD	8000	--	--	8000
2,4,6-trichlorophenol	88-06-2	TBD	91	--	91	--
2,4-dichlorophenol	120-83-2	TBD	2400	--	--	2400
2,4-dimethylphenol	105-67-9	TBD	1600	--	--	1600
2,4-dinitrophenol	51-28-5	TBD	160	--	--	160
2,4-dinitrotoluene	121-14-2	TBD	160	--	--	160
2,6-dinitrotoluene	606-20-2	TBD	80	--	--	80
2-chloronaphthalene	91-58-7	TBD	6400	--	--	6400
2-chlorophenol	95-57-8	TBD	400	--	--	400
2-methylnaphthalene	91-57-6	TBD	5	5	--	320
2-methylphenol	95-48-7	TBD	4000	--	--	4000
2-nitroaniline	88-74-4	TBD	--	--	--	--
2-nitrophenol	88-75-5	TBD	--	--	--	--
3-nitroaniline	99-09-2	TBD	--	--	--	--
3,3'-dichlorobenzidine	91-94-1	TBD	2.2	--	--	2.2
4,6-dinitro-2-methylphenol	534-52-1	TBD	--	--	--	--
4-bromophenyl phenyl ether	101-55-3	TBD	--	--	--	--
4-chloro-3-methylphenol	59-50-7	TBD	--	--	--	--
4-chloroaniline	106-47-8	TBD	320	--	--	320
4-chlorophenyl phenyl ether	7005-72-3	TBD	--	--	--	--
4-methylphenol	106-44-5	TBD	400	--	--	400
4-nitroaniline	100-01-6	TBD	--	--	--	--
4-nitrophenol	100-02-7	TBD	--	--	--	--
acenaphthene	83-32-9	TBD	4800	--	--	4800
acenaphthylene	208-96-8	TBD	--	--	--	--
aniline	62-53-3	TBD	180	--	180	--
anthracene	120-12-7	TBD	24000	--	--	24000
benzidine	92-87-5	TBD	0.0043	--	0.0043	240
benzo(a)anthracene	56-55-3	TBD	0.14	--	0.14	--
benzo(a)pyrene	50-32-8	TBD	0.10	0.10	0.14	--
benzo(b)fluoranthene	205-99-2	TBD	0.14	--	0.14	--
benzo(ghi)perylene	191-24-2	TBD	--	--	--	--
benzo(k)fluoranthene	207-08-9	TBD	0.14	--	0.14	--
benzoic acid	65-85-0	TBD	320000	--	--	320000
benzyl alcohol	100-51-6	TBD	24000	--	--	24000
bis(2-chloroethoxy)methane	111-91-1	TBD	--	--	--	--
bis(2-chloroethyl) ether	111-44-4	TBD	0.91	--	0.91	--
bis(2-chloroisopropyl) ether	108-60-1	TBD	3200	--	--	3200
bis(2-ethylhexyl) phthalate	117-81-7	TBD	71	--	71	1600
butyl benzyl phthalate	85-68-7	TBD	16000	--	--	16000

TABLE 5
Analytes and Target Reporting Limits
SVOC by SW846 8270C, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Soil

Analyte	CAS RN	PQL (mg/kg)	Target ReportingLimit (mg/kg)	MTCA Method A, Unrestricted Land Use (mg/kg)	MTCA Method B, Carcinogen (mg/kg)	MTCA Method B, Non-carcinogen (mg/kg)
carbazole	86-74-8	TBD	50	--	50	--
chrysene	218-01-9	TBD	0.14	--	0.14	--
dibenz(a,h)anthracene	53-70-3	TBD	0.14	--	0.14	--
dibenzofuran	132-64-9	TBD	160	--	--	160
diethyl phthalate	84-66-2	TBD	64000	--	--	64000
dimethyl phthalate	131-11-3	TBD	80000	--	--	80000
di-n-butyl phthalate	84-74-2	TBD	800	--	--	800
di-n-octyl phthalate	117-84-0	TBD	1600	--	--	1600
fluoranthene	206-44-0	TBD	3200	--	--	3200
fluorene	86-73-7	TBD	3200	--	--	3200
hexachlorobenzene	118-74-1	TBD	0.63	--	0.63	64
hexachlorobutadiene	87-68-3	TBD	13	--	13	16
hexachlorocyclopentadiene	77-47-4	TBD	480	--	--	480
hexachloroethane	67-72-1	TBD	71	--	71	80
indeno(1,2,3-cd)pyrene	193-39-5	TBD	0.14	--	0.14	--
isophorone	78-59-1	TBD	1100	--	1100	16000
naphthalene	91-20-3	TBD	5	5	--	1600
nitrobenzene	98-95-3	TBD	40	--	--	40
n-nitrosodimethylamine	62-75-9	TBD		--	--	--
n-nitrosodi-n-propylamine	621-64-7	TBD	0.14	--	0.14	--
n-nitrosodiphenylamine	86-30-6	TBD	200	--	200	--
pentachlorophenol	87-86-5	TBD	8.3	--	8.3	2400
phenanthrene	85-01-8	TBD	--	--	--	--
phenol	108-95-2	TBD	48000	--	--	48000
pyrene	129-00-0	TBD	2400	--	--	2400
pyridine	110-86-1	TBD	80	--	--	80

Note: Target Reporting Limit is the lowest value from the listed regulatory levels (see Section 7.1 of QAPP for a discussion of how regulatory levels were chosen).
PQL = Practical Quantitation Limit. This should be less than the Target Reporting Limit.
TBD = To Be Determined. PQLs will be supplied by laboratory. There may be cases where the laboratory can not meet the Target Reporting Limit.

SEAT:\00\Working\050403700QAPP Table 2-15

TABLE 6
Analytes and Target Reporting Limits
SVOC by SW846 8270C, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Water

Analyte	CAS RN	PQL (µg/L)	Target Reporting Limit (µg/L)	Aquatic Life - Marine/Chronic - Ch. 173-201A WAC (µg/L)	Aquatic Life - Marine/Chronic - Clean Water Act §304 (µg/L)	Aquatic Life - Marine/Chronic - National Toxics Rule, 40 CFR 131 (µg/L)	Human Health – Marine – Clean Water Act §304 (µg/L)	Human Health – Marine – National Toxics Rule, 40 CFR 131 (µg/L)	Method B, Carcinogen (µg/L)	Method B, Non-Carcinogen (µg/L)
1-methylnaphthalene	90-12-0	TBD	0.2	–	–	–	–	–	–	–
2,4,5-trichlorophenol	95-95-4	TBD	3600	–	–	–	3600	–	–	–
2,4,6-trichlorophenol	88-06-2	TBD	2.4	–	–	–	2.4	6.5	3.9	–
2,4-dichlorophenol	120-83-2	TBD	190	–	–	–	290	790	–	190
2,4-dimethylphenol	105-67-9	TBD	550	–	–	–	850	–	–	550
2,4-dinitrophenol	51-28-5	TBD	3500	–	–	–	5300	14000	–	3500
2,4-dinitrotoluene	121-14-2	TBD	3.4	–	–	–	3.4	9.1	–	1400
2,6-dinitrotoluene	606-20-2	TBD	5	–	–	–	–	–	–	–
2-chloronaphthalene	91-58-7	TBD	1000	–	–	–	1600	–	–	1000
2-chlorophenol	95-57-8	TBD	97	–	–	–	–	–	–	97
2-methylnaphthalene	91-57-6	TBD	0	–	–	–	–	–	–	–
2-methylphenol	95-48-7	TBD	1	–	–	–	–	–	–	–
2-nitroaniline	88-74-4	TBD	2	–	–	–	–	–	–	–
2-nitrophenol	88-75-5	TBD	2	–	–	–	–	–	–	–
3,3'-dichlorobenzidine	91-94-1	TBD	0.028	–	–	–	0.028	0.077	0.046	–
3-nitroaniline	99-09-2	TBD	2	–	–	–	–	–	–	–
4,6-dinitro-2-methylphenol	534-52-1	TBD	5	–	–	–	–	–	–	–
4-bromophenyl phenyl ether	101-55-3	TBD	2	–	–	–	–	–	–	–
4-chloro-3-methylphenol	59-50-7	TBD	2	–	–	–	–	–	–	–
4-chloroaniline	106-47-8	TBD	2	–	–	–	–	–	–	–
4-chlorophenyl phenyl ether	7005-72-3	TBD	2	–	–	–	–	–	–	–
4-methylphenol	106-44-5	TBD	1	–	–	–	–	–	–	–
4-nitroaniline	100-01-6	TBD	2	–	–	–	–	–	–	–
4-nitrophenol	100-02-7	TBD	5	–	–	–	–	–	–	–
acenaphthene	83-32-9	TBD	640	–	–	–	990	–	–	640
acenaphthylene	208-96-8	TBD	0.2	–	–	–	–	–	–	–
aniline	62-53-3	TBD	–	–	–	–	–	–	–	–
anthracene	120-12-7	TBD	26000	–	–	–	40000	110000	–	26000
benzidine	92-87-5	TBD	0.000	–	–	–	0.000	0.001	0.000	89
benzo(a)anthracene	56-55-3	TBD	0.018	–	–	–	0.018	0.031	0.030	–
benzo(a)pyrene	50-32-8	TBD	0.018	–	–	–	0.018	0.031	0.030	–
benzo(b)fluoranthene	205-99-2	TBD	0.018	–	–	–	0.018	0.031	0.030	–
benzo(ghi)perylene	191-24-2	TBD	–	–	–	–	–	–	–	–
benzo(k)fluoranthene	207-08-9	TBD	0.018	–	–	–	0.018	0.031	0.030	–
benzoic acid	65-85-0	TBD	10	–	–	–	–	–	–	–

TABLE 6
Analytes and Target Reporting Limits
SVOC by SW846 8270C, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Water

Analyte	CAS RN	PQL (µg/L)	Target Reporting Limit (µg/L)	Aquatic Life - Marine/Chronic - Ch. 173-201A WAC (µg/L)	Aquatic Life - Marine/Chronic - Clean Water Act §304 (µg/L)	Aquatic Life - Marine/Chronic - National Toxics Rule, 40 CFR 131 (µg/L)	Human Health – Marine – Clean Water Act §304 (µg/L)	Human Health – Marine – National Toxics Rule, 40 CFR 131 (µg/L)	Method B, Carcinogen (µg/L)	Method B, Non-Carcinogen (µg/L)
benzyl alcohol	100-51-6	TBD	5	–	–	–	–	–	–	–
bis(2-chloroethoxy)methane	111-91-1	TBD	1	–	–	–	–	–	–	–
bis(2-chloroethyl) ether	111-44-4	TBD	0.53	–	–	–	0.53	1.4	0.85	–
bis(2-chloroisopropyl) ether	108-60-1	TBD	42000	–	–	–	65000	170000	–	42000
bis(2-ethylhexyl) phthalate	117-81-7	TBD	2.2	–	–	–	2.2	5.9	3.6	400
butyl benzyl phthalate	85-68-7	TBD	1300	–	–	–	1900	–	–	1300
carbazole	86-74-8	TBD	1	–	–	–	–	–	–	–
chrysene	218-01-9	TBD	0.018	–	–	–	0.018	0.031	0.030	–
dibenz(a,h)anthracene	53-70-3	TBD	0.018	–	–	–	0.018	0.031	0.030	–
dibenzofuran	132-64-9	TBD	1	–	–	–	–	–	–	–
diethyl phthalate	84-66-2	TBD	28000	–	–	–	44000	120000	–	28000
dimethyl phthalate	131-11-3	TBD	72000	–	–	–	1100000	2900000	–	72000
di-n-butyl phthalate	84-74-2	TBD	2900	–	–	–	4500	12000	–	2900
di-n-octyl phthalate	117-84-0	TBD	1	–	–	–	–	–	–	–
fluoranthene	206-44-0	TBD	90	–	–	–	140	370	–	90
fluorene	86-73-7	TBD	3500	–	–	–	5300	14000	–	3500
hexachlorobenzene	118-74-1	TBD	0.00029	–	–	–	0.00029	0.00077	0.00047	0.24
hexachlorobutadiene	87-68-3	TBD	18	–	–	–	18	50	30	190
hexachlorocyclopentadiene	77-47-4	TBD	1100	–	–	–	1100	17000	–	3600
hexachloroethane	67-72-1	TBD	3.3	–	–	–	3.3	8.9	5.3	30
indeno(1,2,3-cd)pyrene	193-39-5	TBD	0.018	–	–	–	0.018	0.031	0.030	–
isophorone	78-59-1	TBD	600	–	–	–	960	600	1600	120000
naphthalene	91-20-3	TBD	4900	–	–	–	–	–	–	4900
nitrobenzene	98-95-3	TBD	450	–	–	–	690	1900	–	450
n-nitrosodimethylamine	62-75-9	TBD	1	–	–	–	–	–	–	–
n-nitrosodi-n-propylamine	621-64-7	TBD	0.5	–	–	–	0.51	–	0.82	–
n-nitrosodiphenylamine	86-30-6	TBD	6.0	–	–	–	6.0	16	9.7	–
pentachlorophenol	87-86-5	TBD	3.0	7.9	7.9	7.9	3.0	8.2	4.9	7100
phenanthrene	85-01-8	TBD	0.2	–	–	–	–	–	–	–
phenol	108-95-2	TBD	1100000	–	–	–	1700000	4600000	–	1100000
pyrene	129-00-0	TBD	2600	–	–	–	4000	11000	–	2600
pyridine	110-86-1	TBD	1	–	–	–	–	–	–	–

Note: Target Reporting Limit is the lowest value from the listed regulatory levels (see Section 7.1 of QAPP for a discussion of how regulatory levels were chosen).
Regulatory levels were not available for all compounds. Standard laboratory reporting limits were stated for these analytes.
PQL = Practical Quantitation Limit. This should be less than the Target Reporting Limit.
TBD = To Be Determined. PQLs will be supplied by laboratory. There may be cases where the laboratory can not meet the Target Reporting Limit.

