CLEANUP ACTION PLAN (CAP)

5603 North Waterfront Drive
Tacoma, Washington 98407

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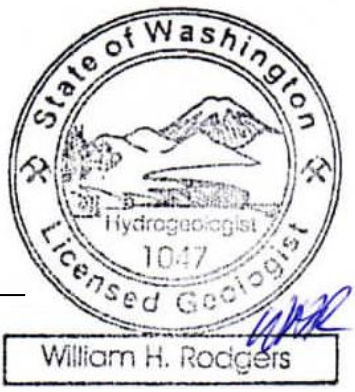

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LIST OF ABBREVIATIONS AND ACRONYMS

ARAR .....Applicable or Relevant Appropriate Requirements
BGS ..... Below ground surface
BTEX..... Benzene, Toluene, Ethyl benzene and Xylenes
CAP .....Cleanup Action Plan
COC .....Constituent of concern
CSIA .....Compound Specific Isotopic Analysis
CSM ..... Conceptual Site Model
CUL .....Cleanup level
DCA .....Disproportionate Cost Analysis
DO .....Dissolved Oxygen
DRO.....Diesel-range organics
Ecology .....Washington State Department of Ecology
EPA.....U.S. Environmental Protection Agency
FS.....Feasibility Study
Ft .....Feet
Gpm.....Gallons per minute
GRO.....Gasoline-range organics
ISCO.....*in situ* chemical oxidation
LNAPL.....Light Nonaqueous Phase Liquid
mg/kg.....Milligrams per kilograms
mg/L.....Milligrams per liter
MNA.....Monitored Natural Attenuation
MTCA ..... Model Toxics Control Act
ORC .....Oxygen release compound
ORO.....Oil-range organics
Psi.....Pounds per square inch
RAO .....Remedial Action Objectives
RI .....Remedial Investigation
SL.....Screening level
SVE .....Soil Vapor Extraction
TPH.....Total Petroleum Hydrocarbons
UST.....Underground storage tank
VI.....Vapor Intrusion
WAC .....Washington Administrative Code
yd3 .....Cubic yards
µg/L.....Micrograms per liter
µg/m3 .....Micrograms per cubic meter

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1.0 INTRODUCTION

Eco Con Inc. (ECI) has prepared this Cleanup Action Plan (CAP) in preparation for the remediation of petroleum-contaminated soil (PCS) and groundwater at 5603 North Waterfront Drive in Tacoma, Washington (Subject Site). This CAP provides limited site background information (with the responsibility of the reader to be generally familiar with the Site history), results of previous Site investigations and current Site conditions.

1.1 Site Description

The Subject Site is identified as the Breakwater Marina, a property that occupies a single tax parcel (Pierce County Parcel Number: 8950100010), 29.30 acres in size. The Site is located to the southwest of the Washington State Department of Transportation ferry dock (Pt. Defiance – Vashon Island) and northwest of the Tacoma Yacht Club (See Appendix A: Figure 1). The Site is currently zoned as Municipal Area (City of Tacoma) and a portion of the Metropolitan Parks District Point Defiance Park (Pierce County Assessor Website, 2013). This CAP is written exclusively for the Breakwater Marina, which includes the infrastructure (175 slips from 25 – 100 feet) associated with a marina. The current owner of the parcel that the site is located within is the Metropolitan Park District.

The following is the legal description of the property as provided by Pierce County Assessor's website:

> *Section 23 Township 21 Range 02 Quarter 11 - TACOMA TIDELAND SUPL 61: THAT POR OF BLK A 1961 SUPPLEMENTAL EXCEPTING THEREFROM BEG AT MOST WLY COR SD BLK A TH ON SWLY LI ON AZIMUTH OF 307 DEG 39 MIN 10 SEC 1561.83 FT TH ON AZIMUTH OF 238 DEG 57 MIN 10 SEC 265 FT TH ON AZIMUTH OF 142 DEG 25 MIN 30 SEC 730 FT TH ON AZIMUTH OF 238 DEG 56 MIN 25 SEC 216.76 FT TH ON AZIMUTH OF 142 DEG 25 MIN 30 SEC 540.19 FT TO NWLY LI OF BLK A TH ON AZIMUTH OF 71 DEG 00 MIN 10 SEC 925 FT TO BEG ALSO EXC FOLL DESC PROP BEG AT MOST WLY COR SD BLK A TH N 71 DEG 00 MIN 10 SEC E 925.09 FT TH S 37 DEG 34 MIN 30 SEC E 540.19 FT TO POB TH SWLY LI ON AZIMUTH OF 238 DEG 56 MIN 25 SEC 216.76 FT TH S 37 DEG 34 MIN 30 SEC E 740 FT TH S 58 DEG 57 MIN 10 SEC W 265 FT TH S 52 DEG 20 MIN 50 SEC E 981 FT TO SE COR OF BLK A TH N 58 DEG 57 MIN 10 SEC E 230 FT TH N 37 DEG 34 MIN 30 SEC W TO POB SEG E 7139 DC/BL 03-16-06BL..*

1.2 Site Geology and Hydrogeology

1.2.1 Regional Geology

The Subject Site is located in the physiographic setting called the Puget Sound Lowlands. This area is filled in with deep deposits of glacial debris which can reach thicknesses of at least 2000 feet in the Tacoma area (Alt and Hyndman, 1984). The Puget Sound Lowlands lie between the Olympic Peninsula and northern Willapa Hills on the west, and the Cascade subcontinent on the east. Bedrock beneath the thick glacial deposits in the Puget Sound Lowlands consists of oceanic crustal rocks.

Multiple periods of continental glaciation occurred in the region during the Pleistocene Epoch (2.5 mya to 11,000 years ago) as Cordilleran glaciers advanced into the Puget Sound Lowland. The most recent of these, the Vashon, was about 5,000 feet thick near Seattle, and approximately 1,500-feet thick in the area of the Site. The terminus of these glaciers was approximately 12 miles south of Olympia. After the

last glacial retreat (approximately 10,000 years ago), incision of the valleys in the Puget Sound Lowlands and subsequent deposition of fluvial and alluvial deposits has occurred to the present.

1.2.2 Regional Groundwater Conditions

The regional hydrogeologic setting is defined as the Puget-Willamette Trough Regional Aquifer system (USGS, 1994). This regional aquifer system underlies an elongated basin that extends from near the Canadian border in Washington State to central Oregon. The regional aquifer system is delineated into three areas: 1) the Puget Sound Lowlands in northern Washington, 2) a central area that extends southward from the Puget Sound Lowlands to northern Oregon, and 3) the Willamette River Valley, which extends southward from the Columbia River to central Oregon (USGS, 1994). The Site lies in the southern extent of the Puget Sound Lowlands.

The regional aquifers are hosted in unconsolidated sediments. In the Puget Sound Lowlands, the unconsolidated deposits are as much as 3,000-feet thick near Seattle. The aquifers are located within discontinuous lenses of sands and gravels that can yield large volumes of water. Some wells within the permeable aquifers can yield as much as 2,000 gallons per minute (gpm) or more. The Central Pierce County Aquifer System consists primarily of unconsolidated sediments deposited by glaciers and associated melt water. The groundwater moves regionally toward the Puget Sound and river valleys that constitute the aquifer system boundaries (EPA Website, 2013).

Based on previous hydrogeologic investigations, the area is underlain by three aquifers (EPA Website, 2013). The uppermost aquifer is a fill aquifer, and is composed of dredge sand and various fill material. The sandy fill varies in thickness and extends from ground surface to depths of up to eleven feet below ground surface (bgs). A silt layer averaging up to eleven feet in thickness (upper aquitard) separates the fill aquifer from the underlying sand aquifer. This aquitard zone consists of fine-grained overbank deposits that can be locally interbedded with very fine sands. The sand aquifer is composed of fine- to coarse-grained sand and variable amounts of silt. A discontinuous fine-grained layer (lower aquitard) separates the sand aquifer from the lower aquifer. The lower aquifer consists of interbedded sand and sandy gravel layers and discontinuous layers of silty sand, silt, and clay.

