REPORT

TACOMA COGENERATION PROJECT PHASE 2 SITE ASSESSMENT

Prepared for
Sithe Energies, U.S.A., Inc.
Western Division
San Diego, California
May 1991

Woodward-Clyde

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May 16, 1991

Mr. Jim Urick
Sithe Energies U.S.A., Inc.
1230 Columbia Street, Suite 500
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Re: Tacoma Cogeneration Project, Phase 2 Site Assessment
Dear Jim,

Woodward-Clyde Consultants is pleased to submit this report for your proposed power plant in Tacoma, Washington. The site assessment indicates that it is unlikely that remedial actions in accordance with the State of Washington Model Toxics Control Act would be required at this site. If you would like to discuss this conclusion, please call me or Alex Tula at any time.

We appreciate the opportunity to provide our services to Sithe Energies U.S.A, Inc., and look forward to working with you again. Please let us know if we can be of further assistance to you.

Sincerely,

WOODWARD-CLYDE CONSULTANTS

Nancy E. Walker
Senior Project Scientist

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EXECUTIVE SUMMARY

Sithe Energies U.S.A., Inc. (Sithe) is proposing construction and operation of a 225-megawatt cogeneration plant to produce electrical power for sale to Puget Sound Power & Light Company and to provide thermal energy to Domtar Gypsum. Sithe requested that Woodward-Clyde Consultants (WCC) conduct a Phase 2 Site Assessment to evaluate the potential for soil and/or groundwater contamination at the proposed project site. Data from the site assessment indicate that it is unlikely that remedial actions in accordance with State of Washington Model Toxics Control Act would be required at this site.

The site assessment included a terrain conductivity study, excavation of 16 test pits, installation of seven monitoring wells, and collecting and chemically analyzing four composite soil samples and four groundwater samples. Analytical results were compared to the State of Washington Model Toxics Control Act (MTCA) Soil and Ground Water Cleanup Levels and State of Washington Draft Ground Water Quality Standards to determine whether remedial action could be needed. The following summarizes the results of the site assessment.

The terrain conductivity study did not indicate areas of anomalous conductivity that would suggest the presence of buried drums. Debris on the site is evidence that recent, unauthorized disposal at the site has occurred. Chemical analysis of soil and groundwater samples, however, show no indication that significant impact to soil or groundwater has occurred as result of the unauthorized disposal.

Chemicals detected in soil samples include acetone, methylene chloride, 1,1,1-Trichloroethane, Di-n-butylphthalate and bis (2-ethylhexyl) phthalate, several polynuclear aromatic hydrocarbon compounds and several metals, all at very low concentrations. All occurrences can likely be attributed to laboratory/sampling contamination or are present at concentrations well below regulatory guidelines. The presence of these chemicals in soil is considered insignificant.

Di-n-butylphthalate, and bis (2-ethylhexyl) phthalate were detected in groundwater samples at concentrations below method detection limits and in some cases also were detected in laboratory QA/QC blank samples. The presence of these compounds likely can be attributed to laboratory or sample handling contamination and is considered insignificant. Carbon disulfide and chloroform were detected in groundwater at concentrations below regulatory standards or equal to the method detection limit. Carbon disulfide is a common laboratory solvent. The presence of these chemicals in groundwater also is considered insignificant.

Arsenic was detected in groundwater samples from two wells screened in the dredge fills at concentrations exceeding the MTCA Method A Cleanup Level. Levels of arsenic found in groundwater range from .005 mg/L to 0.48 mg/L compared to the MTCA Method A Cleanup level of 0.005 mg/L. It is widely recognized that arsenic is ubiquitous in soil and shallow groundwater in the south Puget Sound region. The levels of arsenic found at the site in groundwater sampled from wells screened in dredge fill likely represent local area background concentrations.

Lead was detected in groundwater samples from two wells at equal to or slightly above both the method detection limit and the MTCA Cleanup Level of 0.005 mg/L. The levels of lead also likely represent area background concentrations.

Arsenic and lead are the only groundwater constituents that exceed MTCA Method A cleanup levels, and these levels most likely represent area background levels. Regardless, MTCA Method A cleanup levels are based on the use of groundwater as a drinking water source, as defined in Section 720 of the Model Toxics Control Act (WAC 173-340-720). Groundwater present in the dredge fill at the proposed facility site does not meet the requirements for being a current or potential future source of drinking water. Cleanup levels established for arsenic and lead in groundwater by the Model Toxics Control Act therefore would not be applicable to the levels of lead or arsenic detected at the site.

Based on this data, in our opinion it appears unlikely that remedial action in accordance with the Model Toxics Control Act would be required at this site.

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1.0 INTRODUCTION

1.1 BACKGROUND

Sithe Energies U.S.A., Inc. (Sithe) is proposing construction and operation of a 225-megawatt cogeneration plant to produce electrical power to sell to Puget Sound Power & Light Company and to provide thermal energy to a manufacturing facility owned by Domtar Gypsum. The plant will use natural gas as its primary fuel source, with provision for a secondary fuel. Sithe requested that Woodward-Clyde Consultants (WCC) conduct a Phase 2 Site Assessment to evaluate the potential for soil and/or groundwater contamination at the proposed project site.

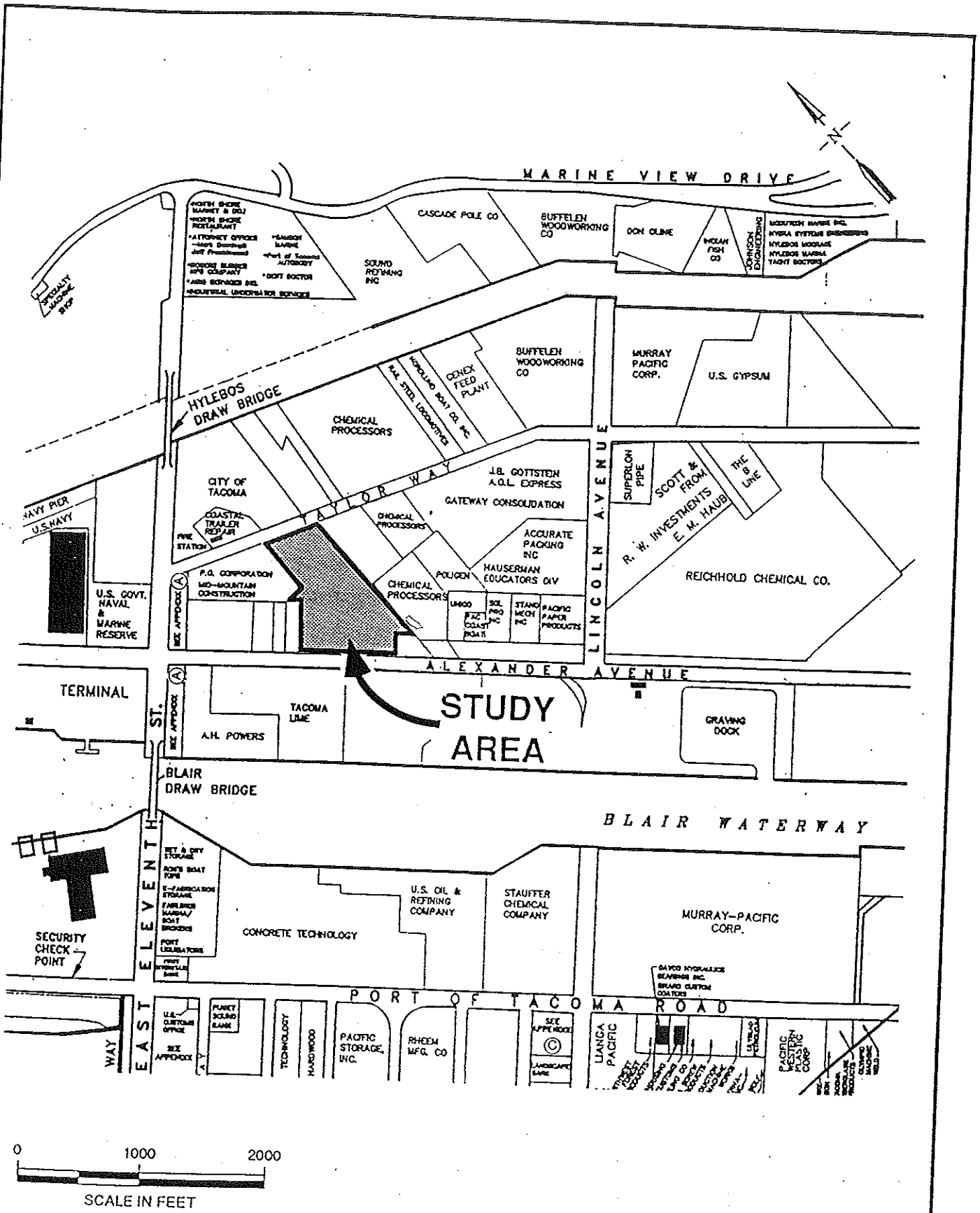
The proposed site is located between Alexander Avenue and Taylor Way in the City of Tacoma (Fig. 1-1). The City is the current property owner. The site consists of two undeveloped parcels (Parcel 1 and Parcel 2) within an industrial neighborhood of the Port of Tacoma. The site is within the Environmental Protection Agency's (EPA) Commencement Bay Nearshore/Tideflats Superfund Site. The site has not been identified by EPA or the Washington State Department of Ecology (Ecology) as a potential source of contamination. Ecology has jurisdiction over any cleanup activities at the site.