SEAT:\00\Working\050403700QAPP Table 2-15

TABLE 7
Analytes and Target Reporting Limits
PCB by SW846-8082, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Soil

Analyte	CAS RN	PQL (mg/kg)	Target ReportingLimit (mg/kg)	MTCA Method A, Unrestricted Land Use (mg/kg)	MTCA Method B, Carcinogen (mg/kg)	MTCA Method B, Non-carcinogen (mg/kg)
Aroclor 1016	12674-11-2	TBD	0.033	–	–	5.6
Aroclor 1221	11104-28-2	TBD	0.033	–	–	–
Aroclor 1232	11141-16-5	TBD	0.033	–	–	–
Aroclor 1242	53469-21-9	TBD	0.033	–	–	–
Aroclor 1248	12672-29-6	TBD	0.033	–	–	–
Aroclor 1254	11097-69-1	TBD	0.033	–	–	1.6
Aroclor 1260	11096-82-5	TBD	0.033	–	–	–
Total PCBs[1]	1336-36-3	TBD	0.5	1.0	0.5	–

Water

Analyte	CAS RN	PQL (µg/L)	Target Reporting Limit (µg/L)	Aquatic Life - Marine/Chronic - Ch. 173-201A WAC (µg/L)	Aquatic Life - Marine/Chronic - Clean Water Act §304 (µg/L)	Aquatic Life - Marine/Chronic - National Toxics Rule, 40 CFR 131 (µg/L)	Human Health – Marine – Clean Water Act §304 (µg/L)	Human Health – Marine National Toxics Rule, 40 CFR 131 (µg/L)	MTCA Method B, Carcinogen (µg/L)	MTCA Method B, Non-Carcinogen (µg/L)
Aroclor 1016	12674-11-2	TBD	0.0058	–	–	0.03	–	–	–	0.0058
Aroclor 1221	11104-28-2	TBD	1	–	–	–	–	–	–	–
Aroclor 1232	11141-16-5	TBD	1	–	–	–	–	–	–	–
Aroclor 1242	53469-21-9	TBD	1	–	–	–	–	–	–	–
Aroclor 1248	12672-29-6	TBD	1	–	–	–	–	–	–	–
Aroclor 1254	11097-69-1	TBD	0.0017	–	–	0.03	–	–	–	0.0017
Aroclor 1260	11096-82-5	TBD	0.03	–	–	0.03	–	–	–	–
Total PCBs[1]	1336-36-3	TBD	0.000064	0.03	0.03	0.03	0.000064	0.00017	0.00011	–

Note: Target Reporting Limit is the lowest value from the listed regulatory levels (see Section 7.1 of QAPP for a discussion of how regulatory levels were chosen). Regulatory levels were not available for all compounds. Standard laboratory reporting limits were stated for these analytes.

[1] Soil and water samples will be analyzed for individual aroclors. Total PCBs will be calculated, as needed, by summing the individual aroclors.

PQL = Practical Quantitation Limit. This should be less than the Target Reporting Limit.

TBD = To Be Determined. PQLs will be supplied by laboratory. There may be cases where the laboratory can not meet the Target Reporting Limit.

SEAT:\00\Working\050403700QAPP Table 2-15

TABLE 8
Analytes and Target Reporting Limits
DIOXINS & FURANS by SW846-8290, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Soil

Analyte	CAS RN	PQL (mg/kg)	Target ReportingLimit (pg/g)	MTCA Method A, Unrestricted Land Use (pg/g)	MTCA Method B, Carcinogen (pg/g)
2,3,7,8-TCDD	1746-01-6	TBD	6.7	–	6.7
1,2,3,7,8-PeCDD	40321-76-4	TBD	0.3	–	–
1,2,3,6,7,8-HxCDD	54653-85-7	TBD	0.3	–	–
1,2,3,4,7,8-HxCDD	39227-28-6	TBD	0.3	–	–
1,2,3,7,8,9-HxCDD	19408-74-3	TBD	160	–	160
1,2,3,4,6,7,8-HpCDD	35822-46-9	TBD	1.5	–	–
OCDD	3268-87-9	TBD	1.5	–	–
2,3,7,8-TCDF	51207-31-9	TBD	0.2	–	–
1,2,3,7,8-PeCDF	57117-41-6	TBD	0.2	–	–
2,3,4,7,8-PeCDF	57117-31-4	TBD	0.2	–	–
1,2,3,6,7,8-HxCDF	57117-44-9	TBD	0.3	–	–
1,2,3,7,8,9-HxCDF	72918-21-9	TBD	0.2	–	–
1,2,3,4,7,8-HxCDF	70648-26-9	TBD	0.3	–	–
2,3,4,6,7,8-HxCDF	60851-34-5	TBD	0.2	–	–
1,2,3,4,6,7,8-HpCDF	67562-39-4	TBD	0.7	–	–
1,2,3,4,7,8,9-HpCDF	55673-89-7	TBD	0.3	–	–
OCDF	39001-02-0	TBD	1.5	–	–

Note: Target Reporting Limit is the lowest value from the listed regulatory levels (see Section 7.1 of QAPP for a discussion of how regulatory levels were chosen). Regulatory levels were not available for all compounds. Standard laboratory reporting limits were stated for these analytes.
PQL = Practical Quantitation Limit. This should be less than the Target Reporting Limit.
TBD = To Be Determined. PQLs will be supplied by laboratory. There may be cases where the laboratory can not meet the Target Reporting Limit.

SEAT:\00\Working\050403700QAPP Table 2-15

TABLE 9
Analytes and Target Reporting Limits
DIOXI/FURANs by SW846-8290, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Water

Analyte	CAS RN	PQL (µg/L)	Target Reporting Limit (pg/L)	Human Health – Marine – Clean Water Act §304 (pg/L)	Human Health – Marine – National Toxics Rule, 40 CFR 131 (pg/L)	Method B, Carcinogen (pg/L)
2,3,7,8-TCDD	1746-01-6	TBD	0.0051	0.0051	0.014	0.0086
1,2,3,7,8-PeCDD	40321-76-4	TBD	0.33	–	–	–
1,2,3,6,7,8-HxCDD	54653-85-7	TBD	0.33	–	–	–
1,2,3,4,7,8-HxCDD	39227-28-6	TBD	0.33	–	–	–
1,2,3,7,8,9-HxCDD	19408-74-3	TBD	0.33	–	–	–
1,2,3,4,6,7,8-HpCDD	35822-46-9	TBD	0.33	–	–	–
OCDD	3268-87-9	TBD	0.66	–	–	–
2,3,7,8-TCDF	51207-31-9	TBD	0.066	–	–	–
1,2,3,7,8-PeCDF	57117-41-6	TBD	0.33	–	–	–
2,3,4,7,8-PeCDF	57117-31-4	TBD	0.33	–	–	–
1,2,3,6,7,8-HxCDF	57117-44-9	TBD	0.33	–	–	–
1,2,3,7,8,9-HxCDF	72918-21-9	TBD	0.33	–	–	–
1,2,3,4,7,8-HxCDF	70648-26-9	TBD	0.33	–	–	–
2,3,4,6,7,8-HxCDF	60851-34-5	TBD	0.33	–	–	–
1,2,3,4,6,7,8-HpCDF	67562-39-4	TBD	0.33	–	–	–
1,2,3,4,7,8,9-HpCDF	55673-89-7	TBD	0.33	–	–	–
OCDF	39001-02-0	TBD	0.66	–	–	–

Note: Target Reporting Limit is the lowest value from the listed regulatory levels (see Section 7.1 of QAPP for a discussion of how regulatory levels were chosen).
Regulatory levels were not available for all compounds. Standard laboratory reporting limits were stated for these analytes.
PQL = Practical Quantitation Limit. This should be less than the Target Reporting Limit.
TBD = To Be Determined. PQLs will be supplied by laboratory. There may be cases where the laboratory can not meet the Target Reporting Limit.

SEAT:\00\Working\050403700QAPP Table 2-15

TABLE 10
Analytes and Target Reporting Limits
TOTAL PETROLUEM HYDROCARBONS by NWTPHDx and NWTPH-G, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Soil

Analtye	CAS RN	PQL (mg/kg)	Target ReportingLimit (mg/kg)	MTCA Method A, Unrestricted Land Use (mg/kg)
Diesel Range Organics	NA	TBD	2000	2000
Heavy Oil rane Organics	NA	TBD	2000	2000
Gasoline Range Organics - TPH-G	NA	TBD	30	30

Note: Target Reporting Limit is the lowest value from the listed regulatory levels (see Section 7.1 of QAPP for a discussion of how regulatory levels were chosen).
PQL = Practical Quantitation Limit. This should be less than the Target Reporting Limit.
TBD = To Be Determined. PQLs will be supplied by laboratory. There may be cases where the laboratory can not meet the Target Reporting Limit.

SEAT:\00\Working\050403700QAPP Table 2-15

TABLE 11
Analytes and Target Reporting Limits
ORGANOCHLORINE PESTICIDES by SW846-8081, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Soil

Analyte	CAS RN	PQL (mg/kg)	Target ReportingLimit (mg/kg)	MTCA Method A, Unrestricted Land Use (mg/kg)	MTCA Method B, Carcinogen (mg/kg)	MTCA Method B, Non-carcinogen (mg/kg)
aldrin	309-00-2	TBD	0.059	--	0.059	2.4
chlordane	57-74-9	TBD	2.9	--	2.9	40
4,4'-DDD	72-54-8	TBD	4.2	--	4.2	--
4,4'-DDE	72-55-9	TBD	2.9	--	2.9	--
4,4'-DDT	50-29-3	TBD	3	3.0	2.9	40
dieldrin	60-57-1	TBD	0.063	--	0.06	4.0
endosulfan I	959-98-8	TBD	480	--	--	480
endosulfan II	33213-65-9	TBD	480	--	--	480
endosulfan sulfate	1031-07-8	TBD	480	--	--	480
endrin	72-20-8	TBD	24	--	--	24
endrin aldehyde	7421-93-4	TBD	24	--	--	24
endrin ketone	53494-70-5	TBD	24	--	--	24
heptachlor	76-44-8	TBD	0.22	--	0.22	40
heptachlor epoxide	1024-57-3	TBD	0.11	--	0.11	1.0
a-hexachlorocyclohexane	319-84-6	TBD	0.16	--	0.16	--
b-hexachlorocyclohexane	319-85-7	TBD	0.56	--	0.56	--
d-hexachlorocyclohexane	319-86-8	TBD	--	--	--	--
lindane	58-89-9	TBD	0.01	0.01	0.77	24
methoxychlor	72-43-5	TBD	400	--	--	400
toxaphene	8001-35-2	TBD	0.91	--	0.91	--

Note: Target Reporting Limit is the lowest value from the listed regulatory levels (see Section 7.1 of QAPP for a discussion of how regulatory levels were chosen).
PQL = Practical Quantitation Limit. This should be less than the Target Reporting Limit.
TBD = To Be Determined. PQLs will be supplied by laboratory. There may be cases where the laboratory can not meet the Target Reporting Limit.