Base on previous studies (ECI, 2013) and information obtained from the EPA, the flow direction and depth of the shallow groundwater in the subject Site area is highly variable and is influenced by seasonal and tidal changes. The reported depth to groundwater is approximately six to nine feet bgs, with general groundwater flow direction to the northeast.

1.3 Previous Environmental Work

The site currently (as of the date of this report) houses an open excavation measuring approximately 100 feet long by 15 feet wide by 6 to 8 feet deep, secured with a chain link fence. Groundwater is present in the former 8,000 gallon UST excavation area.

1.3.1 Focused Subsurface Investigation (November 2013)

In November 2013, ECI directed the advancement of soil borings adjacent to the five USTs, as described in ECI's letter report entitled Focused Subsurface Investigation / Underground Storage Tank Assessment, dated November 15, 2013. Thirteen borings were advanced as part of this focused subsurface

investigation. Areas investigated included soils and groundwater adjacent to the five USTs. Depth of the borings ranged from eight to ten feet bgs and depth to groundwater ranged from five to six feet bgs. Soil samples were collected from three to four feet bgs and from the groundwater interface. Groundwater and soil samples were analyzed for the site contaminants of concern (COC), identified as: gasoline-range organics (GRO), diesel-range organics (DRO), and select volatile organic compounds benzene, toluene, ethylbenzene and xylenes. Analysis indicated only one of the samples, the groundwater sample collected from Boring B1 (ECIB1-W), contained concentrations of DRO (34,300 µg/L) above the applicable state cleanup levels of 500 µg/L (Model Toxics Control Act (MTCA) Method A Cleanup Levels (CUL) for Unrestricted Land Use, WAC 173-340-900: Table 720-1).

These results indicate that the areas investigated are impacted from one of the contaminants of concern (DRO), reported exceeding the applicable MTCA Method A CUL in groundwater. Therefore, based on the analytical results obtained from this investigation, ECI recommended further investigation in the area of ECI Boring B1, located on the northwestern edge of Tank #1, to further delineate groundwater contamination.

1.3.2 Supplemental Focused Subsurface Investigation (January 2014)

In December 2013, ECI directed the advancement of soil borings, as described in ECI's letter report titled Supplemental Focused Subsurface Investigation (SFSI), dated January 13, 2014. Six borings were advanced as part of this SFSI. Areas investigated included adjacent soils and groundwater to the northwest and northeast of boring B1. Depth of the borings reached ten feet bgs, and depth to groundwater ranged from eight to nine feet bgs. Soil samples were collected from the groundwater interface. Groundwater samples collected from each boring were analyzed for DRO. Analysis indicated concentrations of DRO to be below laboratory method reporting limits (or non-detect) in all six of the groundwater samples. Because the laboratory analysis did not detect concentrations of target analytes in groundwater, and the field screening of soil samples did not indicate the presence of contamination, the soil samples collected were not analyzed.

These results, and the results from the previous investigations, indicated a localized area of impacted groundwater located at the northwestern end of the 8,000 gallon UST. This localized area is impacted with DRO (34,300 µg/L) above the applicable MTCA Method A CUL in groundwater (500 µg/L). Therefore, based on the analytical results obtained from this SFSI and previous investigation, ECI recommended further remedial actions at the Breakwater Marina Site, which are further discussed in this CAP.

1.3.3 UST Closure & Site Assessment (December 2014)

ECI completed the decommissioning and UST site assessment during the closure of the five USTs at the Subject Site in December 2014. The system consisted of one 8,000-gallon diesel UST, one 8,000-gallon gasoline UST, two 3,000-gallon gasoline USTs and one 3,000-gallon diesel UST.

Each UST was decommissioned by removal and transported off-site for cleaning and disposal. The Soil sampling conducted following the UST removal (site assessment) confirmed the presence of DRO, GRO, benzene, total xylenes, and total lead exceeding applicable MTCA Method A Cleanup Levels. Soil sample analytical results reported GRO in fifteen (15) samples, DRO in three (3) samples, benzene in two (2) samples, total xylenes in three (3) samples, and total lead in one (1) of the samples at concentrations

that exceed their applicable MTCA Method A soil cleanup levels. One grab groundwater sample was collected from the excavation following the removal of the USTs. Analytical results of the groundwater sample reported the presence of DRO and lead at concentrations above laboratory method reporting limits (MRL), but below the MTCA Method A cleanup levels for DRO and lead in groundwater. None of the other analytes were identified above the MRL.

2.0 PROPOSED CLEANUP ACTION PLAN

The following sections describe the proposed remedial actions for the Breakwater Marina site. Descriptions and details of technical and engineering design elements of this CAP will be provided under separate cover in a work plan after consideration and approval by the Tacoma-Pierce County Health Department (TPCHD).

2.1 Goals and Objectives

The specific cleanup goals and objectives for the Site include the following:

- Remediation of soil and groundwater contaminated with GRO, DRO, benzene and xylenes.
- Protection of human health and the environment, including protection against direct contact with contaminated soil and direct contact or consumption of contaminated groundwater while allowing for the most beneficial use of the Site by the property owners.
- Entrance of the Subject Site into the Washington State Voluntary Cleanup Program (VCP) with the objective of receiving a No Further Action (NFA) Determination.

The selection of this proposed remedial action below will address each of the goals and objectives, and complies with WAC 174-340-360 and TPCHD regulations. In the event that groundwater monitoring indicates that the proposed remedial action does not appear to be effective in meeting the goals/objectives of the CAP in a reasonable time frame, a more aggressive remediation technology may need to be considered.

2.2 General Description of Proposed Cleanup Action

A combination of excavating and off-site disposal of petroleum contaminated soil (PCS), pumping groundwater (de-watering) with off-site disposal, and well installation and monitoring of groundwater have been determined to be the property owner's preferred remediation technique.

2.2.1 Contaminants of Concern (COCs)

Contaminants of concern (COCs), by association with the historical site activities have been identified as gasoline-range organics (GRO), diesel-range organics (DRO), select volatile organic compounds - benzene, toluene, ethylbenzene, and xylenes (BTEX), and total lead. Cleanup levels have been derived from the Model Toxics Control Act (MTCA) Method A (MTCA-A) Soil Cleanup Levels (CULs) for Unrestricted Land Use. In addition to the MTCA-A CULs, additional COCs are provided in WAC 173-340: Table 830-1 – Required Testing for Petroleum Releases.

Contaminants of Concern & Applicable Cleanup Levels – Soil & Groundwater

MTCA Method A Soil and Groundwater Cleanup Levels for Unrestricted Land Use Table 720-1 Method A Cleanup Levels for Ground Water Table 740-1 Method A Soil Cleanup Levels for Unrestricted Land Uses			
Primary Contaminant of Concern	Analytical Method	Cleanup Levels (CUL) Soil - mg/kg	Cleanup Levels (CUL) Groundwater - µg/l
Diesel-Range Organics (DRO)	NWTPH-Dx	2,000	500
Heavy Oil-Range Organics (HRO/ORO)	NWTPH-Dx Extended	2,000	500
Gasoline-Range Organics (GRO)	NWTPH-Gx	100/30*	1,000/800*
Benzene (B)	EPA 8021B	0.03	5
Toluene (T)	EPA 8021B	7	1,000
Ethylbenzene (E)	EPA 8021B	6	700
Xylenes (X)	EPA 8021B	9	1,000
Total Lead	EPA 200.8	250	15

2.2.2 Sampling

Sample collection during and following soil and groundwater remediation activities will be completed by a properly trained environmental professional using appropriate sampling techniques including EPA sampling method 5035. Each sample will be placed into a new analyte-specific laboratory provided sample container, assigned a unique sample identification, placed into a climate-controlled container maintained at 4° Celsius and submitted to an accredited laboratory, under industry standard chain of custody protocols.