A Phase 1 Site Assessment has been conducted at the site (Dames and Moore, 1990).

1.2 PURPOSE

Evaluation of the presence of soil or groundwater contamination, and the extent and costs of site cleanup are needed to determine the viability of developing the site. The purpose of the investigation was to collect data that could be used to address the following questions:

- Has the site been impacted by unauthorized disposal of hazardous materials, either above or below ground?



Project No. 91C0191A	Sithe Energies, U.S.A., Inc. Tacoma Cogeneration Project	SITE LOCATION MAP	Figure 1-1
Woodward-Clyde Consultants			

- Has soil (via the surface water pathway) or groundwater been impacted by adjacent facility operations, particularly the Chemical Processors site to the northeast?

- Are levels of chemicals in soil and groundwater at the site such that remedial action in accordance with the Washington Department of Ecology Model Toxics Control Act (MTCA) may be required in the future?

- Is groundwater leaving the site chemically impacted, and could the site be a source of chemicals to either the Blair or Hylebos waterways, via surface water or ground water pathways?

- Are levels of chemicals in soil such that construction excavation spoils would have to be treated by expensive remedial techniques?

- What are planning level costs associated with remedial actions, should any be required, and disposal of construction excavation spoils?

In addition to addressing these specific questions, this program is designed to demonstrate that Sithe has used "due diligence" toward investigating potential environmental impacts resulting from soil or groundwater contamination at this site. Due diligence is not clearly defined in the CERCLA regulations. Instead it is a legal concept that signifies levels of effort to determine if a site is or is not contaminated. In light of the historical non-development of the site, it is judged that this program is sufficient to demonstrate due diligence.

1.3 SCOPE

The scope of our investigation included the following:

- A terrain conductivity survey

- Excavation of 16 test pits

- Installation of three monitoring wells in the shallow, unconfined groundwater unit and four monitoring wells in a deeper, confined groundwater unit

- Laboratory analysis for volatile and semi-volatile organic compounds, chlorinated pesticides, PCBs, priority pollutant metals, total phenols, and cyanide of four soil samples collected from the test pits, three groundwater samples collected from the shallow monitoring wells, and one groundwater sample collected from a deep monitoring well

- Preparation of a report comparing levels of chemicals detected in soil and groundwater to MTCA Soil and Ground Water Cleanup Levels and State of Washington Draft Ground Water Quality Standards to determine if remedial action is needed

2.0
FIELD INVESTIGATION METHODOLOGY

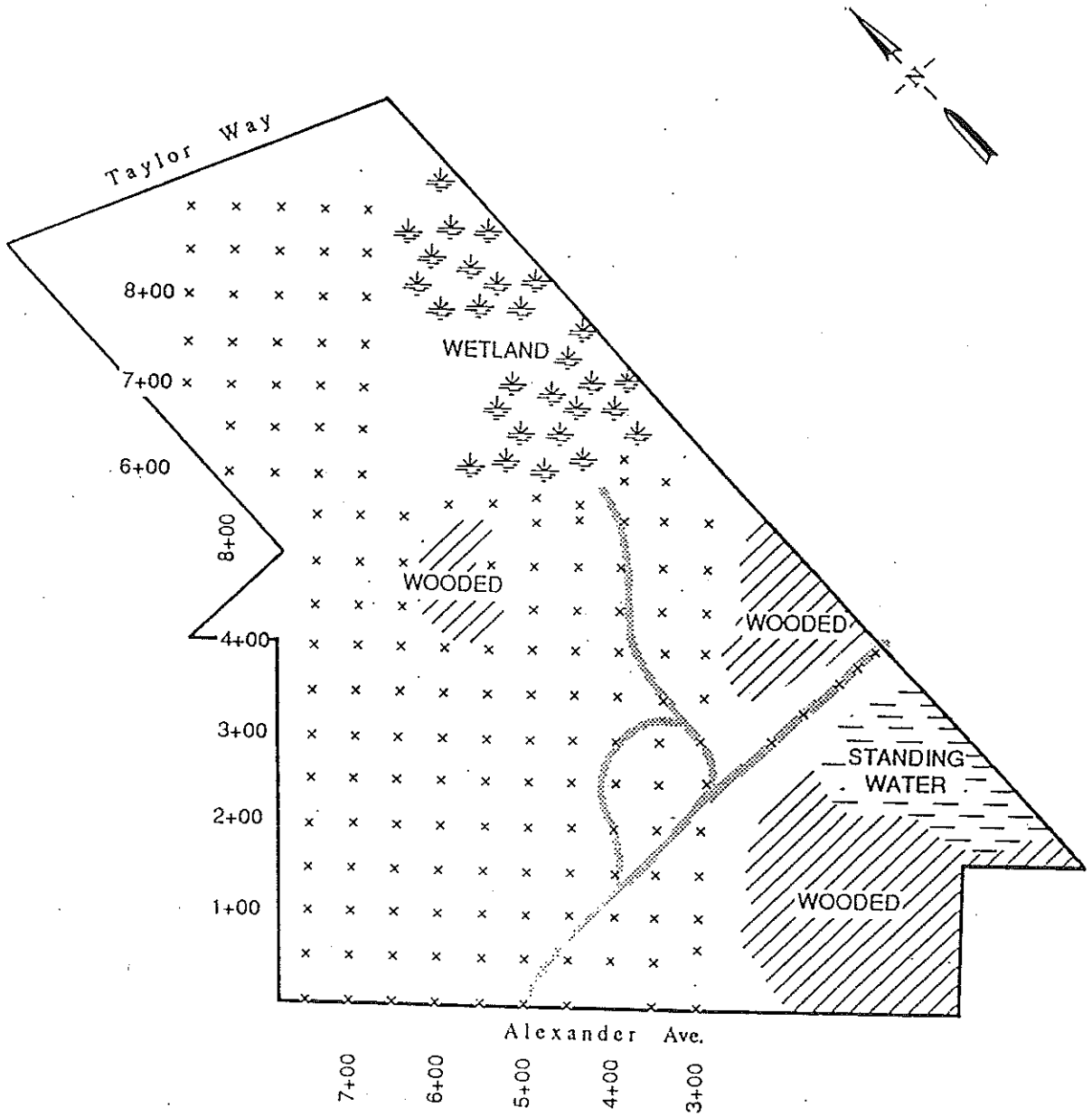
2.1 TERRAIN CONDUCTIVITY SURVEY

The terrain conductivity survey (TCS) was conducted by WCC on March 27, 1991. The primary objectives of the TCS were to identify areas of anomalous conductivity that may indicate the presence of buried drums that could contain potentially hazardous material, and to guide selection of test pit locations.

Terrain conductivity was measured at individual points on a 50-foot grid spacing (Fig. 2-1). A regular grid spacing could not be maintained over some parts of the site due to the presence of dense foliage. These areas were surveyed as access allowed. Other areas were not surveyed due to the presence of standing water.

A Geonics EM-31 electromagnetic conductivity meter was used to measure the apparent conductivity of subsurface materials. The unit consists of transmitting and receiving coils mounted on opposite ends of a rigid beam. Measurements were taken with the coils oriented in horizontal and vertical planes with the beam oriented parallel to the survey line. Measurements also were taken with the coils oriented in a vertical plane with the beam oriented perpendicular to the survey line. Data gathered from the survey are presented in Appendix A. The averages of the horizontal plane readings were used to prepare a contour map (Fig. 2-2). A contour map of the vertical plane readings was also prepared (Fig. 2-3).

Terrain conductivity is influenced by the moisture content of subsurface materials, the presence and concentration of dissolved ionic species, and the porosity, clay content, mineral composition, and density of the soil matrix. Individual terrain conductivity measurements reflect the combined influence of these factors over the effective exploration depth of the instrument. The effective exploration depth during this survey was estimated to be about 20 feet. The TCS did not indicate any areas of anomalous conductivity that would suggest the presence of any buried metal drums.