SEAT:\00\Working\050403700QAPP Table 2-15

TABLE 12
Analytes and Target Reporting Limits
ORGANOCHLORINE PESTICIDES by SW846-8081, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Water

Analyte	CAS RN	PQL (µg/L)	Target Reporting Limit (µg/L)	Aquatic Life - Marine/Chronic Ch. 173-201A WAC (µg/L)	Aquatic Life - Marine/Chronic Clean Water Act §304 (µg/L)	Aquatic Life - Marine/Chronic - National Toxics Rule 40 CFR 131 (µg/L)	Human Health – Marine Clean Water Act §304 (µg/L)	Human Health – Marine – National Toxics Rule 40 CFR 131 (µg/L)	Method B, Carcinogen (µg/L)	Method B Non-Carcinogen µg/L)
aldrin	309-00-2	TBD	0.00005	0.0019	--	--	0.00005	0.00014	0.000082	0.017
chlordane	57-74-9	TBD	0.00059	0.0040	0.004	0.004	0.00081	0.00059	0.0013	0.092
4,4'-DDD	72-54-8	TBD	0.00031	0.0010	--	--	0.00031	0.00084	0.0005	--
4,4'-DDE	72-55-9	TBD	0.00022	0.0010	--	--	0.00022	0.00059	0.00036	--
4,4'-DDT	50-29-3	TBD	0.00022	0.0010	0.001	0.001	0.00022	0.00059	0.00036	0.024
dieldrin	60-57-1	TBD	0.000054	0.0019	0.0019	0.0019	0.000054	0.00014	0.000087	0.028
endosulfan I	959-98-8	TBD	0.0087	0.0087	--	0.0087	--	--	--	58
endosulfan II	33213-65-9	TBD	0.0087	0.0087	--	0.0087	--	--	--	58
endosulfan sulfate	1031-07-8	TBD	0.0087	0.0087	--	0.0087	--	--	--	58
endrin	72-20-8	TBD	0.0023	0.0023	0.0023	0.0023	0.06	0.81	--	0.2
endrin aldehyde	7421-93-4	TBD	0.0023	0.0023	0.0023	0.0023	0.06	0.81	--	0.2
endrin ketone	53494-70-5	TBD	0.0023	0.0023	0.0023	0.0023	0.06	0.81	--	0.2
heptachlor	76-44-8	TBD	0.000079	0.0036	0.0036	0.0036	0.000079	0.00021	0.00013	0.12
heptachlor epoxide	1024-57-3	TBD	0.000039	--	0.0036	0.0036	0.000039	0.00011	0.000064	0.003
a-hexachlorocyclohexane	319-84-6	TBD	0.0049	--	--	--	0.005	0.013	0.0079	--
b-hexachlorocyclohexane	319-85-7	TBD	0.017	--	--	--	0.017	0.046	0.028	--
d-hexachlorocyclohexane	319-86-8	TBD	0.041	--	--	--	0.041	--	--	--
lindane	58-89-9	TBD	0.038	--	--	--	1.8	0.063	0.038	6.0
methoxychlor	72-43-5	TBD	0.03	--	0.03	--	--	--	--	8.4
toxaphene	8001-35-2	TBD	0.0002	0.0002	0.0002	0.0002	0.00028	0.00075	0.00045	--

Note: Target Reporting Limit is the lowest value from the listed regulatory levels (see Section 7.1 of QAPP for a discussion of how regulatory levels were chosen).
PQL = Practical Quantitation Limit. This should be less than the Target Reporting Limit.
TBD = To Be Determined. PQLs will be supplied by laboratory. There may be cases where the laboratory can not meet the Target Reporting Limit.

SEAT:\00\Working\050403700QAPP Table 2-15

TABLE 13
Analytes and Target Reporting Limits
ORGANOPHOSPHOROUS PESTICIDES by SW846-8141, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Soil

Analyte	CAS RN	PQL (mg/kg)	Target ReportingLimit (mg/kg)	MTCA Method A, Unrestricted Land Use (mg/kg)	MTCA Method B, Carcinogen (mg/kg)	MTCA Method B, Non-carcinogen (mg/kg)
alachlor	15972-60-8	TBD	12	–	12	800
methyl azinphos	86-50-0	TBD	–	–	–	–
bolstar (sulfopros)	35400-43-2	TBD	–	–	–	–
carbaryl	63-25-2	TBD	8000	–	–	8000
chlorpyrifos	2921-88-2	TBD	240	–	–	240
chlorfenvinphos	470-90-6	TBD	–	–	–	–
coumaphos	56-72-4	TBD	–	–	–	–
crotoxyphos	7700-17-6	TBD	–	–	–	–
o,s-demeton	8065-48-3	TBD	3.2	–	–	3.2
diazinon	333-41-5	TBD	72	–	–	72
dichlorvos	62-73-7	TBD	3.4	–	3.4	40
dicrotophos	141-66-2	TBD	8.0	–	–	8.0
dimethoate	60-51-5	TBD	16	–	–	16
disulfoton	298-04-4	TBD	3.2	–	–	3.2
ethion	563-12-2	TBD	40	–	–	40
ethoprop	13194-48-4	TBD	–	–	–	–
ethyl p-nitrophenyl phenylphosphorothioate	2104-64-5	TBD	0.8	–	–	0.8
fensulfothion	115-90-2	TBD	20	–	–	20
fenthion	55-38-9	TBD	–	–	–	–
malathion	121-75-5	TBD	1600	–	–	1600
merphos	150-50-5	TBD	2.4	–	–	2.4
methyl parathion	298-00-1	TBD	20	–	–	20
mevinphos	7786-34-7	TBD	20	–	–	20
monocrotophos	2157-98-4	TBD	–	–	–	–
parathion	56-38-2	TBD	480	–	–	480
phorate	298-02-2	TBD	16	–	–	16
ronnel	299-84-3	TBD	4000	–	–	4000
sulfotepp	3689-24-5	TBD	40	–	–	40
tetrachlorvinphos	961-11-5	TBD	42	–	42	2400
tokuthion	34643-46-4	TBD	–	–	–	–
trichloronate	327-98-0	TBD	–	–	–	–

Note: Target Reporting Limit is the lowest value from the listed regulatory levels (see Section 7.1 of QAPP for a discussion of how regulatory levels were chosen).
PQL = Practical Quantitation Limit. This should be less than the Target Reporting Limit.
TBD = To Be Determined. PQLs will be supplied by laboratory. There may be cases where the laboratory can not meet the Target Reporting Limit.

SEAT:\00\Working\050403700QAPP Table 2-15

TABLE 14
Analytes and Target Reporting Limits
ORGANOPHOSPHOROUS PESTICIDES by SW846-8141, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Water

Analyte	CAS RN	PQL (µg/L)	Target Reporting Limit (µg/L)	Aquatic Life - Marine/Chronic - Ch. 173-201A WAC (µg/L)	Aquatic Life - Marine/Chronic - Clean Water Act §304 (µg/L)	Human Health – Marine – Clean Water Act §304 (µg/L)	Human Health – Marine – National Toxics Rule, 40 CFR 131 (µg/L)
alachlor	15972-60-8	TBD	0.4	--	--	--	--
methyl azinphos	86-50-0	TBD	1	--	--	--	--
bolstar (sulfopros)	35400-43-2	TBD	0.7	--	--	--	--
carbaryl	63-25-2	TBD	0.4	--	--	--	--
chlorpyrifos	2921-88-2	TBD	0.0056	0.0056	0.006	--	--
chlorfenvinphos	470-90-6	TBD	0.4	--	--	--	--
coumaphos	56-72-4	TBD	2	--	--	--	--
crotoxyphos	7700-17-6	TBD	0.4	--	--	--	--
o,s-demeton	8065-48-3	TBD	0.1	--	0.1	--	--
diazinon	333-41-5	TBD	2	--	--	--	--
dichlorvos	62-73-7	TBD	8	--	--	--	--
dicrotophos	141-66-2	TBD	0.4	--	--	--	--
dimethoate	60-51-5	TBD	2.6	--	--	--	--
disulfoton	298-04-4	TBD	0.7	--	--	--	--
ethion	563-12-2	TBD	0.4	--	--	--	--
ethoprop	13194-48-4	TBD	2	--	--	--	--
ethyl p-nitrophenyl phenylphosphorothioate	2104-64-5	TBD	0.4	--	--	--	--
fensulfothion	115-90-2	TBD	0.8	--	--	--	--
fenthion	55-38-9	TBD	0.8	--	--	--	--
malathion	121-75-5	TBD	0.1	--	0.1	--	--
merphos	150-50-5	TBD	2	--	--	--	--
methyl parathion	298-00-1	TBD	1.2	--	--	--	--
mevinphos	7786-34-7	TBD	5	--	--	--	--
monocrotophos	2157-98-4	TBD	0.4	--	--	--	--
parathion	56-38-2	TBD	0.6	--	--	--	--
phorate	298-02-2	TBD	0.4	--	--	--	--
ronnel	299-84-3	TBD	0.7	--	--	--	--
sulfotepp	3689-24-5	TBD	0.7	--	--	--	--
tetrachlorvinphos	961-11-5	TBD	8	--	--	--	--
tokuthion	34643-46-4	TBD	0.7	--	--	--	--
trichloronate	327-98-0	TBD	8	--	--	--	--

Note: Target Reporting Limit is the lowest value from the listed regulatory levels (see Section 7.1 of QAPP for a discussion of how regulatory levels were chosen).
There were only regulatory levels for three analytes for OP pesticides in water. Standard laboratory reporting limits were used as the Target Reporting Limit in these cases.
PQL = Practical Quantitation Limit. This should be less than the Target Reporting Limit.
TBD = To Be Determined. PQLs will be supplied by laboratory. There may be cases where the laboratory can not meet the Target Reporting Limit.

SEAT:\00\Working\050403700QAPP Table 2-15

TABLE 15
Analytes and Target Reporting Limits
HERBICIDES by SW846-8151, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Soil

Analyte	CAS RN	PQL (mg/kg)	Target ReportingLimit (mg/kg)	MTCA Method A, Unrestricted Land Use (mg/kg)	MTCA Method B, Non-carcinogen (mg/kg)
dalapon	75-99-0	TBD	2400	--	2400
2,4-db	94-82-6	TBD	640	--	640
dicamba	1918-00-9	TBD	2400	--	2400
2,4-dichlorophenoxyacetic acid	94-75-7	TBD	800	--	800
dichloroprop	120-36-5	TBD	--	--	--
dinoseb	88-85-7	TBD	80	--	80
2-methyl-4-chlorophenoxy-acetic acid	94-74-6	TBD	40	--	40
(2-methyl-4-chlorophenoxy)-2-propionic acid	93-65-2	TBD	80	--	80
2,4,5-tp	93-72-1	TBD	640	--	640
2,4,5-trichlorophenoxyacetic acid	93-76-5	TBD	800	--	800

Water

Analyte	CAS RN	PQL (µg/L)	Target Reporting Limit (µg/L)	Human Health – Marine – Clean Water Act §304 (µg/L)	Human Health – Marine – National Toxics Rule, 40 CFR 131 (µg/L)
dalapon	75-99-0	TBD	0.4	--	--
2,4-db	94-82-6	TBD	0.4	--	--
dicamba	1918-00-9	TBD	0.4	--	--
2,4-dichlorophenoxyacetic acid	94-75-7	TBD	0.4	--	--
dichloroprop	120-36-5	TBD	0.4	--	--
dinoseb	88-85-7	TBD	0.2	--	--
2-methyl-4-chlorophenoxy-acetic acid	94-74-6	TBD	100	--	--
(2-methyl-4-chlorophenoxy)-2-propionic acid	93-65-2	TBD	100	--	--
2,4,5-tp	93-72-1	TBD	0.2	--	--
2,4,5-trichlorophenoxyacetic acid	93-76-5	TBD	0.2	--	--

Note: Target Reporting Limit is the lowest value from the listed regulatory levels (see Section 7.1 of QAPP for a discussion of how regulatory levels were chosen). There were no regulatory levels for herbicides in water. Standard laboratory reporting limits were used as the Target Reporting Limit.

PQL = Practical Quantitation Limit. This should be less than the Target Reporting Limit.

TBD = To Be Determined. PQLs will be supplied by laboratory. There may be cases where the laboratory can not meet the Target Reporting Limit.