Samples with concentrations of COC's in excess of applicable cleanup levels will be classified as performance samples and used to guide further excavation activities. Confirmation[1] samples will be collected from the excavation sidewalls and the base of the excavation.

2.2.3 PCS Excavation & Off-Site Disposal

The excavation of petroleum-contaminated soil (PCS) identified during previous environmental investigations, including the 2014 UST Site Assessment, will be completed starting on the northwest side of the current excavation and extending to the east (Appendix A, Figure 4). The remedial excavation will be bounded to the north by a concrete sea wall, and to the south by a hillside. Soil samples will be collected during PCS excavation to determine the extent of excavation activities.

During soil sample collection, samples will be field-screened using a photoionization detector (PID), and olfactory, soil staining and sheen testing. Samples exhibiting indications of petroleum impact will be used to guide the excavation activities.

[1] Confirmation samples are samples collected at the completion of excavation at locations beneath or adjacent to areas from which contaminated soil has been removed to determine or verify whether cleanup levels have been achieved.

PCS will be disposed at the Pierce County Regional Landfill (LRI) following application and receipt of an approved Waste Disposal Authorization (WDA) from TPCHD.

2.2.4 Groundwater Monitoring and Pumping

Five one-inch diameter monitoring wells will be installed at approximately equal distances from the northwest to the southeast remedial excavation extent. Two four-inch diameter (dewatering) wells / sumps will be installed within the northwest excavation area (8,000 gallon UST Basin) and the southeast excavation area (3000 gallon UST Basin).

ECI will use the following rationale to determine if a monitoring well will be placed in each temporary boring location:

- If groundwater is not found within 15 feet below ground surface, the boring will be properly abandoned by filling with granular bentonite and capping the surface with asphalt or concrete patch;

- If groundwater is found in the boring, a groundwater monitoring well will be installed, unless the onsite environmental professional determines, based on field conditions at the time of drilling, that the location will not contribute to meeting the stated objectives.

The five one-inch groundwater monitoring well installations will include placement of 1-inch diameter 0.01-inch slot Schedule 40 PVC well screen from the bottom of the boring to at least five feet below ground surface. The well screen will be coupled with blank 1-inch diameter Schedule 40 PVC well casing extending from the well screen to just below the ground surface. The annular space around the well screen will be filled with 10/20 silica sand from the bottom of the boring to at least one-foot above the top of the screen. The rest of the annular space will be filled with bentonite chips to two feet bgs, and with concrete from two feet bgs to the surface. The monitoring wells will be completed with a flush-mount steel monument. Each monitoring well completion will comply with the minimum standards for well construction (WAC 173-160). The onsite environmental professional will determine actual well construction specifications based on groundwater depth and physical and chemical soil conditions observed during drilling operations.

The four-inch groundwater monitoring wells will be installed using the same protocol as the one-inch wells, only using four-inch diameter well screen and blank casing. These wells will be used as a conduit for pumping of groundwater from the localized area of DRO contaminated groundwater (utilizing a vacuum truck). This will be conducted monthly, until groundwater monitoring has indicated that contamination is below MTCA Method A CULs, or that it's determined that additional remedial actions are necessary to clean up the localized area of groundwater contamination. Groundwater pumped from this area will be properly disposed of according to TPCHD and Ecology regulations.

ECI will develop the installed monitoring wells at least 48 hours subsequent to completing the installation, allowing sufficient time for the annular seal to properly set. The purpose of well development is to repair borehole damage caused by advancement and installation procedures, such as the smearing of fine-grained particles along the borehole walls (mud cake) and the generation of suspended solids in the water (turbidity). Development generally is designed to break down the mud

cake and remove these particles from the wells to improve the hydraulic connection between the well and formation so that groundwater can enter the wells more freely. Development also is designed to remove the groundwater and suspended solids disturbed by well installation so that groundwater representative of ambient conditions can be sampled. This process will involve block surging and pumping groundwater until certain water quality parameters (e.g., pH, specific conductance, and temperature) have stabilized and turbidity has been decreased to acceptable levels.

In addition to well development, each monitoring well will be surveyed to determine the elevation of the top of casing to facilitate the determination of groundwater elevations. The northern portion of the top of each well casing will be surveyed to determine its height in relationship to surveying monuments located in the Subject Property area. A surveyor licensed in the State of Washington will complete this survey.

Prior to sampling, ECI will use a peristaltic pump and disposable plastic tubing to purge each well of a minimum of three casing volumes of water. The end of the tubing will be placed 2 to 3 feet from the bottom of the well to permit reasonable draw down while preventing cascading conditions.

Groundwater will be collected into a measured bucket to record the purge volume. Casing volumes will be calculated based on total well depth, standing water level, and casing diameter.

One casing volume will be calculated as: $V = (\pi r^2 h / 144)$

Where: V is the volume of one well casing of water (in ft^3, 1 ft^3 = 7.48 gallons);
r is the inner radius of the well casing (in inches);
h is the total height of the water column in the well (in feet).

It is most important to obtain a representative sample from the well. Stable water quality parameter (temperature, pH and specific conductance) measurements indicate representative sampling is obtainable. Water quality is considered stable if for three consecutive readings:

- Temperature varies by no more than 1° C;
- pH varies by no more than 0.2 pH units;
- Specific conductance readings are within 10% of the average.

Measurements will be taken before the start of purging, in the middle of purging, and at the end of purging each casing volume. If water quality parameters are not stable after 5 casing volumes or 30 minutes, purging will cease (which will be noted in the logbook) and groundwater samples will be taken. The depth to water, water quality measurements and purge volumes will be entered in the logbook. If a well de-waters completely during purging and three casing volumes are not purged, that well will be allowed to recharge up to 80% of the static water column and de-watered once more. After water levels have recharged to 80% of the static water column the second time, groundwater samples will be collected.

Groundwater samples will be collected from each monitoring well utilizing a peristaltic pump at a flow rate of 100 milliliters per minute (mL/min), a sample will be collected from 1 foot below the top of the

water column. A one-liter amber bottle will be filled for each sample location. Each sample will then be assigned a unique sample identifying number and placed in a climate controlled container maintained at 4° Celsius. Samples will be delivered to an offsite, Ecology-accredited laboratory for analysis of DRO utilizing Ecology Test Method NWTPH-Dx.

2.3 Responsibility for Cleanup Action

The site owner will be conducting remedial actions through the Voluntary Cleanup Program. The Site is currently not covered by an Ecology Administrative Action; therefore, any state or local permits that are required will need to be obtained.

During the Site cleanup work, the Site owner will be responsible for implementing, operating, and maintaining the groundwater monitoring network. Once the cleanup is complete and the final report is produced, the TPCHD and Ecology will evaluate the overall success of the cleanup and may issue a "No Further Action" (NFA) determination for the Site at their discretion. ECI has been retained by the site owner to prepare this CAP, provide a work plan for the cleanup, provide oversight during the cleanup, and to provide draft and final remedial action reports.

3.0 CLEANUP STANDARDS

This section develops Site cleanup standards for chemical constituents that were detected in affected Site media. Cleanup standards consist of:

1) CULs defined by regulatory criteria that are adequately protective of human health and the environment, and
2) The point of compliance at which the CULs must be met.
3)

The process for developing CULs consists of identifying:

- The contaminated media,
- The contaminants of concern (COC)
- The current and potential pathways of exposure,
- The current and potential receptors, and
- The current and potential land use

3.1 Cleanup Levels

Under MTCA, CULs determine at what level a particular hazardous substance does not threaten human health or the environment. The CULs for soil and groundwater are identified in this section.