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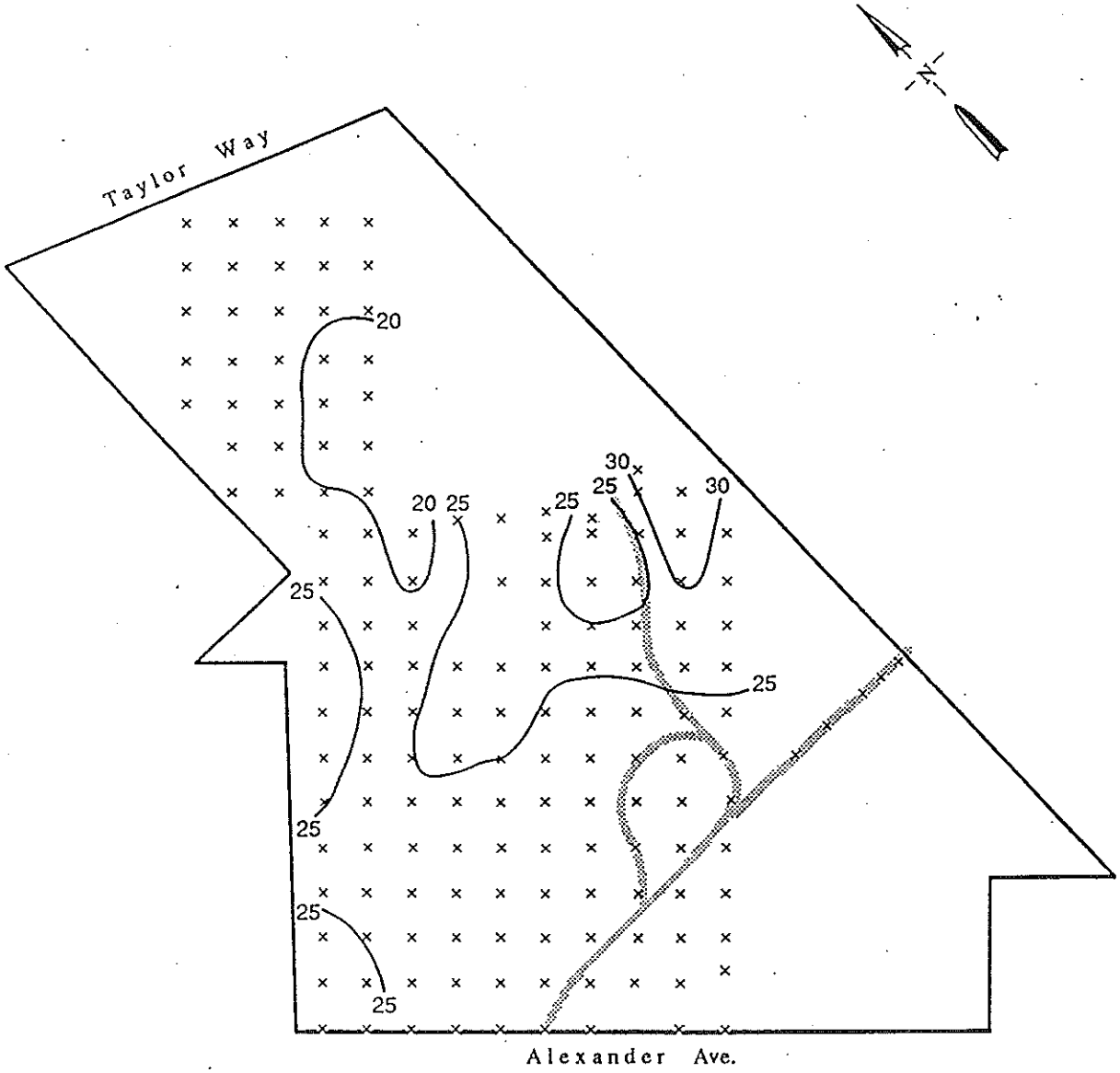
SCALE IN FEET

Project No. 91C0191A	Sithe Energies, U.S.A., Inc. Tacoma Cogeneration Project	ELECTROMAGNETIC SURVEY GRID POINTS	Figure 2-1
Woodward-Clyde Consultants			



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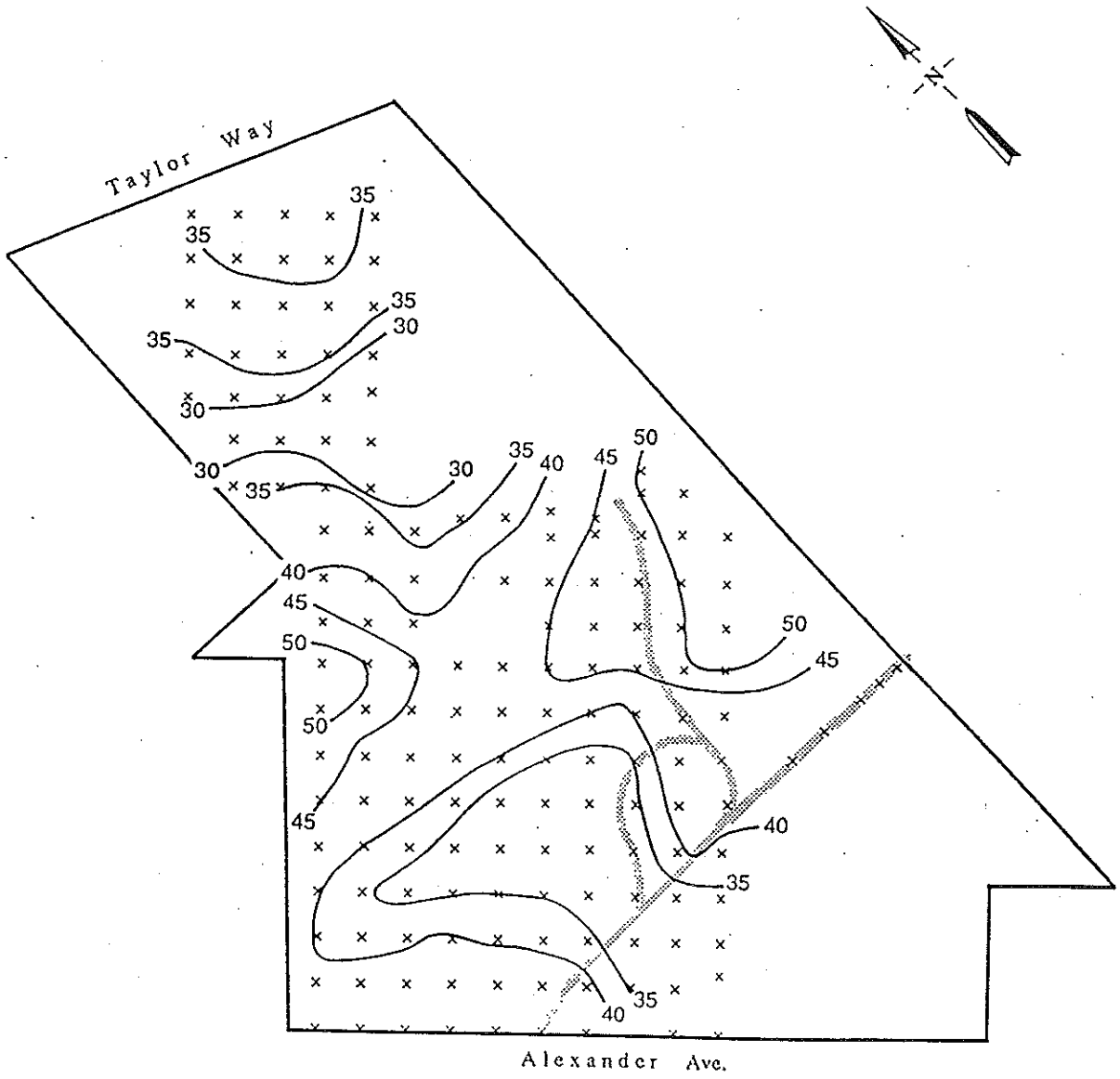
Project No. 91C0191A	Sithe Energies, U.S.A., Inc. Tacoma Cogeneration Project	TERRAIN CONDUCTIVITY CONTOURS HORIZONTAL POSITION (in millimhos/meter)	Figure 2-2
Woodward-Clyde Consultants			



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Project No. 91C0191A	Sithe Energies, U.S.A., Inc. Tacoma Cogeneration Project	TERRAIN CONDUCTIVITY CONTOURS VERTICAL POSITION (in millimhos/meter)	Figure 2-3
Woodward-Clyde Consultants			

2.2 TEST PITS

2.2.1 Test Pit Locations

Test pits were excavated in groups of two to four pits, where each group was intended to characterize the subsurface associated with particular features of the site (Fig. 2-4). Soil collected from each of the pits within a group was composited and submitted for laboratory analysis.

The test pits within each group were excavated to assess any chemical impacts associated with the following site features:

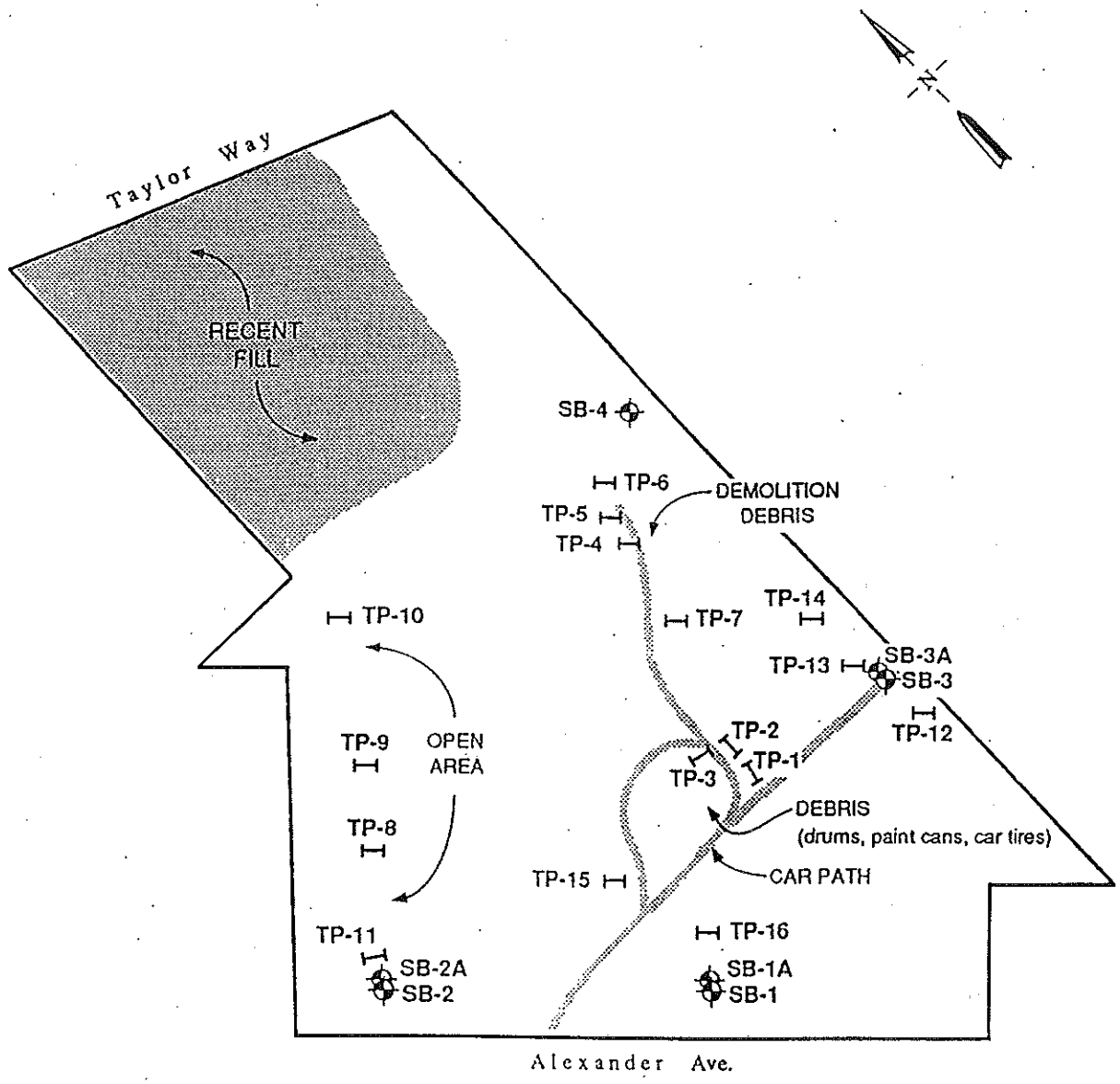
- Test Pits 1, 2, and 3 were excavated to assess any chemical impact to soil associated with empty drums, paint cans, and other surface debris present onsite (Sample TP010203).

- Test Pits 4, 5, 6, and 7 were excavated to assess chemical impact to soil associated with demolition debris (Sample TP040507).

- Test Pits 8, 9, 10, and 11 were excavated in an area devoid of trees. The lack of trees suggests that the fill is relatively recent (Sample TP08091011).

- Test Pits 12, 13, and 14 were excavated near the eastern property line and along an abandoned road that crosses the property to assess any chemical impact from the adjacent property owned by Chemical Processors (Sample TP121314).

- Test Pits 15 and 16 were excavated to assess any chemical impact in the central southwest portion of the site. A sample from these test pits was not collected for chemical analysis. Soil from these test pits was similar in appearance to soil from other test pits.



KEY TO SYMBOLS

- Monitoring well location
- Test pit location

0 200 400

SCALE IN FEET

Project No. 91C0191A	Sithe Energies, U.S.A., Inc. Tacoma Cogeneration Project	MONITORING WELL AND TEST PIT LOCATION MAP	Figure 2-4
Woodward-Clyde Consultants			

Soil from the portion of the site adjacent to Taylor Avenue was not sampled. According to Russell Post of Tacoma City Light, this area is presently receiving fill of known chemical composition (personal communication, March 28, 1991).

2.2.2 Method of Excavation

A backhoe was used to excavate the test pits. The bucket of the backhoe was cleaned using a pressure washer between each group of test pits.

2.2.3 Soil Sampling Methods

Composite soil samples were prepared from soil collected from each group of test pits. The sampling and compositing procedure was conducted as follows:

- Soil was collected from the wall of each of the test pits just above the water table using a stainless steel spoon and placing it in a capped glass jar to prevent loss of volatile chemicals.

- When soil had been collected from each of the test pits within a group, it was removed from the jars and placed into a stainless steel mixing bowl and thoroughly homogenized.

- The spoon and mixing bowl were decontaminated before collecting a sample from each test pit using a solution of laboratory grade detergent and water followed by a rinse with nanograde methanol and a final rinse with distilled water.

2.3 GROUNDWATER MONITORING WELLS

2.3.1 Drilling and Well Construction Methods

Three monitoring wells were installed in the shallow, unconfined groundwater unit and four monitoring wells were installed in a deeper, confined groundwater unit at the locations depicted on Figure 2-4. All of the wells were drilled using hollow stem auger

techniques. Soil cuttings were contained in drums for proper disposal according to regulatory guidelines. Soil samples for describing lithology and possible chemical analysis were collected at approximately 5-foot intervals using a split-spoon sampler. The sampler was washed in a solution of laboratory grade detergent and tap water and rinsed with distilled water prior to each sampling event. All other downhole equipment and materials were steam-cleaned prior to use in each well.

The wells were constructed through the augers with 2-inch diameter Schedule 40, flush-threaded PVC well casing with 5 feet of 0.010-inch slotted PVC well screen. A select silica sand filter pack was installed adjacent to and approximately 2 feet above the well screen. Bentonite clay pellets were installed above the filter pack to approximately 2 feet below ground surface. A concrete cap and a locking steel protective monument were installed above the bentonite seal to protect the well from unauthorized access. Well logs are presented in Appendix B.

The wells were developed by inserting a length of 1-inch diameter PVC hose and pumping water from the well using a gasoline-powered centrifugal pump. The wells were pumped dry repeatedly to flush sediment from the well and induce flow of groundwater into the well. The wells were pumped until the water produced was relatively free of suspended silt and clay. Water produced during development was contained in drums for proper disposal according to regulatory guidelines.

2.3.2 Water Sampling Methods

Prior to collecting groundwater samples, at least three casing volumes of water were purged from each well using a teflon bailer and new nylon line. Prior to sampling, the bailer was washed in a solution of laboratory grade detergent and tap water, rinsed with distilled water, rinsed with nanograde methanol, and final rinsed with distilled water. The samples were transferred directly from the bailer to the sample container. The bottles were labeled, wrapped in protective material and placed in an ice chest with ice. The samples were transported to Analytical Technologies, Inc., of Renton, Washington, under standard WCC chain-of custody procedures.

3.0
SITE DESCRIPTION

3.1 SITE LOCATION

The property is located on Alexander Avenue southeast of East 11th Street in the NW 1/4 of the NW 1/4 of Section 35 and the SW 1/4 of the SW 1/4 of Section 26, Township 25 N, Range 4 E, Tacoma, Pierce County, Washington. Land surface elevation at the site is 10 to 15 feet above mean sea level.

3.2 SITE HISTORY

The site history was derived from aerial photographs and reviewed for the Phase 1 site assessment.

3.2.1 Aerial Photographs

Black and white aerial photographs of the site vicinity were obtained for the years 1946, 1969, 1979, and 1985. The scale of the photographs is one inch = 200 feet (1 to 2400). The following descriptions of the site from the aerial photographs provide a pictorial history of the site.

1946: Eighty to ninety percent of the subject site is covered with low vegetation and small, dendritic surface drainages. One larger channel crosses the southern part of the site near Alexander Avenue. Ten to twenty percent of the site adjacent to Taylor Avenue, has apparently received fill. This area is covered with bushes and trees and drainage channels are absent. The extreme northeast corner of the property may have been receiving fill at the time of the photograph.

The property currently operated by Chemical Processors is undeveloped. Several above-ground storage tanks are present on the adjacent property to the northwest, which is currently owned by the P.Q. Corporation.

1969: The dendritic surface drainage channels are absent and a large pond is present on the property currently owned by Chemical Processors. A white colored material, possibly lime, has been placed in the area of the pond. The area in the extreme northeast corner of the site, in which fill was being placed in 1949, has been expanded. What may be wood waste has been placed on the property in this area.

1979: The electrical substation has been constructed in the southeast corner of the site. Trees are present in a distribution similar to today. A well-defined haul road crosses the site to the property currently owned by Chemical Processors. Earth-moving operations and several chemical process areas are active on the Chemical Processors property.

1985: The process areas on the Chemical Processors property have been expanded and the storage yard is in place.

3.2.2 Phase 1 Site Assessment

A Phase 1 site assessment of the property was conducted in 1990 by the firm of Dames & Moore. Information presented in the Phase 1 Assessment is not repeated here. The assessment included:

- A reconnaissance-level wetlands survey.
- A review of aerial photographs from the years 1965, 1970, 1971, 1975, 1980, 1985, and 1988.
- A review of historical topographic maps, land ownership maps, fire insurance maps, and city directories.
- A review of state and federal hazardous waste sites lists.

3.3 SURFICIAL FEATURES

Surficial features observed at the site include wetlands, wooded areas, wildlife habitat, recent fill, and debris piles. Wetlands and wildlife habitat are discussed in a separate report to Sithe (WCC, 1991)

3.3.1 Fill

Fill was observed being stockpiled in the northernmost part of the site at the time of the field investigation. It is understood this material is railroad ballast and contains petroleum hydrocarbons (Russell Post, personal communication to Nancy Walker, March 28, 1991). According to Mr. Post, Tacoma City Light has been using the site for storing sediment for about two years. The fill is approximately three feet thick and covers an area of about two acres. The fill is not evident in the 1985 aerial photograph.