SEAT:\00\Working\050403700QAPP Table 2-15

TABLE 16
Sample Containers, Preservation and Holding Time, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

		Soils				Waters			
Analysis	Method	Minimum Sample Size	Sample Containers	Sample Preservation	Holding Times	Minimum Sample Size	Sample Containers	Sample Preservation	Holding Times
VOC	SW-846 8260B	100 g	4 or 8 oz glass widemouth with Teflon-lined lid	Cool 4°C	14 days	120 mL	3 - 40 mL VOA Vials	HCl - pH<2	14 days preserved 7 days unpreserved
SVOC	SW-846 8270C	100 g	4 or 8 oz glass widemouth with Teflon-lined lid	Cool 4°C	14 days to extraction, 40 days from extraction to analysis	1 L	1 liter amber glass with Teflon-lined lid	Cool 4°C	7 days to extraction 40 days from extraction to analysis
PCDD/PCDF	SW-846 8290	100 g	4 or 8 oz glass widemouth with Teflon-lined lid	Cool 4°C	30 days to extraction, 40 days from extraction to analysis	1 L	1 liter amber glass with Teflon-lined lid	Cool 4°C	30 days to extraction 40 days from extraction to analysis
Herbicides	SW-846 8151	100 g	4 or 8 oz glass widemouth with Teflon-lined lid	Cool 4°C	14 days to extraction, 40 days from extraction to analysis	1 L	1 liter amber glass with Teflon-lined lid	Cool 4°C	7 days to extraction 40 days from extraction to analysis
PCB	SW-846 8082	100 g	4 or 8 oz glass widemouth with Teflon-lined lid	Cool 4°C	14 days to extraction, 40 days from extractiom to analysis	1 L	1 liter amber glass with Teflon-lined lid	Cool 4°C	7 days to extraction 40 days from extraction to analysis
Organochlorine Pesticides	SW-846 8081	100 g	4 or 8 oz glass widemouth with Teflon-lined lid	Cool 4°C	14 days to extraction, 40 days from extraction to analysis	1 L	1 liter amber glass with Teflon-lined lid	Cool 4°C	7 days to extraction 40 days from extraction to analysis
Organophosphorous Pesticides	SW-846 8141	100 g	4 or 8 oz glass widemouth with Teflon-lined lid	Cool 4°C	14 days to extraction, 40 days from extraction to analysis	1 L	1 liter amber glass with Teflon-lined lid	Cool 4°C	7 days to extraction 40 days from extraction to analysis
Diesel Range Hydrocarbons	NWTPH-Dx	100 g	8 or 16 oz amber glass wide-mouth with Teflon-lined lid	Cool 4°C	14 days to extraction, 40 days from extractiom to analysis	1 L	1 liter amber glass with Teflon-lined lid	Cool 4 C, HCl to pH < 2	14 days to extraction 40 days from extraction to analysis
Gas Range Hydrocarbons	NWTPH-G	100 g	4 or 8 oz glass widemouth with Teflon-lined lid	Cool 4°C	14 days	120 mL	3 - 40 mL VOA Vials	HCl - pH<2	14 days preserved 7 days unpreserved
Metals Mercury	SW-846 6010/6020 SW-846 7470/7471	100 g	4 or 8 oz glass widemouth with Teflon-lined lid	Cool 4°C	180 days/ 28 days for Mercury	500 mL	1 L poly bottle	HNO_3 - pH<2 (Dissolved metals preserved after filtration)	180 days (28 days for Mercury)

Note: Holding Times are based on elapsed time from date of collection

VOC = Volatile Organic Compounds
SVOC = Semivolatile Organic Compound
PCDD = Polychlorinated Dibenzo-p-dioxins
PCDF = Polychlorinated Dibenzofurans
PCB = Polychlorinated Biphenyls
HCl = Hydrochloric Acid
HNO_3 = Nitric Acid
oz = ounce
mL = milliliter
L = liter
g = gram

SEAT:\00\Working\050403700QAPP Table 16

TABLE 17
Quality Control Sample Types and Frequency, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Parameter	Field QC			Laboratory QC			
	Field Duplicates	Equipment Rinsates	Trip Blanks	Method Blanks	LCS	MS / MSD	Lab Duplicates
VOCs	1/20 samples for each water matrix	1/matrix	1/cooler	1/batch	1/batch	1 set/batch	NA
SVOCs	1/20 samples for each water matrix	1/matrix	NA	1/batch	1/batch	1 set/batch	NA
PCDDs/PCDFs	1/20 samples for each water matrix	1/matrix	NA	1/batch	1/batch	1 set/batch	NA
Herbicides	1/20 samples for each water matrix	1/matrix	NA	1/batch	1/batch	1 set/batch	NA
PCBs	1/20 samples for each water matrix	1/matrix	NA	1/batch	1/batch	1 set/batch	NA
Organochlorine Pesticides	1/20 samples for each water matrix	1/matrix	NA	1/batch	1/batch	1 set/batch	NA
Organophosphorous Pesticides	1/20 samples for each water matrix	1/matrix	NA	1/batch	1/batch	1 set/batch	NA
Diesel Range Hydrocarbons	1/20 samples for each water matrix	1/matrix	NA	1/batch	1/batch	NA	1/batch
Gas Range Hydrocarbons	1/20 samples for each water matrix	1/matrix	NA	1/batch	1/batch	NA	1/batch
Metals/Mercury	1/20 samples for each water matrix	1/matrix	NA	1/batch	1/batch	1 MS/batch	1/batch

Note: An analytical lot or batch is defined as a group of samples taken through a preparation procedure and sharing a method blank, LCS, and MS/ MSD (or MS and lab duplicate). No more than 20 field samples can be contained in one batch.

LCS = Laboratory control sample
MS = Matrix spike sample
MSD = Matrix spike duplicate sample
VOC = Volatile organic compounds
SVOC = Semivolatile Organic Compound
PCDD = Polychlorinated dibenzo-p-dioxins
PCDF = Polychlorinated dibenzofurans
PCB = Polychlorinated biphenyls

SEAT:\00\Working\050403700QAPP Table 17

Table 18
Data Package Deliverables List, MARCH POINT LANDFILL
ANACORTES, WASHINGTON

Analytical Group Method	Deliverable Requirement	Compliance Screen	Summary DV (Level III)	Full DV (Level IV)
Moisture Analysis (soils)	Copies of logbook pages		✓	✓
Volatile Organics SW8240, SW8260, and Semivolatile Organics SW8270 and SIM	Case Narrative	✓	✓	✓
	Chain-of-custody form	✓	✓	✓
	Results summary for each sample and blank	✓	✓	✓
	Tentatively identified compounds in each sample and blank			✓ (if required)
	Blank Spike Results: Identity of spiked compounds, amount spiked, amount recovered, % recovery, acceptance criteria	✓	✓	✓
	Surrogates recovery	✓	✓	✓
	Matrix spike/duplicate matrix spike recoveries	✓	✓	✓
	Blank Summary: Cross reference of field sample ID number, laboratory sample number, and analytical batch	✓	✓	✓
	Instrument performance check (tuning)		✓	✓
	Initial calibration data		✓	✓
	Continuing calibration data		✓	✓
	Internal standards areas and retention times		✓	✓
	Reconstructed ion chromatograms for each sample, blank, and standard			✓
	Quantitation list			✓
	Raw, reference, and background-subtracted mass spectra for each reported target analyte (except MS/MSD)			✓
	Mass spectra of TICs with library spectra of the 3 best-fit matches (except MS/MSD)			✓
	Standards preparation sheet/logs			✓
	Copies of sample preparation work sheets			✓
	Copies of run logs		✓	✓
Organochlorine Pesticides and PCBs SW8080	Case narrative	✓	✓	✓
	Chain-of-custody form	✓	✓	✓
	Results summary for each sample and blank	✓	✓	✓
	Blank Spike Results (IF ANALYZED): Identify of spiked compounds, amount spiked, amount recovered, % recovery, acceptance criteria	✓	✓	✓
	Surrogates recovery	✓	✓	✓
	Matrix spike/duplicate matrix spike recoveries	✓	✓	✓
	Blank Summary: Cross reference of the field sample number, laboratory sample number, and the analytical batch	✓	✓	✓
	Initial calibration for single component analytes, retention time windows, on each column		✓	✓
	Initial calibration for single-component analytes, response factors, on each column		✓	✓
	Initial calibration for multi-component analytes, one standard at reporting limit, on each column		✓	✓
	Initial calibration for multi-component analytes, three-point (5-point for SW846 methods), for detected analytes, on each column		✓	✓

Analytical Group Method	Deliverable Requirement	Compliance Screen	Summary DV (Level III)	Full DV (Level IV)
Organochlorine Pesticides and PCBs SW8080 (Cont'd)	Analyte resolution, on each column PEM calibration verification, on each column, including end-of-run verification		✓	✓
	Mixes A & B calibration verification, on each column, including end-of-run verification		✓	✓
	Florisil cartridge check		✓	✓
	GPC check		✓	✓
	Chromatograms for each sample, blank, and standard, on each column			✓
	Summary of percent difference between primary and confirmation column for each positive result		✓	✓
	Quantitation report, for each column			✓
	Standards preparation sheets/logs			✓
	Copies of sample preparation work sheets			
	Copies of run logs		✓	✓
Chlorophenoxy Herbicides SW8150	Case narrative	✓	✓	✓
	Chain-of-custody form	✓	✓	✓
	Results summary for each sample and blank	✓	✓	✓
	Blank Spike Results: Identity of spiked compounds, amount spiked, amount recovered, % recovery, acceptance criteria	✓	✓	✓
	Surrogates recovery	✓	✓	✓
	Matrix spike/duplicate matrix spike recoveries	✓	✓	✓
	Blank Summary: Cross reference of field sample number, laboratory sample number, and analytical batch	✓	✓	✓
	Initial calibration, retention time windows, on each column		✓	✓
	Initial calibration, response factors, on each column		✓	✓
	Continuing calibration verification, on each column, including end-of-run verification		✓	✓
	Chromatograms for each sample, blank, and standard, on each column			✓
	Summary of percent difference between primary and confirmation column for each positive result		✓	✓
	Quantitation report, for each column			✓
	Standards preparation sheet/logs			✓
	Copies of sample preparation work sheets			✓
	Copies of run logs		✓	✓

Analytical Group Method	Deliverable Requirement	Compliance Screen	Summary DV (Level III)	Full DV (Level IV)
Metals(s) by ICP SW6010	Case narrative	✓	✓	✓
	Cross reference of the field sample ID number, laboratory sample number, and analytical batch	✓	✓	✓
	Chain-of-custody forms	✓	✓	✓
	Sample results	✓	✓	✓
	Blank Results: Initial, continuing, and preparation	✓	✓	✓
	Initial and continuing calibration data	✓	✓	✓
	CRDL standard for ICP			✓
	Laboratory Control Sample Results: Amount spiked, amount recovered, percent recovery, acceptance criteria	✓	✓	✓
	Matrix spike results	✓	✓	✓
	Post-digestion spike recovery for ICP			✓
	Interference check for ICP		✓	✓
	Duplicate sample results	✓	✓	✓
	ICP serial dilutions		✓	✓
	ICP inter-element correction factors			✓
	ICP linear range			✓
	Preparation log			✓
	Analysis run log		✓	✓
	Standards preparation sheet/logs			✓
	Raw data and instrument printouts			✓
Metal(s) by GFAA Various SW846 Methods, 7000 Series	Case narrative	✓	✓	✓
	Cross reference of field sample ID number, laboratory sample number, and analytical batch	✓	✓	✓
	Chain-of-custody forms	✓	✓	✓
	Sample results with CLP flagging	✓	✓	✓
	Blank Results: Initial, continuing, and preparation	✓	✓	✓
	Initial and continuing calibration data	✓	✓	✓
	CRDL standard for AA			✓
	Laboratory Control Sample Results: Amount spiked, amount recovered, % recovery, acceptance criteria, control chart	✓	✓	✓
	Matrix spike results	✓	✓	✓
	Analytical spike for GFAA	✓	✓	✓
	Duplicate sample results	✓	✓	✓
	Standard addition results		✓	✓
	Preparation log			✓
	Analysis run log		✓	✓
	Standards preparation sheet/logs			✓
	Raw data and instrument printouts			✓
Total Organic Carbon SW9060	Case Narrative	✓	✓	✓
	Cross reference of field sample ID, Laboratory Sample No., and Analytical Batch	✓	✓	✓
	Chain-of-custody forms	✓	✓	✓
	Sample results	✓	✓	✓
	Blank results	✓	✓	✓
	Initial and continuing calibration data		✓	✓
	Blank spike results (material spiked, quantity spiked, quantity recovered, percent recovery)	✓	✓	✓
	Matrix spike/duplicate matrix spike results	✓	✓	✓
	Sample preparation log			✓
	Instrument run log		✓	✓
	Printouts and raw data			✓

Analytical Group Method	Deliverable Requirement	Compliance Screen	Summary DV (Level III)	Full DV (Level IV)
Inorganic Analytes (colorimetric)	Case narrative	✓	✓	✓
	Cross reference of field sample ID, Laboratory Sample No., and Analytical Batch	✓	✓	✓
	Chain-of-custody forms	✓	✓	✓
	Sample results	✓	✓	✓
	Blank results	✓	✓	✓
	Initial and continuing calibration data		✓	✓
	Blank spike results (material spiked, quantity spiked, quantity recovered, percent recovery)	✓	✓	✓
	Matrix spike/duplicate results	✓	✓	✓
	Sample preparation log		✓	✓
	Printouts and raw data			✓

SEAT:\00\Working\050403700QAPP Table 1

APPENDIX B
HEALTH AND SAFETY PLAN

GEOENGINEERS, INC.
SITE HEALTH AND SAFETY PLAN CHECKLIST
MARCH POINT LANDFILL

This checklist is to be used in conjunction with the GeoEngineers Safety Program Manual. Together, the program and this checklist constitute the site safety plan for this site. This plan is to be used by GeoEngineers personnel on this site. If the work entails potential exposures to other substances or unusual situations, additional safety and health information will be included and the plan will be approved by the GeoEngineers Health and Safety Manager. All plans are to be used in conjunction with current standards and policies outlined in the GeoEngineers Health and Safety Program Manual.