3.1.1 Soil

MTCA regulations (WAC 173-340-704) indicate that:

> *"Method A may be used to establish CULs at sites that have few hazardous substances and … sites where numerical standards are available in this chapter for applicable state and federal laws for all indicator hazardous substances in the media for which the Method A cleanup level is being used."*

These soil CULs are protective of human health due to direct contact or ingestion and are also protective of groundwater (i.e., groundwater in contact with soil or receiving leachate from soil would not be contaminated above the groundwater cleanup level).

The Method A Soil CUL for DRO has been selected as the soil CUL for the Site and is presented in the table above.

3.1.2 Groundwater

Similar to the CULs for soil, the Method A Groundwater CUL for DRO has been selected as the groundwater cleanup level for the Site and is presented in the table above.

The groundwater CUL is protective of human health due to direct contact or consumption (i.e. potable water).

3.2 Points of Compliance

The point of compliance is the point or points where the cleanup levels are to be attained.

Groundwater Point of Compliance:

WAC 173-340-720(8)(b) states that for groundwater:

> *"The standard point of compliance shall be established throughout the site from the uppermost level of the saturated zone extending vertically to the lowest most depth which could potentially be affected by the site."*

WAC 173-340-720(8) also states:

> *"Where it can be demonstrated … that it is not practicable to meet the cleanup level throughout the site within a reasonable restoration time frame, the department may approve a conditional point of compliance that shall be as close as practicable to the source of hazardous substances… not to exceed the property boundary."*

For the Subject Site, a conditional point of compliance is being proposed. The proposed conditional point of compliance for groundwater is the upper saturated zone within the localized area of groundwater contamination.

Soil Point of Compliance:

For soil, WAC 173-340-740 indicates that the point of compliance for soil is where the soil cleanup levels shall be attained.

The most conservative point of compliance for soil is for the protection of groundwater. WAC 173-340-740(6)(b) states:

> *"For soil cleanup levels based on the protection of groundwater, the point of compliance shall be established in the soils throughout the site."*

Ecology also recognizes that soil cleanup cannot always be attained and states:

> *"The department recognizes that, for those cleanup actions selected under this chapter that involve containment of hazardous substances, the soil cleanup levels will typically not be met at the points of compliance specified…"*

In those cases, Ecology may determine that the cleanup action complies with the cleanup standard if certain criteria are met. The criteria includes: the cleanup action is protective of human health, institutional controls be put into place, and compliance monitoring be performed.

It is proposed that the point of compliance for the Subject Site will be based on the protection of groundwater and be throughout the site. The determination of the adequacy of soil cleanup will be based on the ability to comply with MTCA Method A Cleanup Levels for the site, and to meet performance standards designed to minimize human or environmental exposure.

4.0 APPLICABLE LAWS

MTCA requires that all cleanup actions conducted under MTCA shall comply with applicable state and federal laws (WAC 173-340-710(1). MTCA defines applicable state and federal laws to include legally applicable requirements and those requirements that are relevant and appropriate. Collectively, these requirements are referred to as applicable or relevant and appropriate requirements (ARARs). This section provides a brief overview of potential ARARs for the site cleanup. The primary ARAR is the MTCA cleanup regulation (WAC 173-340).

Other than MTCA, the primary ARARs that may pertain to the cleanup action include the following:

- Federal Maximum Contaminant Levels (40 CFR Part 141), developed under the Safe Drinking Water Act;
- Washington Clean Air Act, Chapter 70.94 RCW;
- Solid and Hazardous Waste Management (Chapter 70.105 RCW; and the accompanying Dangerous Waste regulations (WAC 173-303);
- State of Washington Solid Waste Regulations (WAC 173-350 and WAC 173-351);
- The Federal Resource Conservation and Recovery Act (RCRA) including the Land Disposal Restrictions (40 CFR 260 – 282);
- Washington Industrial Safety and Health Act (RCW 49.17) and the Federal Occupational Safety and Health Act (29 CFR 1910, 1926);
- State Environmental Policy Act SEPA (Chapter 43.21C RCW and WAC 197-11);
- Construction Stormwater General Permit (Chapter 90.48 RCW) (33 U.S.C. Section 1251 et seq.).

State and federal groundwater and air quality criteria are considered in the development of CULs. State Dangerous Waste Regulations may be applicable to contaminated soil removed from the site during cleanup activities. State Environmental Policy Act requirements will be addressed concurrent with the site CAP to the degree applicable for the selected cleanup action.

4.1 Public Participation / Communication

Consideration of public concerns is an inherent part of the Site cleanup process under MTCA (see WAC 173-340-600). Ecology is responsible for providing public notice and the opportunity for public comments on this draft CAP per WAC 173-340-600(13), if required. The formal review and comment period will be approximately 30 days. After review and consideration of public comments, the contents of this document may be revised accordingly.

5.0 IMPLEMENTATION SCHEDULE

This implementation schedule is a best estimate of the time to implement this CAP and may change depending on conditions found.

Soil Excavation
The excavation of PCS will start within two weeks following the approval of the CAP. Work is expected to take between five and ten days.

Groundwater Sampling & Pumping
Groundwater monitoring well installation and sampling will be conducted following the completion of soil remediation activities and will continue until the groundwater sample results are below applicable cleanup levels. If cleanup levels are not obtained, the selected remedy may be re-evaluated.

6.0 REPORTING

Project reporting will be completed following the completion of each major project goal and upon completion of each periodic field event (quarterly sampling, etc). Project reports will be submitted to the Tacoma-Pierce County Health Department and to the Washington State Department of Ecology (Ecology) under the Voluntary Cleanup Program (VCP). If submitted to Ecology, a formal opinion may be requested. These reports will detail activities that have occurred and identify activities that are anticipated to occur during the next quarter.

Upon completion of the cleanup action and follow-up confirmation sampling, a draft Remedial Action Completion Report will be prepared for submittal to the Tacoma-Pierce County Health Department and Ecology documenting the results and performance of the cleanup action, and summarizing performance sampling and the results of confirmation sampling. The groundwater monitoring well installations and sampling will be documented in a second separate report. If the confirmation soil sampling results adequately demonstrate that cleanup has successfully remediated soil to below the Site CULs, the report will include or be accompanied by a request for a No Further Action Likely determination from Ecology, which will be then be followed by a request for a No Further Action determination once DRO concentrations in groundwater have decreased to below the MTCA CUL and the completed remedial action meets the substantive requirements of MTCA.

6.1 Use of Document

This interim remedial investigation and feasibility study report has been prepared for Breakwater Marina and for review by Tacoma-Pierce County Health Department and Ecology for specific application to the Breakwater Marina site located in Tacoma, Washington. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of Breakwater Marina.