3.3.2 Debris

Surface debris was present at the site during the field investigation. The debris included empty 55-gallon drums, empty paint cans, automobile tires, creosoted logs, and household and demolition debris.

3.4 GEOLOGY

The site is located in the Nearshore/Tideflats area of Tacoma. The Nearshore/Tideflats area is located on a sequence of silts and sands within the Puyallup River delta. In addition, the area is covered with dredge fill associated with the industrial development of the Port of Tacoma.

Investigations performed in the Port of Tacoma area have identified four stratigraphic units within the deltaic sediments beneath the dredge fill.

(1) Upper Silts: Sediments ranging from sandy silt to clay with locally abundant organic material.

(2) Sands and Silts: Sands and silty sands with interbedded silt. This zone is commonly found interbedded with the Upper Silts and is reportedly encountered at depths ranging from just below ground surface (bgs) to 25 feet bgs. The lower contact of this zone is reportedly gradational but generally occurs at depths of between 70 and 100 feet bgs.

(3) Lower Silts: Predominantly silts interbedded with the overlying Sands and Silts, encountered at depths ranging from about 70 to 120 feet bgs.

(4) Deep Sands: Sand and silty sand generally encountered at depths greater than about 120 feet bgs.

The deep monitoring wells at the site penetrate the fill and Upper Silts and are screened in the Sands and Silts. The shallow wells are screened in the dredge fill.

The thickness of dredge fill encountered at the site ranges from 8 to 15 feet. The fill consists of loose, fine- to medium-grained sands with little silt. Debris consisting of asphalt, wood, bricks, and rope was encountered within the dredge fill below 6 feet bgs in Test Pits 8 and 9 and Well SB-2A. Wood waste was encountered in Well SB-4 from 1 to 10.5 feet bgs.

The Upper Silts range in thickness from less than 5 feet to about 12 feet. The Upper Silts at the site consist of soft clays with occasional interbeds of silt. The Sands and Silts beneath the Upper Silts at the site consist of medium dense, fine- to medium-grained sands.

3.5 HYDROGEOLOGY

3.5.1 Hydrostratigraphy

Groundwater is present in an unconfined condition in the fill and in a confined condition in the Sands and Silts beneath the site. At the time of our investigation, groundwater elevation was 10.47 to 10.82 feet above sea level in the wells screened in the fill, and 2.87 to 3.12 feet above sea level in the deeper wells screened within the Sands and Silts.

3.5.2 Direction and Gradient of Groundwater Flow

Groundwater elevations in wells screened in the fill were measured on April 4, 1991. The direction of groundwater flow calculated from these measurements is directly south towards the Blair Waterway at an average gradient of 0.001 feet per foot. It should be noted, however, that heavy rainfall occurred on the day water levels were measured (April 4). Groundwater gradient may be altered by such events.

Groundwater elevations in the Sands and Silts were measured on April 2 and 4, 1991. These data indicate that on April 4, groundwater flow was directly north towards the Hylebos Waterway at an average gradient of 0.003 feet per foot.

4.0
LABORATORY ANALYSIS

Soil and groundwater chemical analysis was conducted by Analytical Technologies Inc. (ATI) of Renton, Washington. Four soil samples were collected from the test pits. Three groundwater samples were collected from wells screened in the dredge fill and one sample was collected from a well screened in the Sands and Silts. Soil and groundwater samples were analyzed for the following parameters:

- Volatile Organic Compounds (EPA Method 8240)
- Semi-Volatile Organic Compounds (EPA Method 8270)
- Priority Pollutant Metals (various methods)
- Chlorinated Pesticides and PCBs (EPA Method 8080)
- Total Phenols (EPA Method 9066)
- Total Cyanide (EPA Method 9012)

Analytical results are discussed in Section 5.0. Laboratory data sheets are presented in Appendix C.

Laboratory quality control/quality assurance (QA/QC) consisted of (1) one reagent blank, one matrix spike, and one matrix spike duplicate for each media (soil and groundwater) and (2) surrogate recoveries on each sample analysis.

5.0
ANALYTICAL RESULTS

5.1 RESULTS OF ORGANIC, GENERAL CHEMICAL, AND METALS ANALYSES IN SOIL

Soil samples were collected and composited from groups of test pits as discussed in Section 2.2. Results of organic, general chemical, and metals analyses were compared to the Washington Department of Ecology Model Toxics Control Act (MTCA) Method A- Industrial Cleanup Levels for Soil.

5.1.1 Detections of Volatile Organic Chemicals (EPA Method 8240) in Soil

Acetone was detected in Soil Samples TP010203, TP08091011, and TP121314 at concentrations of 4.3, 1.0, and 0.96 milligrams per kilogram (mg/kg), respectively. Acetone was not detected in Sample TP040507. A Method A cleanup level for acetone in industrial soils has not been established by the MTCA.

Methylene chloride was detected in all four soil samples at concentrations ranging from 0.82 to 0.97 mg/kg. Methylene chloride also was detected in laboratory QA/QC blank samples. The MTCA Method A Cleanup level for methylene chloride in industrial soil is 0.5 mg/kg. Methylene chloride is a common laboratory contaminant. Because it was detected in laboratory QA/QC blank samples, methylene chloride values are considered artifacts of laboratory procedures.

Trichloroethane (1,1,1-Trichloroethane) was detected in Sample TP121314 at 0.13 mg/kg. The MTCA Method A Cleanup level for industrial soil is 20.0 mg/kg.

A summary of detections for Volatile Organic Chemicals is presented in Table 5-1.

TABLE 5–1: SUMMARY OF DETECTIONS IN SOIL OF ORGANIC AND GENERAL CHEMICAL PARAMETERS

Analytical Method/Parameter (Results in mg/kg)	Sample ID Number TP010203	TP040507	TP08091011	TP121314	MTCA Method A Industrial Cleanup Level (mg/kg)
Volatile Organic Compounds (Method 8240)					
Acetone	4.3	<1.0	1.0	0.96	NE
Methylene Chloride	0.85 B	0.82 B	0.97 B	0.88 B	.05
1,1,1–Trichloroethane	<0.050	<0.050	<0.050	0.13	20.0
Semi–Volatile Organic Compounds (Method 8270)					
Di–N–Butylphthalate	0.19 JB	0.084 JB	0.16 JB	0.079 JB	NE
Bis (2–Ethylhexyl) Phthalate	0.047 JB	0.12 JB	<0.17	<0.17	NE
Phenanthrene	<0.17	0.042 J	<0.17	<0.17	20.0 (1)
Fluoranthrene	<0.17	<0.17	0.056 J	<0.17	20.0 (1)
Pyrene	<0.17	<0.17	0.091 J	<0.17	20.0 (1)
Organochlorine Pesticidesa and PCBs (Method 8080)					
None Detected					
General Chemistry					
Total Cyanide	<0.1	<0.1	<0.1	<0.1	NE
Total Phenols	<0.2	<0.2	<0.2	<0.2	NE

Notes:

(1) = Cleanup standard listed is for carcinogenic Polynuclear Aromatic Hydrocarbons (PAHs)

NE = MTCA Cleanup Level not established for this parameter, detected level is considered to be low enough to be of no significant concern.

Value recorded with "less than" (<) symbol indicates analytical result was less than the listed detection limit

J = Value estimated by laboratory

B = Compound also detected in laboratory QA/QC blank

5.1.2 Detections of Semi-Volatile Organic Chemicals (EPA Method 8270) in Soil

Di-n-butylphthalate was detected in all soil samples at concentrations ranging from 0.079 to 0.19 mg/kg. All reported values are below method detection limits and are estimated by the laboratory. The compound was also detected in the laboratory QA/QC blanks. A Method A cleanup level for di-n-butylphthalate in industrial soils has not been established. Di-n-butylphthalate is a compound used as a plasticizer in rubber products. It is a common laboratory contaminant. Because it was detected in laboratory QA/QC blank samples, di-n-butylphthalate values are considered artifacts of laboratory or sampling procedures.

Bis (2-ethylhexyl) phthalate was detected in Samples TP010203 and TP040507 at 0.047 and 0.12 mg/kg, respectively. All reported values are below method detection limits and are estimated by the laboratory. Bis (2-ethylhexyl) phthalate was also detected in the laboratory QA/QC blanks. A Method A cleanup level for this compound in industrial soils has not been established by the MTCA. Bis (2-ethylhexyl) phthalate is a compound used as a plasticizer in rubber products. It is also a common laboratory contaminant. Because it was detected at concentrations below the analytical method detection limit, it is considered an artifact of laboratory or sampling procedures.

The polynuclear aromatic hydrocarbon (PAH) compounds phenanthrene, fluoranthrene, and pyrene were detected in Samples TP040507 and TP08091011. The reported values of these compounds were all below method detection limits and are thus concentrations estimated by the laboratory. Phenanthrene was detected in Sample TP040507 at 0.042 mg/kg. Fluoranthrene and pyrene were detected in Sample TP08091011 at concentrations of 0.056 and 0.091 mg/kg, respectively. The MTCA Method A Cleanup level for carcinogenic PAH compounds in industrial soils is 20.0 mg/kg.

A summary of detections for Semi-Volatile Organic Chemicals is presented in Table 5-1.

5.1.3 Detections of Organochlorine Pesticides and PCBs (EPA Method 8080) in Soil

No compounds were detected in any samples under Method 8080. The analytical results for this method are presented in Table 5-1.