1.0 General Project Information

Project Name:	March Point Landfill
Project Number:	504-037-00; Task 3
Type of Project:	Environmental
Start/Completion:	Summer 2007
Subcontractors:	To be determined

Liability Clause - This Site Safety Plan is intended for use by GeoEngineers Employees only. It does not extend to the other contractors or subcontractors working on this site. If requested by subcontractors, this site safety plan may be used as a minimum guideline for those entities to develop safety plans or procedures for their own staff to work under. In this case, Form C-3 shall be signed by the subcontractor.

2.0 Scope Of Work

The general scope of work is as follows:

1. GeoEngineers personnel to support investigations proposed in the Uplands RI/FS work plan.
2. Perform investigation in order to define the nature and extent of soil and groundwater contamination.

3.0 PERSONNEL/CONTACT INFORMATION PHONE NUMBERS

TITLE	NAME	TELEPHONE NUMBERS
Site Safety and Health Supervisor	Neil Morton	(206) 239-3238
Project Manager	Neil Morton	(206) 239-3238
Health and Safety Program Manager	Leah Alcyon, CIH	(206) 728-2674
Field Engineer/Geologist	To be determined	
Client	Panjini Balaraju, Ecology	(360) 407-6161
Current Owner	Stein Svendsen	(360) 293-5812

Site Safety and Health Supervisor -- The individual present at a hazardous waste site responsible to the employer and who has the authority and knowledge necessary to establish the site-specific health and safety plan and verify compliance with applicable safety and health requirements.

4.0 EMERGENCY INFORMATION

Hospital Name and Address:
Island Hospital Emergency Dept.
1211 24th St.
Anacortes, WA 98221

Phone Numbers (Hospital ER): (360) 299-1311 (in emergency call 911)
Starting from: March Point
Arriving at: Emergency Dept.
Route to Hospital Map:

Head southeast on S March Point Rd/March's Point Rd toward Casino Dr 0.4 mi 1 min
Turn right at WA-20 W 2.7 mi 4 mins
Continue on WA-20-SPUR W 2.7 mi 3 mins
Turn right at Commercial Ave/WA-20-SPUR 0.7 mi 2 mins
Temporary directions due to construction:
Commercial Ave. to 26th St.
West on 26th St., onto the hospital campus, park in parking lot next to building
Emergency Department is accessed through temporary canopy on right.

To access the Island Hospital Emergency Department visitors MUST enter the hospital campus from 26th St., off Commercial Ave. Due to construction, a temporary entrance will be in effect until late 2007.

Ambulance: 9-1-1
Poison Control: Seattle (206) 253-2121; Other (800) 732-6985
Police: 9-1-1
Fire: 9-1-1
Location of Nearest Telephone: Cell phones are carried by field personnel.
Nearest Fire Extinguisher: Located in the GEI vehicle on site.
Nearest First-Aid Kit: Located in the GEI vehicle on site.

4.1 Standard Emergency Procedures

1. Get help -
   - send another worker to phone 911 (if necessary)
   - as soon as feasible, notify GeoEngineers' project manager
2. Reduce risk to injured person -
   - turn off equipment
   - move person from injury location (if possible)
   - keep person warm
   - perform CPR (if necessary)
3. Transport injured person to medical treatment facility (if necessary) -
   - by ambulance (if necessary) or GeoEngineers vehicle
   - stay with person at medical facility
   - keep GeoEngineers manager apprised of situation and notify human resources manager of situation

5.0 Personnel Training Records

Name of Employee	Level of Training (24/ 40 hr)	Date of Last Training	HAZWOPER Supervisor Training	First Aid/ CPR	Respirator Fit Test
To be determined					

6.0 Known (or Anticipated) Hazards

Note: A hazard assessment will be completed at every site prior to beginning field activities. Updates will be included in the daily log. This list is a summary of hazards listed on the form.

6.1 Physical Hazards

X	Drill rig
	Back hoe
X	Track hoe (test pits)
	Crane
	Front End Loader
	Excavations/trenching (1:1 slopes for Type B soil)
	Shored/braced excavation if greater than 4 feet of depth
X	Overhead hazards/power lines
X	Tripping/puncture hazards (debris and wood chips on-site, steep slopes or pits)
X	Unusual traffic hazard – Street traffic and railroad tracks
X	Saw Mill operations, including trucks loading and unloading logs
X	Piles of logs on-site

6.2 Physical Hazard Mitigation Measures or Procedures

- Work areas will be marked with reflective cones, barricades and/or caution tape. Personnel will wear blaze orange vests for increased visibility by vehicle and equipment operators.
- Field personnel will be aware constantly of the location and motion of heavy equipment. A safe distance will be maintained between personnel and the equipment. Personnel will be visible to the operator at all times and will remain out of the swing and/or direction of the equipment apparatus. Personnel will approach operating heavy equipment only when they are certain the operator has indicated it is safe to do so.
- Heavy equipment and/or vehicles used on this site will not work within 20 feet of overhead utility lines without first ensuring that the lines are not energized. This distance may be reduced to 10 feet depending on the client and the use of a safety watch.

  Overhead Power Line Clearance Safety

  Working equipment around overhead power lines requires distance and a spotter. Before a job begins, call the utility company and find out voltage in lines. Have the equipment de-energized if possible. Ensure that the equipment remains de-energized by using some type of lockout and tag procedure, and ensure that the electrician uses grounding lines when they are required.
- Keep a safe distance from energized parts which is a minimum of 10 feet for 50 kV and under. The minimum distance will be more for higher voltages (above 50kV). The only exception is for trained and qualified electrical workers using insulated tools designed for high voltage lines.
- Don't operate equipment around overhead power lines unless you are authorized and trained to do so. If an object (scaffolds, crane, etc.) must be moved in the area of overhead power lines, appoint a competent worker whose sole responsibility is to observe the clearance between the power lines and the object. Warn others if the minimum distance is not maintained.
- Never touch an overhead line if it has been brought down by machinery or has fallen. Never assume lines are dead. When a machine is in contact with an overhead line, **DO NOT** allow anyone to come near or touch the machine. Stay away from the machine and summon outside assistance. Never touch a person who is in contact with a live power line.
- If you are in a vehicle that is in contact with an overhead power line, **DON'T LEAVE THE VEHICLE**. As long as you stay inside and avoid touching metal on the vehicle, you may avoid an electrical hazard. If you need to get out to summon help or because of fire, jump out without touching any wires or the machine, keep your feet together, and hop to safety.
- When mechanical equipment is being operated near overhead power lines, employees standing on the ground may not contact the equipment unless it is located so that the required clearance cannot be violated even at the maximum reach of the equipment.
- When working near overhead power lines, the use of nonconductive wooden or fiberglass ladders is recommended. Aluminum ladders and metal scaffolds or frames are efficient conductors of electricity.
- Avoid storing materials under or near overhead power lines.
- Personnel entry into unshored or unsloped excavations deeper than 4 feet is not allowed. Any trenching and shoring requirements will follow guidelines established in WAC 296-155, the Washington State Construction standards or OSHA 1926.651 Excavation Requirements. In the event that a worker is required to enter an excavation deeper than 4 feet, a trench box or other acceptable shoring will be employed or the side walls of the excavation will be sloped according to the soil type and guidelines as outlined in OSHA/WISHA regulations. If the shoring/sloping

deviates from that outlined in the WAC, it will be designed and stamped by a PE. Prior to entry, personnel will conduct air monitoring as described later in this plan. All hazardous encumbrances and excavated material will be stockpiled at least 2 feet from the edge of a trench or open pit. If concentrations of volatile gases accumulate within an open trench or excavation, the means of entering shall adhere to confined space entry and air monitoring procedures outlined under the air monitoring recommendations in this plan and the GeoEngineers Safety Program Manual.

- Personnel will avoid tripping hazards, steep slopes, pit and other hazardous encumbrances. If it becomes necessary to work within 6 feet of the edge of a pit, slope, pier or other potentially hazardous area, appropriate fall protection measures will be implemented by the Site Safety and Health Supervisor in accordance with OSHA/WISHA regulations and the GEI Safety Program manual.

Engineering controls:

_____	Trench shoring (1:1 slope for Type B Soils)
X	Location work spaces upwind/wind direction monitoring
_____	Other soil covers (as needed)
_____	Other (specify)_____
_____	

6.3 Chemical Hazards (potentially present at site)

Petroleum Hydrocarbons:

X	Naphthalenes
X	Aromatic hydrocarbons (benzene, ethylbenzene, toluene, xylenes [BETX])
X	Gasoline
X	Diesel fuel
X	Waste oil
_____	Other petroleum fuels (list) _____

Other: Asbestos

X	Asbestos

6.4 Hazards from Other Organic Compounds (present or potentially present at site)

X	PCBs Polychlorinated biphenyls
X	PAHs (polycyclic aromatic hydrocarbons)
X	Pesticides/Herbicides
X	VOCs (volatile organic compounds)
X	SVOCs (Semivolatile organic compounds)
X	Dioxins/ Furans

6.5 Metals (Potentially present at site)

X	Lead
X	Copper
X	Chromium
X	Zinc
X	Other metals (arsenic, cadmium, manganese, mercury, nickel, thallium, vanadium)

Historical Sampling:

Upland soil and groundwater samples have not been collected. Historical upland surface water/leachate sampling results are as follows:

- **1986 Ecology Site Inspection.** Three surface water and one leachate sample collected. Arsenic, copper, mercury, and nickel detected at concentrations greater than applicable surface water criteria.
- **1989 Ecology Sampling.** One leachate sample collected. Arsenic, cadmium, chromium, copper, lead, nickel, thallium, and zinc detected at concentrations greater than applicable surface water criteria.
- **1996 Skagit County Sampling.** Two leachate samples collected. No compounds detected at concentrations greater than applicable surface water criteria.
- **1998 Ecology Sampling.** Two leachate samples collected. Manganese, #2 diesel, benzo(a)anthracene, and aroclor 1242 detected at concentrations greater than applicable surface water criteria.

Due to the lack of soil and groundwater sampling and chemical analysis in the upland portion of this site, the health effects of categories of potential chemicals on site have been included below.

Summary of Chemical Hazards

Compound/ Description	Exposure Limits/IDLH[b]	Exposure Routes	Toxic Characteristics
Diesel Fuel—liquid with a characteristic odor	None established by OSHA, but ACGIH has adopted 100 mg/m^3 for a TWA (as total hydrocarbons)	Ingestion, inhalation, skin absorption, skin and eye contact	Irritated eyes, skin, and mucous membrane; fatigue; blurred vision; dizziness; slurred speech; confusion; convulsions; and headache, and dermatitis
Gasoline (Unleaded)—clear liquid with a characteristic odor	PEL 300 ppm TLV 300 ppm STEL 500 ppm	Ingestion, inhalation, skin absorption, skin and eye contact	Irritated eyes, skin, and mucous membrane; fatigue; blurred vision; dizziness; slurred speech; confusion; convulsions; and headache, and dermatitis
Mineral Oil – As a mist	The current OSHA PEL for mineral oil mist is 5 mg/m^3 of air as an 8-hr TWA	If the oil is not a mist, then route of exposure is skin and eye contact	Exposure to oil mists can cause eye, skin, and upper respiratory tract irritation
Mineral based crankcase oil – may contain metals, gas, antifreeze and PAHs	It depends on the contaminants	Ingestion, inhalation, skin absorption, skin and eye contact	It depends on the contaminants.