7.0 REFERENCES

Documents were reviewed from files obtained from the following sources:

- Washington Department of Ecology (Ecology), Southwest Regional Office, Records
- Tacoma-Pierce County Health Department (TPCHD)
- Pierce County Assessor Website (http://www.co.pierce.wa.us/Index.aspx?NID=91)
- Spencer Law Firm

Appendix A

Project Figures

Figure 1: Site Location Map
Figure 2: Site Topographic Map
Figure 3: Subsurface Investigation Boring Location Map
Figure 4: UST Site Assessment Sample Location Map
Figure 5: Estimated Remedial Excavation & Proposed Monitoring Well Location Map

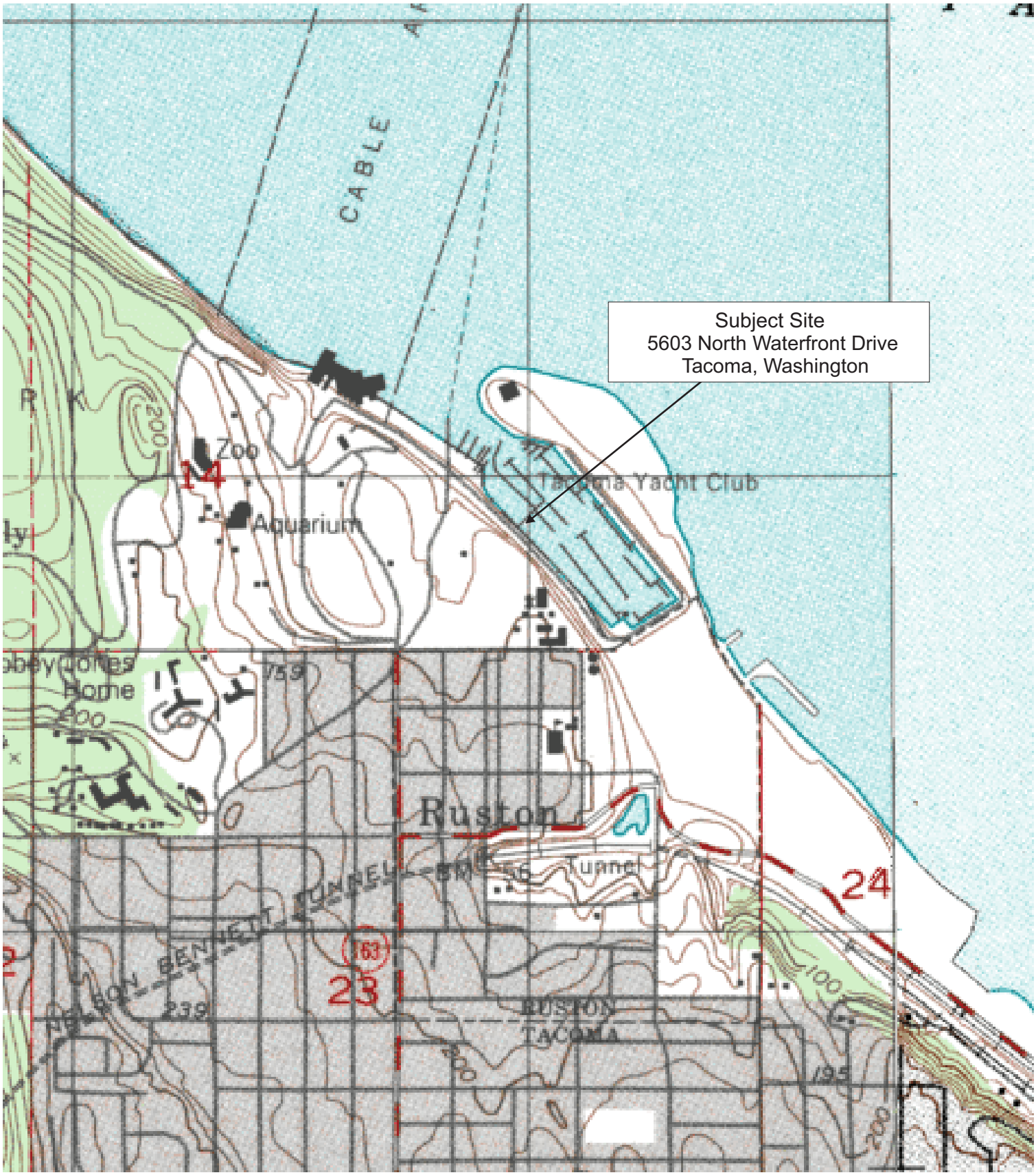
Not To Scale

Project Location Map
Cleanup Action Plan
5603 North Waterfront Drive
Tacoma, Washington

Date:	February 9,2015
Completed By:	K. Spencer
Reviewed By.:	S. Spencer
Version:	ECI-001
Project No.:	0483-05

Figure No.: 01
Sheet 01 of 05

ECI environmental services
www.ecocononline.com



N
Not To Scale

Site Topographic Map
Cleanup Action Plan
5603 North Waterfront Drive
Tacoma, Washington

Date:	February 9,2015
Completed By:	K. Spencer
Reviewed By.:	S. Spencer
Version:	ECI-001
Project No.:	0483-05

Figure No.: 02
Sheet 02 of 05

ECI environmental services
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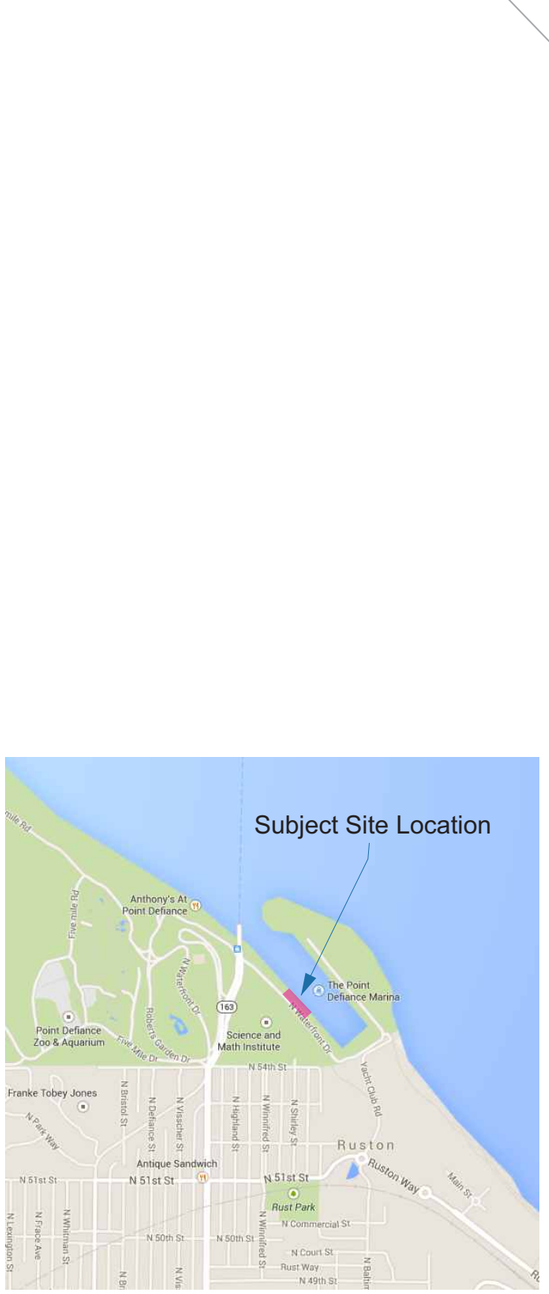

Explanation

- Approximate Boring Locations reported Below the MTCA A CUL
- Groundwater Sample Exceeds MTCA Method A CUL for DRO (DRO Concentration 34,600 ug/L) (Previous Sampling Event)

N

0 10 20 40

Approximate Scale in Feet

Boring Locations Map
Cleanup Action Plan
5603 North Waterfront Drive
Tacoma, Washington

Date:	February 9,2015
Completed By:	K. Spencer
Reviewed By.:	S. Spencer
Version:	ECI-002-011315
Project No.:	0483-05