5.1.4 General Chemical Results for Soil

Cyanide and phenols were not detected in any soil samples at detection limits of 0.1 and 0.2 mg/kg, respectively. The analytical results for general chemical parameters are presented in Table 5-1.

5.1.5 Analytical Results for Metals in Soil

Soil samples were collected from the test pits and submitted for laboratory analysis for the Priority Pollutant suite of metals. These metals are antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc. All analytical results for metals were either below detection limits or were below MTCA Method A Cleanup Levels for industrial soils. Results for these analyses are provided in Table 5-2.

5.2 RESULTS OF ORGANIC, GENERAL CHEMICAL, AND METALS ANALYSES OF GROUNDWATER

Groundwater samples were collected from monitoring wells screened in the dredge fill (SB1A, SB2A, and SB3A) and from Well SB3, screened in the Sands and Silts. Analytical results of organic, general chemical, and metals analyses were compared to the Washington Department of Ecology Model Toxics Control Act (MTCA) Method A Cleanup Levels for Groundwater and to State of Washington Draft Groundwater Quality Standards (173-200 WAC).

5.2.1 Detections of Volatile Organic Chemicals (EPA Method 8240) in Groundwater

Carbon disulfide was detected in the groundwater sample from Well SB2A at a concentration at the method detection limit of 5 micrograms per liter (μg/L). Carbon disulfide is a solvent commonly used in analytical laboratories. A Draft Groundwater Quality Standard or MTCA Method A Cleanup level for carbon disulfide in groundwater has not been established. The presence of carbon disulfide is likely attributable to sample bottle cleaning and treating procedures.

TABLE 5-2: SUMMARY OF RESULTS FOR METALS IN SOIL

Analytical Parameter (Results in mg/kg)	Sample ID Number TP010203	TP040507	TP08091011	TP121314	MTCA Method A Industrial Cleanup Level (mg/kg)
Antimony (Sb)	<0.5	<0.5	<0.5	<0.5	NE
Arsenic (As)	1.6	1.3	1.8	1.7	200.0
Beryllium (Be)	<0.07	<0.06	<0.06	<0.06	NE
Cadmium (Cd)	1.1	1.2	1.5	1.3	10.0
Chromium (Cr)	4.7	1.5	7.2	3.4	500.0
Copper (Cu)	6.3	4.5	3.4	3.6	NE
Lead (Pb)	<1.3	1.3	6.5	3.6	1000.0
Mercury (Hg)	<0.15	<0.15	<0.15	<0.15	1.0
Nickel (Ni)	4.3	4.8	5.2	6.1	NE
Selenium (Se)	<0.5	<0.5	<0.5	<0.5	NE
Silver (Ag)	<0.20	<0.20	<0.20	<0.20	NE
Thallium (Tl)	<0.5	<0.5	<0.5	<0.5	NE
Zinc (Zn)	12	13	21	15	NE

Notes:

NE = MTCA Cleanup Level not established for this parameter, detected level is considered to be low enough to be of no significant concern.

Value recorded with "less than" (<) symbol indicates analytical result was less than the listed detection limit.

Chloroform was detected in the sample from Well SB3 at the method detection limit of 2 μg/L. An MTCA Method A cleanup level for chloroform in groundwater has not been established. The Draft Groundwater Quality Standard for chloroform is 7.0 μg/L.

A summary of detections for Volatile Organic Chemicals in groundwater is presented in Table 5-3.

5.2.2 Detections of Semi-Volatile Organic Chemicals (EPA Method 8270) in Groundwater

Bis (2-ethylhexyl) phthalate was detected in the sample collected from Well SB3 at an estimated concentration of 6.3 μg/L. This value is below the method detection limit of $<$10.0 μg/L. A Method A cleanup level for this compound has not been established by the MTCA. The Draft Groundwater Quality Standard for bis (2-ethylhexyl) phthalate is 6.0 μg/L. Bis (2-ethylhexyl) phthalate is a compound used as a plasticizer in rubber products. It is also a common laboratory contaminant. Because it was detected at concentrations below the analytical method detection limit, it is considered an artifact of laboratory or sampling procedures.

A summary of detections for Semi-Volatile Organic Chemicals in groundwater is presented in Table 5-3.

5.2.3 Detections of Organochlorine Pesticides and PCBs (EPA Method 8080) in Soil

No compounds were detected in groundwater samples under Method 8080. The analytical results for this method are presented in Table 5-3.

5.2.4 General Chemical Results for Groundwater

Cyanide and phenols were not detected in any groundwater samples at detection limits of 0.01 and 0.02 mg/L, respectively. The detection limits for cyanide and phenols were elevated to $<$0.05 and $<$0.10 mg/L in Sample SB3 due to matrix interference. The analytical results for general chemical parameters are presented in Table 5-3.

TABLE 5-3: SUMMARY OF DETECTIONS IN GROUNDWATER OF ORGANIC AND GENERAL CHEMICAL PARAMETERS

Analytical Method/Parameter (Results in µg/L)	Well ID Number/ Screened Unit SB1A (fill)	SB2A (fill)	SB3 (deeper)	SB3A (fill)	MTCA Method A Cleanup Level (µg/L)	State of Washington Draft Groundwater Quality Standard (1) (µg/L)
Volatile Organic Compounds (Method 8240)						
Carbon Disulfide	<1	5	<1	<1	NE	NE
Chloroform	<1	<1	2	<1	NE	7.0
Semi-Volatile Organic Compounds (Method 8270)						
Bis (2-Ethylhexyl) Phthalate	<10	<10	6.3 J	<10	NE	6.0
Organochlorine Pesticides and PCBs (Method 8080)						
No Compounds Detected						
General Chemistry						
Total Cyanide (mg/L)	<0.01	<0.01	<0.05 (2)	<0.01	NE	NE
Total Phenols (mgIL)	<0.02	<0.02	<0.10 (2)	<0.02	NE	NE

Notes:

(1) = Draft Water Quality Standards for Ground Waters of the State of Washington, dated April 1990.

(2) = Elevated detection limit due to matrix interference.

NE = Cleanup Level or Ground Water Quality Standard not established for this parameter.

Value recorded with "less than" (<) symbol indicates analytical result was less than the listed detection limit

J = Value estimated by laboratory

5.2.5 Analytical Results for Metals in Groundwater

Groundwater samples were collected from the monitoring wells and submitted for laboratory analysis for the Priority Pollutant suite of metals. These metals are antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc. Analytical results are provided in Table 5-4.

Antimony, beryllium, cadmium, chromium, copper, mercury, nickel, selenium, silver, and thallium were either below detection limits or were below both MTCA Method A Cleanup Levels for groundwater and Draft Groundwater Quality Standards.

Arsenic in samples collected from SB1A and SB3A was detected at concentrations of 0.005, and 0.006 mg/L, respectively. These concentrations are equal to or slightly greater than the method detection limit of 0.005 mg/L. Arsenic in Sample SB2A was detected at 0.048 mg/L. Arsenic concentrations in SB2A and SB3A exceed both the MTCA Method A Cleanup level of 0.005 mg/L and the Draft Groundwater Quality Standard of 0.00005 mg/L.

Lead was detected in samples from SB1A and SB2A at concentrations of 0.006 and 0.005 mg/L, respectively. These concentrations are equal to or slightly greater than the method detection limit of 0.005 mg/L. The concentration in Sample SB1A exceeds the MTCA Method A Cleanup level of 0.005 mg/L, but does not exceed the Draft Groundwater Quality Standard of 0.05 mg/L.

5.3 SUMMARY OF ANALYTICAL RESULTS

Acetone, methylene chloride, and 1,1,1-Trichloroethane detected in soil samples collected from test pits can be attributed to laboratory contamination or are present at concentrations well below regulatory guidelines. The presence of these chemicals in soil is considered insignificant.

Di-n-butylphthalate and bis (2-ethylhexyl) phthalate were detected in soil and groundwater samples at concentrations below method detection limits and in some cases were also detected in laboratory QA/QC blank samples. The presence of these

TABLE 5–4: SUMMARY OF RESULTS FOR METALS IN GROUNDWATER

Analytical Parameter (Results in mg/L)	Well ID Number/ Screened Unit SB1A (fill)	SB2A (fill)	SB3 (deeper)	SB3A (fill)	MTCA Method A Cleanup Level (mg/L)	State of Washington Draft Groundwater Quality Standard (1) (mg/L)
Antimony (Sb)	<0.005	<0.005	<0.005	<0.005	NE	NE
Arsenic (As)	0.005	0.048	<0.005	0.006	0.005	0.00005
Beryllium (Be)	<0.001	<0.001	<0.001	<0.001	NE	NE
Cadmium (Cd)	<0.0003	<0.0003	<0.0003	<0.0003	0.005	0.01
Chromium (Cr)	<0.005	<0.005	0.015	0.006	0.050	0.05
Copper (Cu)	0.025	0.023	0.026	0.016	NE	1.0
Lead (Pb)	0.006	0.005	<0.005	<0.005	0.005	0.05
Mercury (Hg)	<0.0005	<0.0005	<0.0005	<0.0005	0.002	0.002
Nickel (Ni)	<0.01	<0.01	<0.01	<0.01	NE	NE
Selenium (Se)	<0.005	<0.005	<0.005	<0.005	NE	0.01
Silver (Ag)	<0.003	<0.003	<0.003	<0.003	NE	0.05
Thallium (Tl)	<0.005	<0.005	<0.005	<0.005	NE	NE
Zinc (Zn)	0.039	0.062	0.063	0.038	NE	5.0

Notes:

(1) = Draft Water Quality Standards for Ground Waters of the State of Washington, dated April 1990.