Summary of Chemical Hazards (Continued)

Compound/ Description	Exposure Limits/IDLH[b]	Exposure Routes	Toxic Characteristics
Benzene	OSHA PEL 1 ppm Short term: 5 ppm ACGIH PEL 0.5 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritated eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]
PCBs (as Arochlor 1254)—colorless to pale-yellow viscous liquid with a mild, hydrocarbon odor	PEL 0.5 mg/m^3 TLV 0.5 mg/m^3 REL 0.001 mg/m^3 IDLH 5.0 mg/m^3	Inhalation (dusts or mists), skin absorption, ingestion, skin and/or eye contact	Irritated eyes, chloracne, liver damage, reproductive effects, potential carcinogen
1,2 Dichloroethane, all isomers	PEL 50 ppm TLV 200 ppm Ceiling 100 ppm	Inhalation, ingestion, skin absorption, skin and/or eye contact	Irritated eyes, corneal opacity; central nervous system depression; nausea, vomiting; dermatitis; liver, kidney, cardiovascular system damage; [potential occupational carcinogen]
1,1,1, Trichloroethane	PEL 350 ppm REL 350 ppm IDLH 700 ppm	Inhalation, ingestion, skin and/or eye contact	Irritated eyes, skin; headache, lassitude (weakness, exhaustion), central nervous system depression, poor equilibrium; dermatitis; cardiac arrhythmias; liver damage
1,2 dichloroethylene	OSHA PEL 200 ppm	Eyes, respiratory system, central nervous system	Irritated eyes, respiratory system; central nervous system depression
1,2 dichloropropane	OSHA PEL 75 ppm	Eyes, respiratory system, central nervous system	Irritated eyes, skin, respiratory system; drowsiness, dizziness; liver, kidney damage; in animals: central nervous system depression; [potential occupational carcinogen]
Trichloroethene/ Trichloroethylene/ TCE	TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 2 hours) ACGIH TWA is 50 ppm	Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system	Irritated eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias; liver injury; potential occupational carcinogen

Summary of Chemical Hazards (Continued)

Compound/ Description	Exposure Limits/IDLH[b]	Exposure Routes	Toxic Characteristics[d]
Vinyl Chloride	PEL 1 ppm TLV 1 ppm Ceiling 5 ppm (15 mins)	Inhalation, skin and/or eye contact (liquid)	Lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]
1,4 Dioxane	PEL 100 ppm TLV 20 ppm REL 1 ppm Ceiling IDLH 500 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritated eyes, skin, nose, throat; drowsiness, headache; nausea, vomiting; liver damage; kidney failure; [potential occupational carcinogen]
Polycyclic aromatic hydrocarbons (PAH) as coal tar pitch volatiles	PEL 0.2 mg/m^3 TLV 0.2 mg/m^3 REL 0.1 mg/m^3 IDLH 80 mg/m^3	Inhalation, ingestion, skin and/or eye contact	Dermatitis, bronchitis, potential carcinogen
Arsenic	PEL 0.01 mg/m^3 TLV 0.01 mg/m^3 Ceiling 0.002 mg/m^3 IDLH 5 mg/m^3	Inhalation, skin absorption, ingestion, skin and/or eye contact	Ulcerated nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin, potential carcinogen
Chromium	PEL 1 mg/m^3 TLV 0.5 mg/m^3 REL 0.5 mg/m^3 IDLH 250 mg/m^3	Inhalation, ingestion, skin and/or eye contact	Chromium III is an essential nutrient, Chromium VI can cause irritation to nose, skin ulcers, linked to cancer.
Copper (dusts and mists)	PEL 1 mg/m^3 TLV 1 mg/m^3 REL 1 mg/m^3 IDLH 100 mg/m^3	Inhalation, ingestion, skin and/or eye contact	Irritated eyes and respiratory system, coughing, difficulty breathing, wheezing, potential carcinogen
Lead (and inorganic compounds as lead)	PEL 0.05 mg/m^3 TLV 0.05 mg/m^3 REL 0.05 mg/m^3 IDLH 100 mg/m^3	Inhalation, ingestion, skin and/or eye contact	Lassitude (weakness, exhaustion), insomnia, facial pallor, anorexia, weight loss, malnutrition, constipation, abdominal pain, colic, anemia, gingival lead line, tremor, wrist and ankle paralysis, encephalopathy, kidney disease, irritated eyes, hypotension

Summary of Chemical Hazards (Continued)

Compound/ Description	Exposure Limits/IDLH[b]	Exposure Routes	Toxic Characteristics[d]
Cadmium as dust	OSHA PEL 0.005 mg/m^3 IDLH 9 mg/m^3	respiratory system, kidneys, prostate, blood	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]
Mercury (and inorganic compounds as mercury)	PEL none TLV 0.025 mg/m^3 REL none Ceiling 0.1 mg/m^3 IDLH 10 mg/m^3	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritated eyes and skin, coughing, chest pain, difficulty breathing, bronchitis, pneumonitis, tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion), stomatitis, salivation, gastrointestinal disturbance, anorexia, weight loss, proteinuria

HEALTH HAZARDS OF DIOXINS

Generally, dioxin exposures to humans are associated with increased risk of severe skin lesions such as chloracne and hyperpigmentation, altered liver function and lipid metabolism, general weakness associated with drastic weight loss, changes in activities of various liver enzymes, depression of the immune system, and endocrine- and nervous-system abnormalities. It is a potent teratogenic and fetotoxic chemical in animals. A very potent promoter in rat liver cancers, TCDD also causes cancers of the liver and other organs in animals. Populations occupationally or accidentally exposed to chemicals contaminated with dioxin have increased incidences of soft-tissue sarcoma and non-Hodgkin's lymphoma.

Dioxin-contaminated soil may result in dioxins occurring in a food chain. This is especially important for the general population. It has been estimated that about 98 percent of exposure to dioxins is through the oral route. Exposure as a vapor is normally negligible because of the low vapor pressure typical of these compounds. In the 1980s, a concentration level of 1 ppb 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in soil was specified as "a level of concern," based on cancer effects. However, recent studies indicate that end points other than cancer (such as those listed above) are also of concern based on a projected intake from 1 ppb TCDD in soil. TL-MW-3-PO1, HS-SSP-SO1, and other samples taken on this site indicate levels in the well and soils exceeding 1 ppb.

DDT

The PEL for DDT is 1 mg/m^3 for an 8-hour average with a skin notation. DDT is very highly persistent in the environment, with a reported half-life of between 2 to 15 years, and is immobile in most soils. The DDT in air is gone within two days. DDT attaches tightly to soil and does not move down through the soil quickly to underground water supplies. DDT may attach to small particles and be carried by the

wind. Breakdown products in the soil environment are DDE and DDD, which are also highly persistent and have similar chemical and physical properties. Due to its extremely low solubility in water, DDT will be retained to a greater degree by soils and soil fractions with higher proportions of soil organic matter. DDT in surface water may also evaporate into the air, and the sun or microorganisms break down some DDT in water.

Routes of exposure include inhalation, skin absorption, ingestion, skin and/or eye contact.

Symptoms: Irritation to eyes, skin; paresthesia in the tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis in the hands; vomiting; [potential occupational carcinogen].

DDT is colorless crystals or off-white powder with a slight, aromatic odor.

Self-contained breathing apparatus (SCBA) should be used if there is any detectable concentration of DDT in the breathing air of employees.

METHANE

Methane acts as a simple asphyxiant when inhaled. Its presence displaces air, which lowers the partial pressure of oxygen and causes hypoxia. Methane is odorless and tasteless and will not be detected by the PID. A TLV or 4-gas monitor will detect methane as a flammable gas. The LEL of methane is 5 percent and the UEL is 15 percent. A concentration of methane of 5 percent in a room would cause oxygen deficiency.

Five percent methane would displace the 21 percent oxygen in our normal atmosphere and take it to less than 19.5 percent oxygen that is required for occupational exposures. The atmosphere is 78 percent nitrogen, and presumably some of this would be replaced by the methane as well. Obviously if the methane just replaced the oxygen, the remaining 16% would be lower than allowable for occupational exposures.

Landfill Gas Primer: good information for people working with landfills

http://www.atsdr.cdc.gov/HAC/landfill/html/ch3.html

6.6 Chemical Hazard Mitigation Measures or Procedures

Air monitoring will be conducted for VOC vapors and for establishing the level of respiratory protection. A PID will used on site at all times and if ambient air sampling indicates chemical contamination, respirators will be utilized.

- Half face combination organic vapor/HEPA cartridge respirators will be available on site to be used as necessary. P100 cartridges are used for protection against dust, metals and asbestos, while the combination organic vapor/HEPA cartridges are protective against both dust and vapor. Ensure that the PID or TLV will detect the chemicals of concern on site.
- Level D PPE will be worn at all times on site. Potentially exposed personnel will wash gloves, hands, face, and other pertinent items to prevent hand-to-mouth contact. This will be done prior to hand-to-mouth activities including eating, smoking, etc. Adequate personnel and equipment

decontamination will be used to decrease potential ingestion and inhalation.Individual PELs or action limits are not expected to be exceeded given the planned activities. If there are waste oil contaminants in the soil and conditions are damp, airborne dust is not likely to be an issue. If conditions are dry and dust is visible during site activities, personnel will use P100 cartridges on their respirators. ***6.7 Biological Hazards***

	Poison Ivy or other vegetation	
	Insects or snakes	
	Used hypodermic needs or other infectious hazards	**Do not pick up or contact**
	Others	

6.8 Biological Hazard Mitigation Measures or Procedures

Site personnel shall avoid contact with or exposures to potential biological hazards encountered.

Additional Hazards None anticipated.

6.9 Additional Hazards (Update in Daily Log)

Include evaluation of:

- *Physical Hazards* (excavations and shoring, equipment, traffic, tripping, heat stress, cold stress and others)
- *Chemical Hazards* (odors, spills, free product, airborne particulates and others present)
- *Biological Hazards* (snakes, spiders, other animals, discarded needles, poison ivy and others present)

7 List of Field Activities

Check the activities to be completed during the project	
X	Site reconnaissance
X	Exploratory borings
	Construction monitoring
X	Surveying
X	Test pit explorations
X	Monitoring well installation
X	Monitoring well development
X	Soil sample collection
X	Field screening of soil samples
	Vapor measurements
X	Groundwater sampling
X	Groundwater depth measurement
	Product sample collection
	Soil stockpile testing

List of Field Activities (Continued)

	Check the activities to be completed during the project
	Remedial excavation
	Underground storage tank (UST) removal monitoring
	Remediation system monitoring
	Recovery of free product
X	Surface water and leachate sampling

8 SITE DESCRIPTION (ATTACH ANY ADDITIONAL SITE PLAN DETAILS AND CHEMICAL ANALYSES)

8.1 Site History: Fill in written description here

Knowledge of the waste types and quantities, other than municipal wastes (household, commercial, industrial), that were buried is limited. According to Ecology documents, 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. Wastes at the landfill were routinely burned until 1969 according to Ecology's 2003 Site Hazard Assessment (SHA; Ecology, 2003). From 1969 until 1973 the landfill was the county's primary solid waste disposal site. 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. 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.

Address/Location: 9663 South March Point Road, Anacortes

Site topography: Flat

Predominant wind direction: North

Site drainage: Into Padilla Bay and Padilla Bay Lagoon

___ Municipal drain

X Surface water drainage – If so, direction of flow: either directly into Padilla Bay and Padilla Bay Lagoon or into adjacent drainage ditches and estuarine stream and then into Padilla Bay Lagoon

___ Engineered site drains

___ Other

Utility check complete: To be completed prior to drilling – see documentation Utility Checklist

Traffic or vehicle access control plans: To be completed prior to drilling along South March Point Road

Site access control (exclusion zone) defined by: Yellow caution tape

___ Fence

___ Survey tape

___ Traffic cones

___ Other (traffic control barriers as required by the city)

Hot zone/exclusion zone (Define): *Within 10 feet of borings*

Contamination reduction zone (Define): *Decontamination will be set up and area will be delineated*
This needs to be detailed for the site at the time of set up.

8.2 Personal Protective Equipment

Personal Protective Equipment (PPE). Minimum level of protective equipment for these sites is Level D. After the initial and/or daily hazard assessment has been completed, select the appropriate protective gear (PPE) to preserve worker safety. Task-specific levels of PPE shall be reviewed with field personnel during the pre-work briefing conducted prior to the start of site operations.

Check applicable personal protection gear to be used:

X Hardhat (if overhead hazards, or client requests)
X Steel-toed boots (if crushing hazards are a potential or if client requests)
X Safety glasses (if dust, particles, or other hazards are present or client requests)
X Hearing protection (if it is difficult to carry on a conversation 3 feet away)
X Rubber boots (if wet conditions)
X Safety vest (required by saw mill owner/operator)

Gloves (specify):

X Nitrile
____ Latex
____ Liners
____ Leather
____ Other (specify) _____

Protective clothing:

X **Tyvek (if dry conditions are encountered, Tyvek is sufficient)**
____ Saranex (personnel shall use Saranex if liquids are handled or splash may be an issue)
X Cotton
X Rain gear (as needed)
X Layered warm clothing (as needed)

Inhalation hazard protection:

X Level D
X Level C (respirators with organic vapor filters/ P100 filters)

Limitations of Protective Clothing

PPE clothing ensembles designated for use during site activities shall be selected to provide protection against known or anticipated hazards. However, no protective garment, glove, or boot is entirely chemical-resistant, nor does any PPE provide protection against all types of hazards. To obtain optimum

performance from PPE, site personnel shall be trained in the proper use and inspection of PPE. This training shall include the following:

- Inspect PPE before and during use for imperfect seams, non-uniform coatings, tears, poorly functioning closures, or other defects. If the integrity of the PPE is compromised in any manner, proceed to the contamination reduction zone and replace the PPE.
- Inspect PPE during use for visible signs of chemical permeation such as swelling, discoloration, stiffness, brittleness, cracks, tears, or other signs of punctures. If the integrity of the PPE is compromised in any manner, proceed to the contamination reduction zone and replace the PPE.
- Disposable PPE should not be reused after breaks unless it has been properly decontaminated.