Figure No.: 03

Sheet 03 of 05

ECI environmental services
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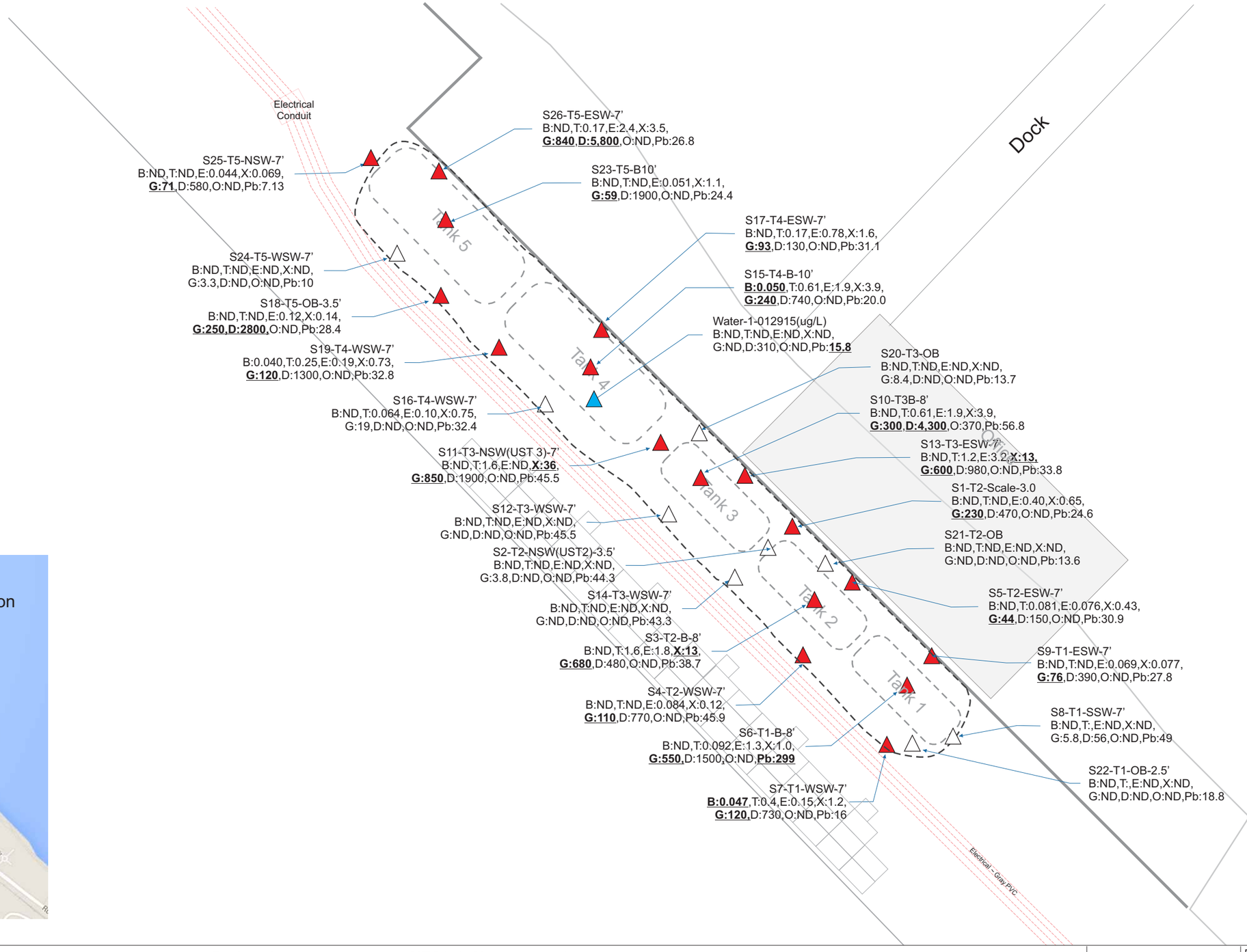

N

0 10 20 40

Approximate Scale in Feet

Explanation

- △ Sample Location Below MTCA
- ▲ Sample Location Exceeding MTCA
- G: Gasoline Range Organics
- D: Diesel Range Organics
- O: Oil Range Organics
- Pb: Total Lead

MTCA-A Cleanup Levels

Gasoline Range Organics: 100/30* mg/kg
Diesel Range Organics: 2000 mg/kg
Oil Range Organics: 2000 mg/kg
Total Lead: 250 mg/kg

Soil Sample Location Map
Cleanup Action Plan
5603 North Waterfront Drive
Tacoma, Washington

Date:	February 9,2015
Completed By:	K. Spencer
Reviewed By.:	S. Spencer
Version:	ECI-002-011315
Project No.:	0483-05

Figure No.: 04
Sheet 04 of 05

ECI environmental services
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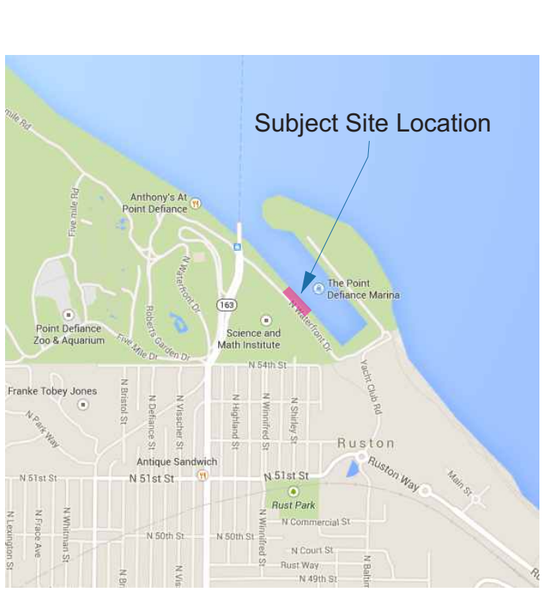