NE = Cleanup Level or Ground Water Quality Standard not established for this parameter, detected level is considered to be low enough to be of no significant concern.

Bold type indicates value exceeding Cleanup Level or Ground Water Quality Standard.

Value recorded with "less than" (<) symbol indicates analytical result was less than the listed detection limit.

compounds can be attributed to laboratory or sample handling contamination and is considered insignificant.

Several polynuclear aromatic hydrocarbon compounds and several metals were detected in soil samples at concentrations well below regulatory guidelines and are considered insignificant.

Carbon disulfide and chloroform were detected in groundwater at concentrations below regulatory standards or equal to the method detection limit. Carbon disulfide is a common laboratory solvent. The presence of these chemicals is considered insignificant.

Arsenic was detected in groundwater samples from Wells SB2A and SB3A at concentrations exceeding the MTCA Method A Cleanup Level. The concentration in Sample SB3A was 0.006 mg/L, 0.001 mg/L above the method detection limit and MTCA Method A Cleanup Level which are both 0.005 mg/L. The concentration of arsenic in sample from SB2A was 0.048 mg/L.

Lead was detected in groundwater samples from SB1A and SB2A equal to or slightly above both the method detection limit and the MTCA Cleanup Level, which are 0.005 mg/L.

6.0
CONCLUSIONS

A Phase 2 investigation was undertaken to address the questions presented in Section 1.2 of this report. Based upon a review of historical aerial photographs, field observation and investigation, and chemical analysis of soil and groundwater, the following may be concluded concerning the proposed project site:

- Unauthorized disposal of empty 55-gallon drums and paint cans, automobile tires, creosoted logs, and household and demolition debris has taken place on the proposed construction site. Chemical analysis of soil and groundwater samples indicate that no significant impact to soil or groundwater has occurred as result of the unauthorized disposal.

- Chemical analysis of a soil sample collected along the eastern boundary of the site, closest to the adjacent Chemical Processors property, indicate that 1,1,1-Trichloroethane is present at a concentration well below the MTCA Method A Cleanup Level. This compound was not detected in any other soil or groundwater samples. There is no further evidence that operations at the Chemical Processors property have impacted the proposed construction site.

- Chemical analyses of groundwater sampled from wells screened in dredge fill at the site indicate that arsenic and lead are present at concentrations exceeding MTCA Method A Cleanup Levels. The MTCA Cleanup level for both arsenic and lead is 0.005 mg/L and is equal to the analytical method detection limit. The levels of lead found in groundwater are just above the MTCA Cleanup Level and likely represent area background concentrations. Levels of arsenic found in groundwater range from slightly greater than to approximately nine times the MTCA Method A Cleanup level. It is widely recognized that arsenic is ubiquitous in soil and shallow groundwater in the south Puget Sound region. The levels of arsenic found at the site in groundwater sampled from wells screened in dredge fill likely represent area

background concentrations. Arsenic was not detected in groundwater sampled from a monitoring well screened in the deeper Silts and Sand unit.

MTCA Method A cleanup levels are based on the most stringent beneficial use of groundwater, as a drinking water source. The characteristics of a drinking water source are defined in Section 720, Groundwater Cleanup Standards (WAC 173-340-720). Groundwater present in the dredge fill at the proposed facility site does not meet the requirements for being a current or potential future source of drinking water. Cleanup levels established for arsenic in groundwater by the Model Toxics Control Act therefore would not be applicable to the levels of arsenic detected at the subject site. It is thus unlikely that remedial action in accordance with the Model Toxics Control Act would be required.

- Groundwater leaving the site may be impacted by concentrations of chemicals that are well below regulatory criteria. Chemical analysis of soil and groundwater indicate that the proposed facility site is not a likely source of chemical impact to the Blair or Hylebos waterways.

- Levels of chemicals in the soil are considered low enough that remediation of construction spoils would not be necessary.

7.0
REFERENCES

Dames and Moore. 1990. Preliminary Assessment of Site Tacoma Cogeneration Project Site.

Russell Post, Tacoma City Light. Personal Communication. March 28, 1991.

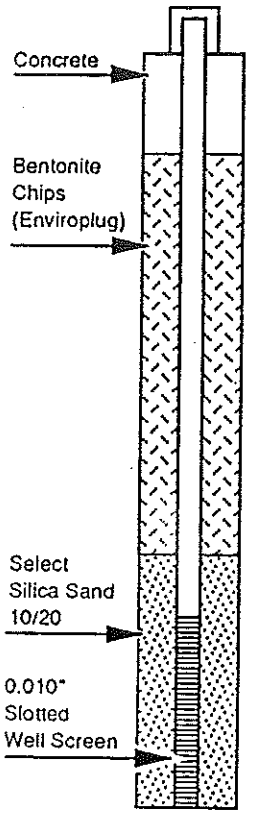
Washington Administrative Code, February 28, 1991. Model Toxics Control Act Cleanup Regulation and Amendments, Chapter 173-340 WAC.

Washington Administrative Code, April 17, 1990. Draft, Water Quality Standards for Ground Waters of the State of Washington, Chapter 173-200 WAC.

Woodward-Clyde Consultants. May 1991. Wetlands Survey of the Proposed Sithe Energies Tacoma Cogeneration Facilities Site.

APPENDIX B
WELL BORING LOGS

BORING NO.	SB-1	ELEVATION:	11.32 ft
LOCATION:		DATE STARTED:	3/28/91
DRILLING AGENCY:	Soil Sampling Service	DATE COMPLTED:	3/28/91
DRILLING EQUIPMENT:	All-terrain CME-50	DRILLER: W. Lindholm	LOGGED BY: K. Teague
DRILLING METHOD:	4" ID HSA	SAMPLER:	SPT

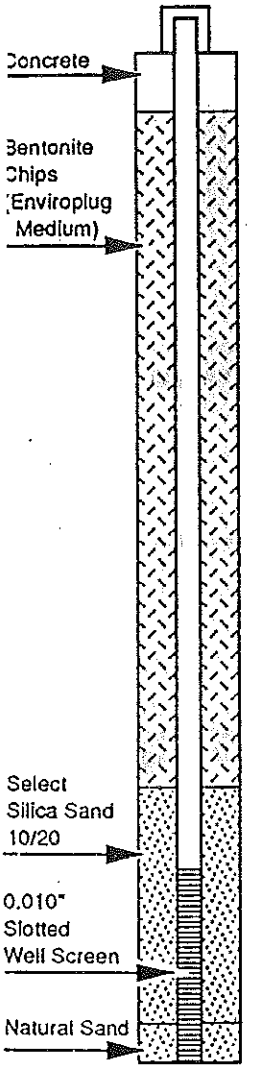


DEPTH (FEET)	BLOWS / 6 IN.	SAMPLE	GRAPHIC LOG	DESCRIPTION
5	1 4 2			(2.5 - 4.0) Loose, saturated, brown, medium grained sand (SP), trace of calcareous shell material (FILL)
10	1 0 0	AIR		(8.5 - 10.0) No recovery. Likely fine to medium grained saturated sand
15	0 0 4			(13.5 - 15.0) Very soft, plastic, saturated, clay (CL) with loose, saturated, gray, fine sand (SP)
20	7 11 16			(18.5 -20.0) Medium dense, saturated, gray, fine to medium sand (SP)

Screened in silt?
15 – 8.5 unknown

Project No. 91C0191A	Sithe Energies, U.S.A., Inc. Tacoma Cogeneration Project	LOG OF BORING SB-1	SHEET 1 of 7
Woodward-Clyde Consultants			

BORING NO.	SB-3	ELEVATION:	14.07 ft
LOCATION:		DATE STARTED:	3/29/91
DRILLING AGENCY:	Soil Sampling Service	DATE COMPLTED:	3/29/91
DRILLING EQUIPMENT:	All-terrain CME-50	DRILLER: W. Lindholm / LOGGED BY:	K. Teague
DRILLING METHOD:	4" ID HSA	SAMPLER:	SPT

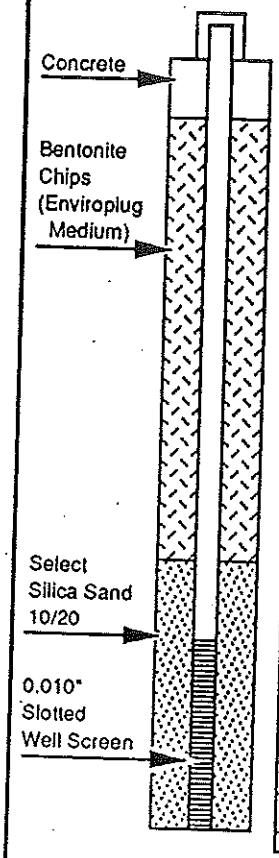


DEPTH (FEET)	BLOWS / 6 IN.	DESCRIPTION
5	4 6 8	Surface: Coarse sandy gravel with cobbles mixed with white powdery lime (3.5 - 5.5) Loose to medium, dense, saturated, medium sand (SP) trace of fine sand (FILL)
10	1 2 1-1/2	(8.5 - 10.5) Very soft, saturated, gray-tan clay (CL) with some darker gray vertically oriented streaks
15	0	(13.5 - 15.5) Very soft, saturated, gray clay (CL), trace to some silt in lower 3"
20	5 4 1 2	(18.5 -20.5) Very soft, saturated gray clay (2 layers, 4" and 7" thick) interbedded with loose, saturated, gray, medium sand
25	5 8 19	(23.5 - 25.5) Loose, saturated, poorly sorted gray silty fine sand (SW) with trace of clay, grading to dense, saturated, gray, medium sand (SP) with serveral white-tan clam shell fragments

screen in clay ?
20.5 - 23.5' unknown

Project No. 91C0191A	Sithe Energies, U.S.A., Inc. Tacoma Cogeneration Project	LOG OF BORING SB-3	SHEET 3 of 7
Woodward-Clyde Consultants			