Respirator Selection, Use, and Maintenance

GeoEngineers has developed a written respiratory protection program in compliance with OSHA requirements contained in 29 CFR 1910.134. Site personnel shall be trained on the proper use, maintenance, and limitations of respirators. Site personnel that are required to wear respiratory protection shall be medically qualified to wear respiratory protection in accordance with 29 CFR 1910.134. Site personnel that will use a tight-fitting respirator must have passed a qualitative or quantitative fit test conducted in accordance with an OSHA-accepted fit test protocol. Fit testing must be repeated annually or whenever a new type of respirator is used.

Respirator Cartridges

If site personnel are required to wear air-purifying respirators, the appropriate cartridges shall be selected to protect personnel from known or anticipated site contaminants. The respirator/cartridge combination shall be certified and approved by NIOSH. A cartridge change-out schedule shall be developed based on known site contaminants, anticipated contaminant concentrations, and data supplied by the cartridge manufacturer related to the absorption capacity of the cartridge for specific contaminants. Site personnel shall be made aware of the cartridge change-out schedule prior to the initiation of site activities. Site personnel shall also be instructed to change respirator cartridges if they detect increased resistance during inhalation or detect vapor breakthrough by smell, taste, or feel although breakthrough is not an acceptable method of determining the change-out schedule. At a minimum, cartridges should be changed a minimum of once daily.

Respirator Inspection and Cleaning

The Site Safety and Health Supervisor shall periodically (i.e., weekly) inspect respirators at the project site. Site personnel shall inspect respirators prior to each use in accordance with the manufacturer's instructions. In addition, site personnel wearing a tight-fitting respirator shall perform a positive and negative pressure user seal check each time the respirator is donned to ensure proper fit and function. User seal checks shall be performed in accordance with the GeoEngineers respiratory protection program or the respirator manufacturer's instructions.

Respirators shall be hygienically cleaned as often as necessary to maintain the equipment in a sanitary condition. At a minimum, respirators shall be cleaned at the end of each work shift. Respirator cleaning procedures shall include an initial soap/water cleaning, a water rinse, a sanitizing soaking, and a final water rinse. One capful of bleach per one gallon of water can be used to create the sanitizing soak solution. When not in use, respirators shall be stored to protect against damage, hazardous chemicals, sunlight, dust, excessive temperatures, and excessive moisture. In addition, respirators shall be stored to prevent deformation of the face piece and exhalation valve.

Facial Hair and Corrective Lenses

Site personnel with facial hair that interferes with the sealing surface of a respirator shall not be permitted to wear respiratory protection or work in areas where respiratory protection is required. Normal eyeglasses cannot be worn under full-face respirators because the temple bars interfere with the sealing surface of the respirator. Site personnel requiring corrective lenses will be provided with spectacle inserts designed for use with full-face respirators. Contact lenses should not be worn with respiratory protection.

9 Air Monitoring Plan

Work upwind if at all possible. The PID will not detect methane and a 4 gas meter typically used for confined spaces is recommended.

Air Monitoring Plan Dioxins and Furans

There are no established PELs for dioxins and furans, thus the emphasis during this project will be working in well-ventilated areas (the sheet pile construction and excavation are to be done outside), on protective equipment used during sampling and other activities, and on decontamination. In areas where dioxins have been found or while sampling product known or suspected to contain dioxin, personnel will wear respirators with combination HEPA (P100)/organic vapor respirators or their equivalent. If vapor concentrations (as monitored with PID) exceed 10 ppm continuously for a 5-minute period, measured in the breathing zone, upgrade to Level C PPE or move to a noncontaminated area. Respiratory protection shall be used whenever working in areas known or suspected to contain dioxins or furans.

Air Monitoring Plan Dust/ Metals

The contaminants listed above present the greatest risk to site personnel through inhalation and ingestion of soil particles. Sediment sampling also found concentrations of heavy metals in soil which could result in exposures close to the PEL if conditions are dry and dusty. Their inhalation/ingestion hazards should be significantly mitigated by wet conditions while excavating contaminated soil. If drilling or excavation activities generate visible dust, the SSO will be notified immediately to assess the need for air monitoring and lab analysis for inhalable and respirable particulates.

Check instrumentation to be used:

- [X] PID (Photoionization Detector)
- [X] Other (i.e., detector tubes): Recommended if PID is measuring VOCs

Check monitoring frequency/locations: and type (specify: work space, borehole, breathing zone):

- [X] **15 minutes - Continuous during soil disturbance activities or handling samples**
- [ ] 15 minutes
- [ ] 30 minutes
- [ ] Hourly (in breathing zone during excavations, drilling, sampling)

Additional personal air monitoring for specific chemical exposure:

Action levels:

- The workspace will be monitored using a photoionization detector (PID). These instruments must be properly maintained, calibrated and charged (refer to the instrument manuals for details). Zero this meter in the same relative humidity as the area it will be used in and allow at least a 10-minute warm-up prior to zeroing. Do not zero in a contaminated area. The PID can be tuned to read chemicals specifically if there are not multiple contaminants on site. It can be tuned to detect one chemical with response factor entered into the equipment, but the PID picks up all volatile organic compounds (VOCs) present. Ionization potential (IP) of chemical has to be less

than lamp (11.7/ 10.6eV) and **PID does not detect methane**. The ppm readout on the instrument is relative to the IP of isobutylene (calibration gas), so conversion must be made in order to estimate ppm of the chemical on-site.

- An initial vapor measurement survey of the site should be conducted to detect "hot spots" if contaminated soil is exposed at the surface. Vapor measurement surveys of the workspace should be conducted at least hourly or more often if persistent petroleum-related odors are detected. Additionally, if vapor concentrations exceed 5 ppm above background continuously for a 5-minute period as measured in the breathing zone, upgrade to Level C PPE or move to a noncontaminated area.
- Standard industrial hygiene/safety procedure is to require that action be taken to reduce worker exposure to organic vapors when vapor concentrations exceed ½ the TLV. Because of the variety of chemicals, the PID will not indicate exposure to a specific PEL and is therefore not a preferred tool for determining worker exposure to chemicals. If odors are detected, then employees will upgrade to respirator with Organic Vapor cartridges and will contact the Health and Safety Program Manager for other sampling options.

Air Monitoring Action Levels

Contaminant	Activity	Monitoring Device	Frequency of Monitoring Breathing Zone	Action Level	Action
Organic Vapors	Environmental Remedial Actions	PID	Start of shift; prior to excavation entry; every 30 to 60 minutes and in event of odors	Background to 5 parts per million (ppm) in breathing zone	Use Level D or Modified Level D PPE
Organic Vapors	Environmental Remedial Actions	PID	Start of shift; prior to excavation entry; every 30 to 60 minutes and in event of odors	5 to 25 ppm in breathing zone	Upgrade to Level C PPE
Organic Vapors	Environmental Remedial Actions	PID	Start of shift; prior to excavation entry; every 30 to 60 minutes	> 25 ppm in breathing zone	Stop work and evacuate the area. Contact Certified Industrial Hygienist (CIH) for guidance.
Combustible Atmosphere	Environmental Remedial Actions	PID	Start of shift; prior to excavation entry; every 30 to 60 minutes	<10% LEL or <1000 ppm	Depends on contaminant. The PEL is usually exceeded before the LEL.
Combustible Atmosphere	Environmental Remedial Actions	PID Or 4 gas meter	Start of shift; prior to excavation entry; every 30 to 60 minutes	>10% LEL or >1000 ppm	Stop work and evacuate the site. Contact CIH for guidance.
Oxygen Deficient/Enriched Atmosphere	Environmental Remedial Actions Confined Spaces	Oxygen meter Or 4 gas meter	Start of shift; prior to excavation entry; every 30 to 60 minutes	>19.5<23.5%	Continue work if inside range. If outside range, exit area and contact CIH.

10 DECONTAMINATION PROCEDURES

Decontamination consists of removing outer protective tyvek clothing and washing soiled boots and gloves using bucket and brush provided on-site in the contamination reduction zone. Inner gloves will then be removed, and respirator, hands and face will be washed in either a portable wash station or a

bathroom facility in the support zone. Employees will perform decontamination procedures and wash prior to eating, drinking or leaving the site. ***Used PPE to be placed in on-site drum.***

Specify other site specific decontamination procedures:

_____

_____

11 WASTE DISPOSAL OR STORAGE

PPE disposal (specify): To drums to be stored on-site pending characterization and disposal.

Drill cutting/excavated sediment disposal or storage:

_____ On-site, pending analysis and further action
__X__ Secured (list method) Drums
_____ Other (describe destination, responsible parties): _____

12 DOCUMENTATION EXPECTED TO BE COMPLETED

NOTE: The Field Log is to contain the following information:
Updates on hazard assessments, field decisions, conversations with subs, client or other parties.
Air monitoring/calibration results; personnel, locations monitored, activity at the time of monitoring
Actions taken
Action level for upgrading PPE and rationale
Meteorological conditions (temperature, wind direction, wind speed, humidity, rain, snow, etc.).

Required forms:
Field Log
Health and Safety Plan acknowledgment by GEI employees (Form C-2)
Contractors Health and Safety Plan Disclaimer (Form C-3)
Conditional forms available at GeoEngineers office: Accident Report (Form C-4)

13 APPROVALS

1. Plan Prepared	_____ Signature	_____ Date	
2. Plan Approval	_____ PM Signature	_____ Date	
3. Health & Safety Officer	Leah Alcyon, CIH Health & Safety Program Manager	_____ Date	

FORM C-1
HEALTH AND SAFETY MEETING
MARCH POINT LANDFILL
504-037-00

All personnel participating in this project must receive initial health and safety orientation. Thereafter, brief tailgate safety meetings will be held as deemed necessary by the Site Safety and Health Supervisor.

The orientation and the tailgate safety meetings shall include a discussion of emergency response, site communications and site hazards.

Date	Topics	Attendee	Company Name	Employee Initials

FORM C-2
SITE SAFETY PLAN – GEOENGINEERS' EMPLOYEE ACKNOWLEDGMENT
MARCH POINT LANDFILL
504-037-00

(All GeoEngineers' site workers complete this form, which should remain attached to the safety plan checklist and filed with other project documentation).

I, _____, do hereby verify that a copy of the current Safety Plan has been provided by GeoEngineers, Inc., for my review and personal use. I have read the document completely and acknowledge a full understanding of the safety procedures and protocol for my responsibilities on site. I agree to comply with all required, specified safety regulations and procedures. I understand that I will be informed immediately of any changes that would affect site personnel safety.

Signed _____ Date _____

Range of Dates From: _____
To: _____

Signed _____ Date _____

Range of Dates From: _____
To: _____

Signed _____ Date _____

Range of Dates From: _____
To: _____

Signed _____ Date _____

Range of Dates From: _____
To: _____

Signed _____ Date _____

FORM C-3
SUBCONTRACTOR AND SITE VISITOR SITE SAFETY FORM
MARCH POINT LANDFILL
504-037-00

I, _____, verify that a copy of the current site Safety Plan has been provided by GeoEngineers, Inc. to inform me of the hazardous substances on site and to provide safety procedures and protocols that will be used by GeoEngineers' staff at the site. By signing below, I agree that the safety of my employees is the responsibility of the undersigned company.

Signed _____ Date _____

Firm: _____

Signed _____ Date _____

Firm: _____

Signed _____ Date _____

Firm: _____

Signed _____ Date _____

Firm: _____

Signed _____ Date _____

Firm: _____

Signed _____ Date _____

Firm: _____

APPENDIX C
HISTORIC AND AERIAL PHOTOGRAPHS

Approaching Whitmarsh Dump on March Point Road

12-13-68

Whitmarsh Dump by Jail Wall

12-13-68

Whitmarsh

12-13-68

Photographs Obtained From Skagit County Health Department

FIGURE 1 – Historic Photographs (1968-1970)

March Point Landfill, Anacortes, Washington

GeoEngineers

SEAT:\0\05040370\00\Finals\05040370OFig5.ppt NEA 02/22/07

Photographs Obtained From Skagit County Health Department

GeoEngineers

FIGURE 2 – Historic Photographs (1968-1970)