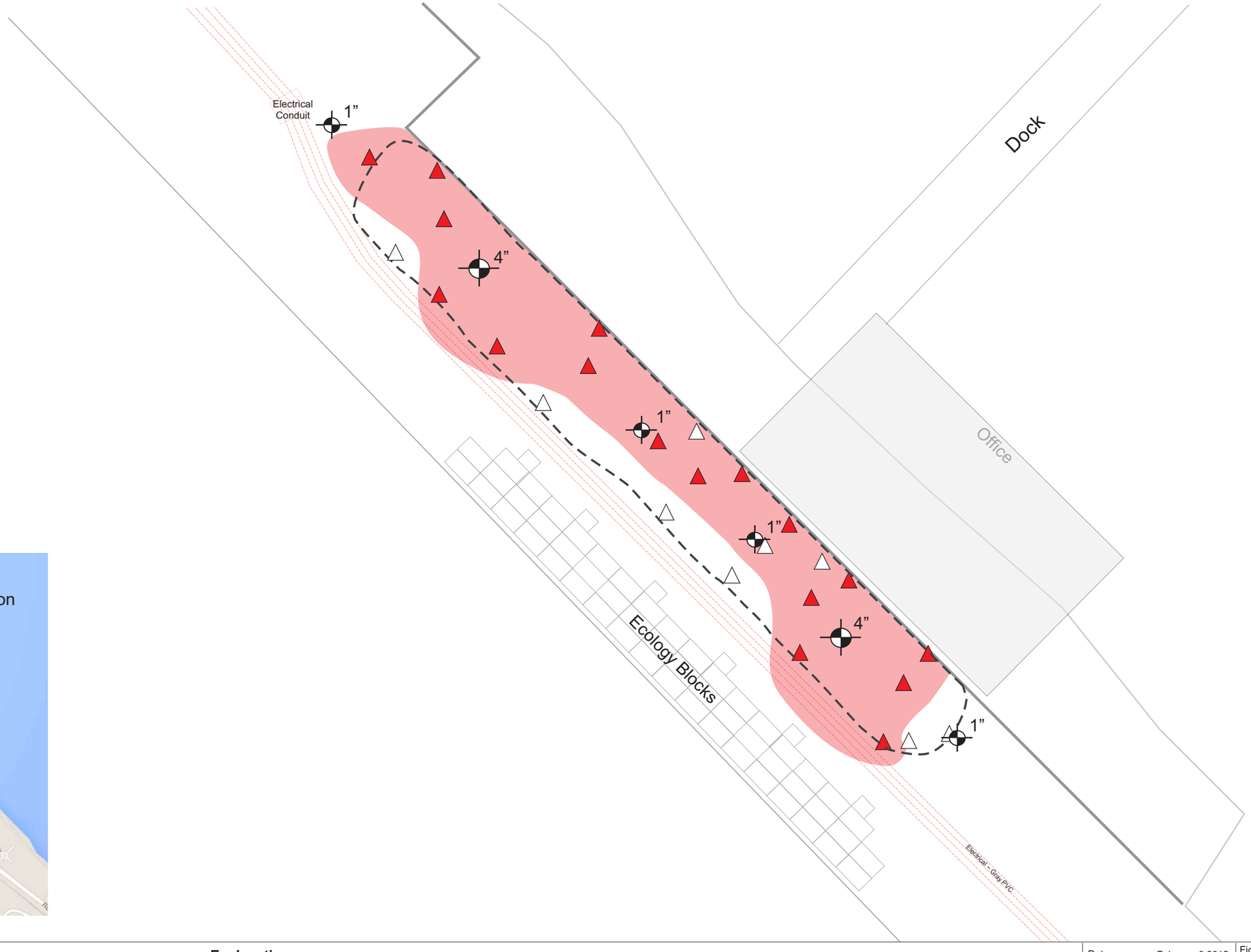

N

0 10 20 40

Approximate Scale in Feet

Explanation

- Sample Location Below MTCA
- Sample Location Exceeding MTCA
- Tank Excavated Area
- Presumed Contaminated Area To Be Excavated
- Proposed Monitoring Well Locations

Estimated Remedial Excavation & Proposed Monitoring Well Location Map
Cleanup Action Plan
5603 North Waterfront Drive
Tacoma, Washington

Date:	February 9,2015
Completed By:	K. Spencer
Reviewed By.:	S. Spencer
Version:	ECI-002-011315
Project No.:	0483-05

Figure No.: 05
Sheet 05 of 05

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Appendix B

Regulatory Compliance Documents

Table 720-1: Method A Cleanup Levels for Ground Water
Table 740-1: Method A Soil Cleanup Levels for Unrestricted Land Uses
Table 830-1: Required Testing for Petroleum Releases

Table 720-1
Method A Cleanup Levels for Ground Water.[a]

Hazardous Substance	CAS Number	Cleanup Level
Arsenic	7440-38-2	5 ug/liter[b]
Benzene	71-43-2	5 ug/liter[c]
Benzo(a)pyrene	50-32-8	0.1 ug/liter[d]
Cadmium	7440-43-9	5 ug/liter[e]
Chromium (Total)	7440-47-3	50 ug/liter[f]
DDT	50-29-3	0.3 ug/liter[g]
1,2 Dichloroethane (EDC)	107-06-2	5 ug/liter[h]
Ethylbenzene	100-41-4	700 ug/liter[i]
Ethylene dibromide (EDB)	106-93-4	0.01 ug/liter[j]
Gross Alpha Particle Activity		15 pCi/liter[k]
Gross Beta Particle Activity		4 mrem/yr[l]
Lead	7439-92-1	15 ug/liter[m]
Lindane	58-89-9	0.2 ug/liter[n]
Methylene chloride	75-09-2	5 ug/liter[o]
Mercury	7439-97-6	2 ug/liter[p]
MTBE	1634-04-4	20 ug/liter[q]
Naphthalenes	91-20-3	160 ug/liter[r]
PAHs (carcinogenic)		See benzo(a)pyrene[d]
PCB mixtures		0.1 ug/liter[s]
Radium 226 and 228		5 pCi/liter[t]
Radium 226		3 pCi/liter[u]
Tetrachloroethylene	127-18-4	5 ug/liter[v]
Toluene	108-88-3	1,000 ug/liter[w]
Total Petroleum Hydrocarbons[x]		
[Note: Must also test for and meet cleanup levels for other petroleum components--see footnotes!]		
Gasoline Range Organics		
Benzene present in ground water		800 ug/liter
No detectable benzene in ground water		1,000 ug/liter
Diesel Range Organics		500 ug/liter
Heavy Oils		500 ug/liter
Mineral Oil		500 ug/liter
1,1,1 Trichloroethane	71-55-6	200 ug/liter[y]
Trichloroethylene	79-01-6	5 ug/liter[z]
Vinyl chloride	75-01-4	0.2 ug/liter[aa]
Xylenes	1330-20-7	1,000 ug/liter[bb]

Footnotes:

a **Caution on misusing this table.** This table has been developed for specific purposes. It is intended to provide conservative cleanup levels for drinking water beneficial uses at sites undergoing routine cleanup actions or those sites with relatively few hazardous substances. This table may not be appropriate for defining cleanup levels at other sites. For these reasons, the values in this table should not automatically be used to define cleanup levels that must be met for financial, real estate, insurance coverage or placement, or similar transactions or purposes. Exceedances of the values in this table do not necessarily mean the ground water must be restored to those levels at all sites. The level of restoration depends on the remedy selected under WAC 173-340-350 through 173-340-390.

b **Arsenic.** Cleanup level based on background concentrations for state of Washington.

c **Benzene.** Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61).

d **Benzo(a)pyrene.** Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61), adjusted to a 1×10^{-5} risk. If other carcinogenic PAHs are suspected of being present at the site, test for them and use this value as the total concentration that all carcinogenic PAHs must meet using the toxicity equivalency methodology in WAC 173-340-708(8).

e **Cadmium.** Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.62).

f **Chromium (Total).** Cleanup level based on concentration derived using Equation 720-1 for hexavalent chromium. This is a total value for chromium III and chromium VI. If just chromium III is present at the site, a cleanup level of 100 ug/l may be used (based on WAC 246-290-310 and 40 C.F.R. 141.62).

g **DDT (dichlorodiphenyltrichloroethane).** Cleanup levels based on concentration derived using Equation 720-2.

h **1,2 Dichloroethane (ethylene dichloride or EDC)**. Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61).

i **Ethylbenzene.** Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61).

j **Ethylene dibromide (1,2 dibromoethane or EDB).** Cleanup level based on concentration derived using Equation 720-2, adjusted for the practical quantitation limit.

k **Gross Alpha Particle Activity, excluding uranium.** Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.15).

l **Gross Beta Particle Activity, including gamma activity.** Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.15).

m **Lead.** Cleanup level based on applicable state and federal law (40 C.F.R. 141.80).

n **Lindane.** Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61).

o **Methylene chloride (dichloromethane).** Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61).

p **Mercury.** Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.62).

q **Methyl tertiary-butyl ether (MTBE).** Cleanup level based on federal drinking water advisory level (EPA-822-F-97-009, December 1997).

r **Naphthalenes.** Cleanup level based on concentration derived using Equation 720-1. This is a total value for naphthalene, 1-methyl naphthalene and 2-methyl naphthalene.

s **PCB mixtures.** Cleanup level based on concentration derived using Equation 720-2, adjusted for the practical quantitation limit. This cleanup level is a total value for all PCBs.

t **Radium 226 and 228.** Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.15).

u **Radium 226.** Cleanup level based on applicable state law (WAC 246-290-310).

v **Tetrachloroethylene.** Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61).

w **Toluene.** Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61).

x **Total Petroleum Hydrocarbons (TPH).** TPH cleanup values have been provided for the most common petroleum products encountered at contaminated sites. Where there is a mixture of products or the product composition is unknown, samples must be tested using both the NWTPH-Gx and NWTPH-Dx methods and the lowest applicable TPH cleanup level must be met.