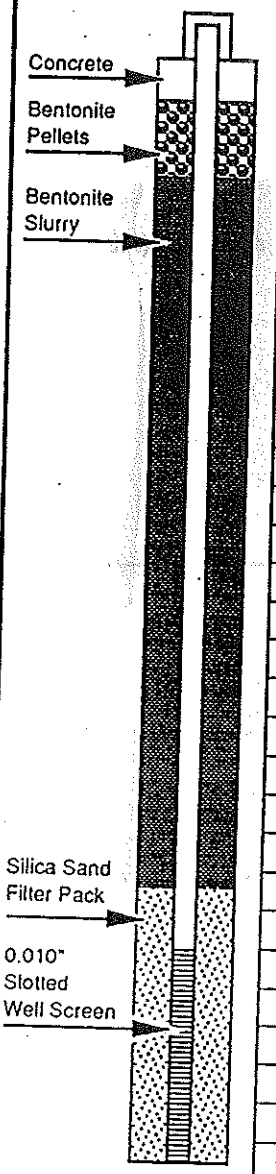
BORING NO. SB-2	ELEVATION: 10.91 ft
LOCATION:	DATE STARTED: 3/29/91
DRILLING AGENCY: Soil Sampling Service	DATE COMPLTED: 3/29/91
DRILLING EQUIPMENT: All-terrain CME-50	DRILLER: W. Lindholm / LOGGED BY: K. Teague
DRILLING METHOD: 4" ID HSA	SAMPLER: SPT



DEPTH (FEET)	BLOWS / 6 IN.	SAMPLE	GRAPHIC LOG	DESCRIPTION
5	2 2 2			(3.5 - 5.5) Loose, wet to saturated, dark gray to brown fine to medium sand (SP), trace of silt, trace of clayey blebs to 4mm diameter (FILL)
10	2 2 1			(8.5 - 10.5) Soft, saturated, gray-brown clay (CL) with abundant roots and rootlets
15	0			(13.5 - 15.5) Very soft, saturated, gray clay (CL)
20	1 8 14 12			(18.5 -20.5) Medium dense, saturated, dark gray, fine to medium sand (SP)

Screened in silt/clay?
15.5 - 18.5 unknown

BORING NO. SB-4	ELEVATION: 13.82 ft
LOCATION:	DATE STARTED: 4/1/91
DRILLING AGENCY: Soil Sampling Service	DATE COMPLTED: 4/1/91
DRILLING EQUIPMENT: All-terrain CME-50	DRILLER: W. Lindholm / LOGGED BY: K. Teague
DRILLING METHOD: 4" ID HSA	SAMPLER: SPT

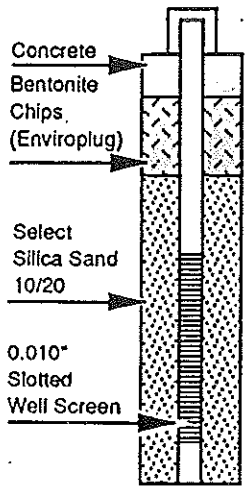


DEPTH (FEET)	BLOWS / 6 IN.	SAMPLE	GRAPHIC LOG	DESCRIPTION
				Surface - sandy gravel
				(1.0) Wood pulp & chunks of rubber
	3			(3.5 - 5.5) Tan wood, fibrous (FILL)
5	3			
	2			
	3			(8.5 - 10.5) Dark brown saturated, wood waste, with bits of black rubber material
	4			
10	3			
	0			(13.5 - 15.5) Very soft, saturated, gray clay (CL) uniform
15				
	3			(18.5 -20.5) Soft, saturated, interbedded gray clay (CL) and gray sandy silt (ML)
	2			
20	1			
	1			(23.5 - 25.5) Soft, saturated, gray silty clay (CL) grading at 25.0 to loose, saturated, gray fine to medium sand
	3			
25	3			
	9			(28.5 30.5) Dense, saturated, gray medium sand (SP) with thin 1/2" - 3/4" interbedded fine sand stringers and one 4" silt lense
	18			
30	14			

screened in clay at least 23.5 - 25'

Project No. 91C0191A	Sithe Energies, U.S.A., Inc. Tacoma Cogeneration Project	LOG OF BORING SB-4	SHEET 4 of 7
Woodward-Clyde Consultants			

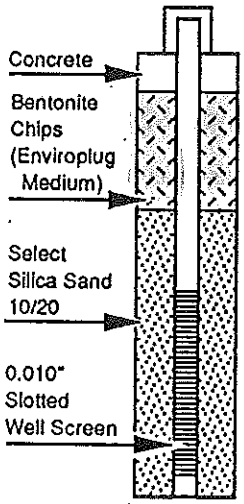
BORING NO. SB-1A		ELEVATION: 11.91 ft	
LOCATION:		DATE STARTED: 3/28/91	
DRILLING AGENCY: Soil Sampling Service		DATE COMPLTED: 3/28/91	
DRILLING EQUIPMENT: All-terrain CME-50		DRILLER: W. Lindholm	LOGGED BY: K. Teague / D. Walker
DRILLING METHOD: 4" ID HSA		SAMPLER:	



DEPTH (FEET)	BLOWS / 6 IN.	SAMPLE	GRAPHIC LOG	DESCRIPTION
				Note: Not Sampled. Stratigraphic information from Well SB-1 except as noted (*)
				(2.3 - 4.0) Loose, saturated, brown, medium grained sand (SP) (FILL)
5				
10				* (10,5) Clay encountered

Project No. 91C0191A	Sithe Energies, U.S.A., Inc. Tacoma Cogeneration Project	LOG OF BORING SB-1A	SHEET 5 of 7
Woodward-Clyde Consultants			

BORING NO. SB-2A		ELEVATION: 11.78 ft	
LOCATION:		DATE STARTED: 3/29/91	
DRILLING AGENCY: Soil Sampling Service		DATE COMPLTED: 3/29/91	
DRILLING EQUIPMENT: All-terrain CME-50		DRILLER: W. Lindholm	LOGGED BY: K. Teague / D. Walker
DRILLING METHOD: 4" ID HSA		SAMPLER:	

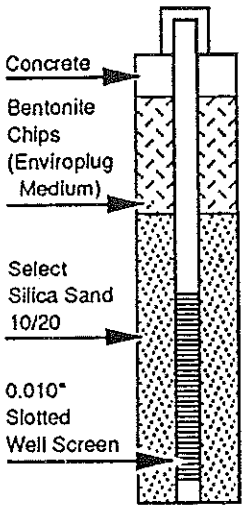


DEPTH (FEET)	BLOWS / 6 IN.	SAMPLE	GRAPHIC LOG	DESCRIPTION
5				Note: Not Sampled. Stratigraphic information from Well SB-2, except as noted (*) (3.5 - 5.5) Loose, wet to saturated, dark gray to brown fine to medium sand (SP), trace of silt, trace of clayey blebs to 4mm diameter (FILL) *(7.0 - 8.5) Refuse encountered
10				(8.5 - 10.5) Soft, saturated, gray-brown clay (CL) with abundant roots and rootlets

Screened in clay 8.5 - 10.5'

Project No. 91C0191A	Sithe Energies, U.S.A., Inc. Tacoma Cogeneration Project	LOG OF BORING SB-2A	SHEET 6 of 7
Woodward-Clyde Consultants			

BORING NO.	SB-3A	ELEVATION:	13.26 ft
LOCATION:		DATE STARTED:	3/29/91
DRILLING AGENCY:	Soil Sampling Service	DATE COMPLTED:	3/29/91
DRILLING EQUIPMENT:	All-terrain CME-50	DRILLER: W. Lindholm	LOGGED BY: K. Teague / D. Walker
DRILLING METHOD:	4" ID HSA	SAMPLER:	



DEPTH (FEET)	BLOWS / 6 IN.	SAMPLE	GRAPHIC LOG	DESCRIPTION
				Note: Not Sampled. Stratigraphic information from Well SB-3 (3.5 - 5.5) Loose to medium, dense, saturated, medium sand (SP) trace of fine sand (FILL)
5				
10				(8.5 - 10.5) Very soft, saturated, gray-tan clay (CL) with some darker gray vertically oriented streaks

Screen in clay 8.5-10.5' (at least)

Project No. 91C0191A	Sithe Energies, U.S.A., Inc. Tacoma Cogeneration Project	LOG OF BORING SB-3A	SHEET 7 of 7
Woodward-Clyde Consultants			

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

Project No. 91C0191A	Sithe Energies, U.S.A., Inc. Tacoma Cogeneration Project	UNIFIED SOIL CLASSIFICATION SYSTEM	Figure 0
Woodward-Clyde Consultants			