March Point Landfill, Anacortes, Washington

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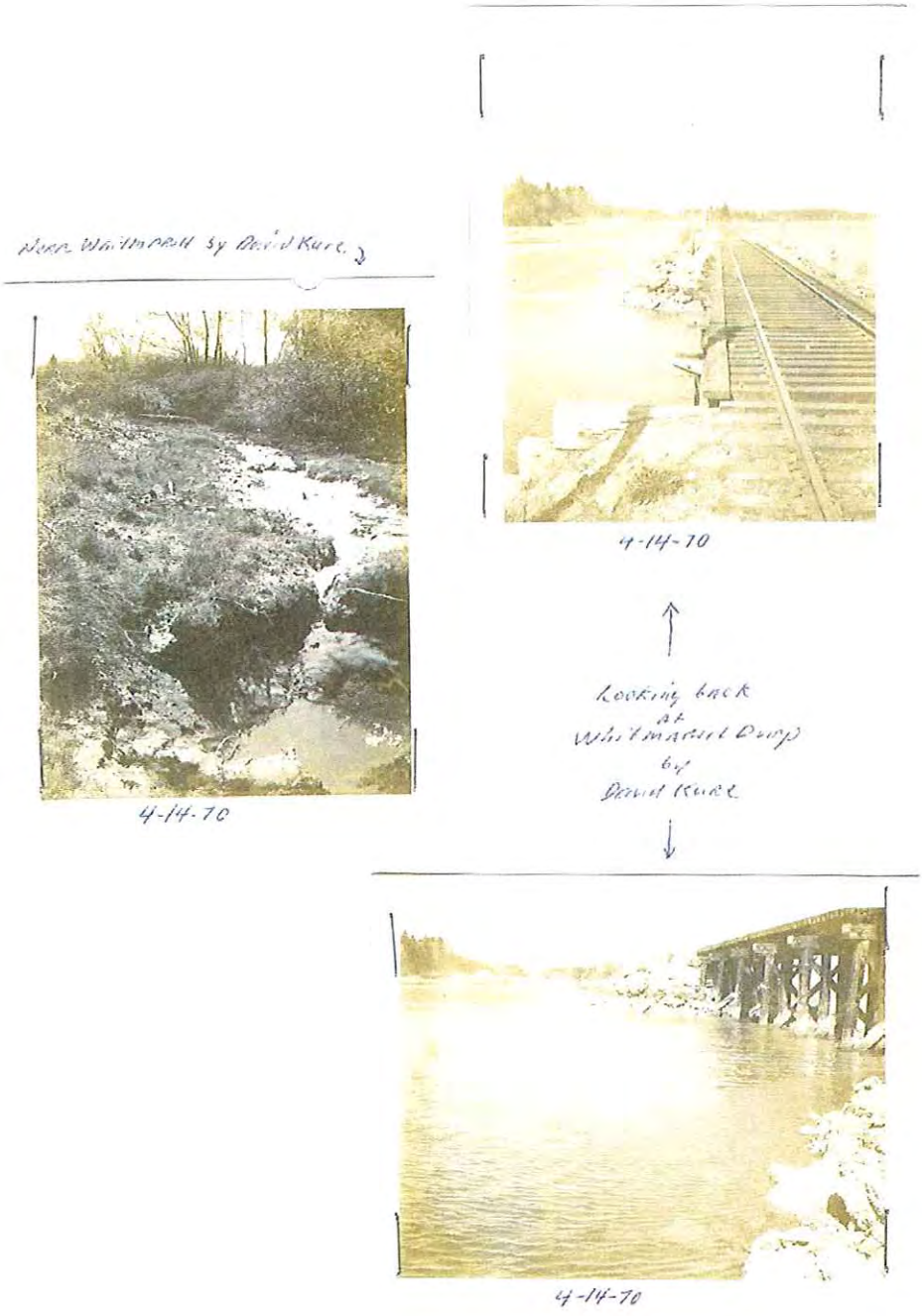


Photographs Obtained From Skagit County Health Department

GeoEngineers

FIGURE 3 – Historic Photographs (1968-1970)

March Point Landfill, Anacortes, Washington

SEAT:\0\050403700\Finals\050403700Fig7.ppt NEA 02/22/07

Photographs Obtained From Skagit County Health Department

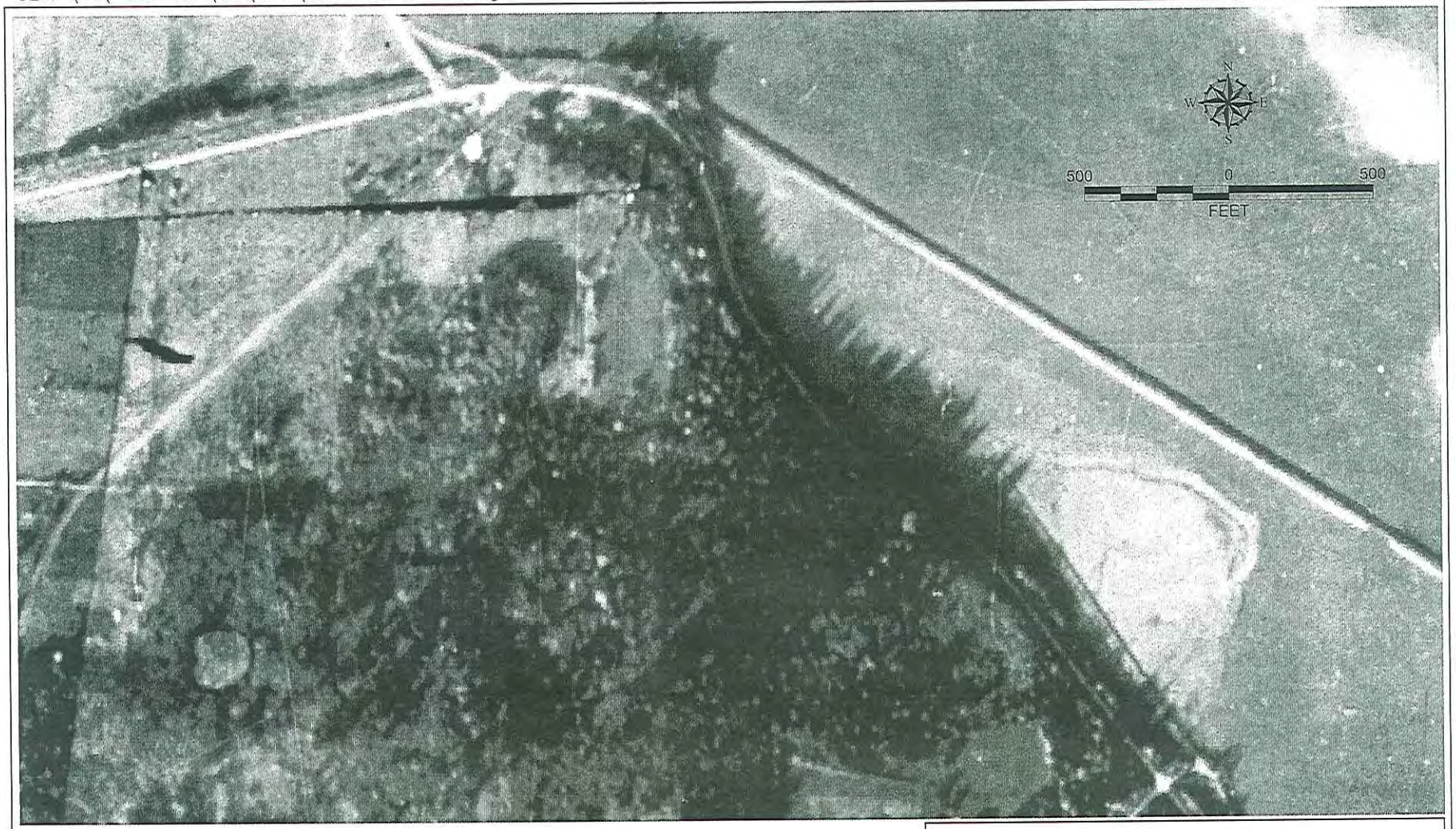
GeoEngineers

FIGURE 4 – Historic Photographs (1968-1970)

March Point Landfill, Anacortes, Washington

SEAT:\0\050403700\Finals\050403700Fig8.ppt NEA 02/22/07

SEAT \P:\ 0504037\00\CAD\050403700F2_F9.dwg Layout Tab Name:Figure 10 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: Image from Skagit County Web site:
http://www.skagitcounty.net/Common/Asp/Default.asp?d=GIS&c=General&p=Digital/main.htm

Aerial Photograph 1937

March Point Landfill
Anacortes, Washington

GeoEngineers

Figure 5

SEAT \P:\ 0504037\00\CAD\050403700F2_F9.dwg Layout Tab Name:Figure 11 NFM:SES 02/06/07 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 Washington State Department of Transportation.

Aerial Photograph 1966

March Point Landfill
Anacortes, Washington

GeoEngineers

Figure 6

SEAT \P:\ 0504037\00\CAD\050403700F2_F9.dwg Layout Tab Name:Figure 12 NFM:SES 04/20/07 Xref:N/A Image:YES

Aerial Photograph 1969

March Point Landfill
Anacortes, Washington

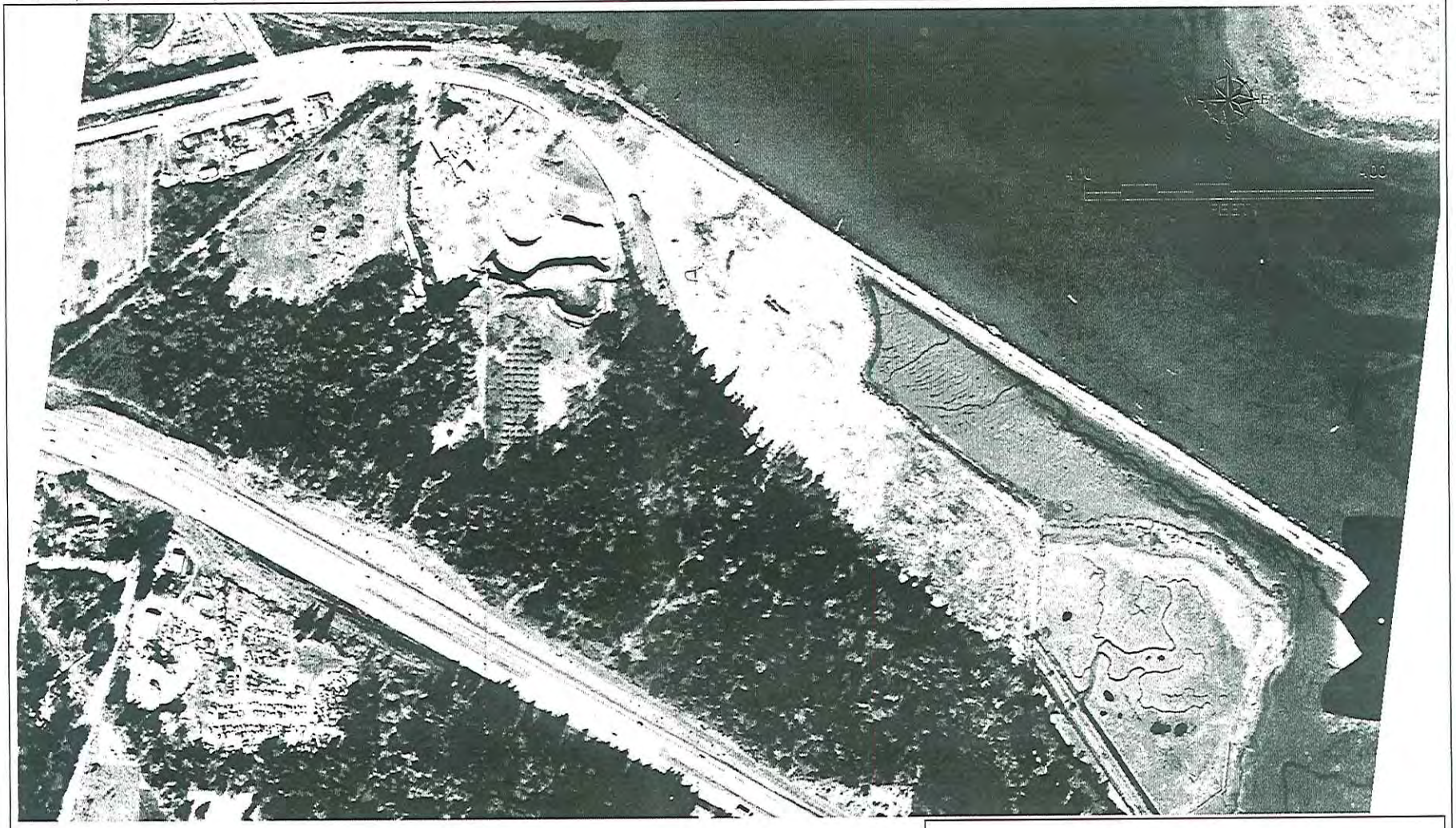
GeoEngineers

Figure 7

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.



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.

Aerial Photograph 1975

Whitmarsh Landfill
Anacortes, Washington

GeoEngineers

Figure 8

SEAT \P:\ 0504037\00\CAD\050403700F2_F9.dwg Layout Tab Name:Figure 14 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.

Aerial Photograph 1981

March Point Landfill
Anacortes, Washington

GeoEngineers

Figure 9

SEAT \P:\ 0504037\00\CAD\050403700F2_F9.dwg Layout Tab Name:Figure 15 NFM:SES 04/20/07 Xref:N/A Image:YES

Aerial Photograph 1992

March Point Landfill
Anacortes, Washington

GeoEngineers

Figure 10

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.

SEAT \P:\ 0504037\00\CAD\050403700F2_F9.dwg Layout Tab Name:Figure 16 NFM:SES 04/20/07 Xref:N/A Image:YES

Aerial Photograph 2001

March Point Landfill
Anacortes, Washington

GeoEngineers

Figure 11

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.