- **Gasoline range organics** means organic compounds measured using method NWTPH-Gx. Examples are aviation and automotive gasoline. The cleanup level is based on protection of ground water for noncarcinogenic effects during drinking water use. Two cleanup levels are provided. The higher value is based on the assumption that no benzene is present in the ground water sample. If any detectable amount of benzene is present in the ground water sample, then the lower TPH cleanup level must be used. No interpolation between these cleanup levels is allowed. The ground water cleanup level for any carcinogenic components of the petroleum [such as benzene, EDB and EDC] and any noncarcinogenic components [such as ethylbenzene, toluene, xylenes and MTBE], if present at the site, must also be met. See Table 830-1 for the minimum testing requirements for gasoline releases.
- **Diesel range organics** means organic compounds measured using NWTPH-Dx. Examples are diesel, kerosene, and #1 and #2 heating oil. The cleanup level is based on protection from noncarcinogenic effects during drinking water use. The ground water cleanup level for any carcinogenic components of the petroleum [such as benzene and PAHs] and any noncarcinogenic components [such as ethylbenzene, toluene, xylenes and naphthalenes], if present at the site, must also be met. See Table 830-1 for the minimum testing requirements for diesel releases.
- **Heavy oils** means organic compounds measured using NWTPH-Dx. Examples are #6 fuel oil, bunker C oil, hydraulic oil and waste oil. The cleanup level is based on protection from noncarcinogenic effects during drinking water use, assuming a product composition similar to diesel fuel. The ground water cleanup level for any carcinogenic components of the petroleum [such as benzene, PAHs and PCBs] and any noncarcinogenic components [such as ethylbenzene, toluene, xylenes and naphthalenes], if present at the site, must also be met. See Table 830-1 for the minimum testing requirements for heavy oil releases.
- **Mineral oil** means non-PCB mineral oil, typically used as an insulator and coolant in electrical devices such as transformers and capacitors measured using NWTPH-Dx. The cleanup level is based on protection from noncarcinogenic effects during drinking water use. Sites using this cleanup level must analyze ground water samples for PCBs and meet the PCB cleanup level in this table unless it can be demonstrated that: (1) The release originated from an electrical device manufactured after July 1, 1979; or (2) oil containing PCBs was never used in the equipment suspected as the source of the release; or (3) it can be documented that the oil released was recently tested and did not contain PCBs. Method B (or Method C, if applicable) must be used for releases of oils containing greater than 50 ppm PCBs. See Table 830-1 for the minimum testing requirements for mineral oil releases.

y **1,1,1 Trichloroethane.** Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61).

z **Trichloroethylene.** Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61).

aa **Vinyl chloride.** Cleanup level based on applicable state and federal law (WAC 246-290-310 and 40 C.F.R. 141.61), adjusted to a 1×10^{-5} risk.

bb **Xylenes.** Cleanup level based on xylene not exceeding the maximum allowed cleanup level in this table for total petroleum hydrocarbons and on prevention of adverse aesthetic characteristics. This is a total value for all xylenes.

Table 740-1
Method A Soil Cleanup Levels for Unrestricted Land Uses.[a]

Hazardous Substance	CAS Number	Cleanup Level
Arsenic	7440-38-2	20 mg/kg[b]
Benzene	71-43-2	0.03 mg/kg[c]
Benzo(a)pyrene	50-32-8	0.1 mg/kg[d]
Cadmium	7440-43-9	2 mg/kg[e]
Chromium		
Chromium VI	18540-29-9	19 mg/kg[f1]
Chromium III	16065-83-1	2,000 mg/kg[f2]
DDT	50-29-3	3 mg/kg[g]
Ethylbenzene	100-41-4	6 mg/kg[h]
Ethylene dibromide (EDB)	106-93-4	0.005 mg/kg[i]
Lead	7439-92-1	250 mg/kg[j]
Lindane	58-89-9	0.01 mg/kg[k]
Methylene chloride	75-09-2	0.02 mg/kg[l]
Mercury (inorganic)	7439-97-6	2 mg/kg[m]
MTBE	1634-04-4	0.1 mg/kg[n]
Naphthalenes	91-20-3	5 mg/kg[o]
PAHs (carcinogenic)		See benzo(a)pyrene[d]
PCB Mixtures		1 mg/kg[p]
Tetrachloroethylene	127-18-4	0.05 mg/kg[q]
Toluene	108-88-3	7 mg/kg[r]
Total Petroleum Hydrocarbons[s]		
[Note: Must also test for and meet cleanup levels for other petroleum components--see footnotes!]		
Gasoline Range Organics		
Gasoline mixtures without benzene and the total of ethyl benzene, toluene and xylene are less than 1% of the gasoline mixture		100 mg/kg
All other gasoline mixtures		30 mg/kg
Diesel Range Organics		2,000 mg/kg
Heavy Oils		2,000 mg/kg
Mineral Oil		4,000 mg/kg
1,1,1 Trichloroethane	71-55-6	2 mg/kg[t]
Trichloroethylene	79-01-6	0.03 mg/kg[u]
Xylenes	1330-20-7	9 mg/kg[v]

Footnotes:

a **Caution on misusing this table.** This table has been developed for specific purposes. It is intended to provide conservative cleanup levels for sites undergoing routine cleanup actions or for sites with relatively few hazardous substances, and the site qualifies under WAC 173-340-7491 for an exclusion from conducting a simplified or site-specific terrestrial ecological evaluation, or it can be demonstrated using a terrestrial ecological evaluation under WAC 173-340-7492 or 173-340-7493 that the values in this table are ecologically protective for the site. This table may not be appropriate for defining cleanup levels at other sites. For these reasons, the values in this table should not automatically be used to define cleanup levels that must be met for financial, real estate, insurance coverage or placement, or similar transactions or purposes. Exceedances of the values in this table do not necessarily mean the soil must be restored to these levels at a site. The level of restoration depends on the remedy selected under WAC 173-340-350 through 173-340-390.

b **Arsenic.** Cleanup level based on direct contact using Equation 740-2 and protection of ground water for drinking water use using the procedures in WAC 173-340-747(4), adjusted for natural background for soil.

c **Benzene.** Cleanup level based on protection of ground water for drinking water use, using the procedures in WAC 173-340-747(4) and (6).

d **Benzo(a)pyrene.** Cleanup level based on direct contact using Equation 740-2. If other carcinogenic PAHs are suspected of being present at the site, test for them and use this value as the total concentration that all carginogenic PAHs must meet using the toxicity equivalency methodology in WAC 173-340-708(8).

e **Cadmium.** Cleanup level based on protection of ground water for drinking water use, using the procedures described in WAC 173-340-747(4), adjusted for the practical quantitation limit for soil.

f1 **Chromium VI.** Cleanup level based on protection of ground water for drinking water use, using the procedures described in WAC 173-340-747(4).

f2 **Chromium III.** Cleanup level based on protection of ground water for drinking water use, using the procedures described in WAC 173-340-747(4). Chromium VI must also be tested for and the cleanup level met when present at a site.

g **DDT (dichlorodiphenyltrichloroethane).** Cleanup level based on direct contact using Equation 740-2.

h **Ethylbenzene.** Cleanup level based on protection of ground water for drinking water use, using the procedures described in WAC 173-340-747(4).

i **Ethylene dibromide (1,2 dibromoethane or EDB).** Cleanup level based on protection of ground water for drinking water use, using the procedures described in WAC 173-340-747(4) and adjusted for the practical quantitation limit for soil.

j **Lead.** Cleanup level based on preventing unacceptable blood lead levels.

k **Lindane.** Cleanup level based on protection of ground water for drinking water use, using the procedures described in WAC 173-340-747(4), adjusted for the practical quantitation limit.

l **Methylene chloride (dichloromethane).** Cleanup level based on protection of ground water for drinking water use, using the procedures described in WAC 173-340-747(4).

m **Mercury.** Cleanup level based on protection of ground water for drinking water use, using the procedures described in WAC 173-340-747(4).

n **Methyl tertiary-butyl ether (MTBE).** Cleanup level based on protection of ground water for drinking water use, using the procedures described in WAC 173-340-747(4).

o **Naphthalenes.** Cleanup level based on protection of ground water for drinking water use, using the procedures described in WAC 173-340-747(4). This is a total value for naphthalene, 1-methyl naphthalene and 2-methyl naphthalene.

p **PCB Mixtures.** Cleanup level based on applicable federal law (40 C.F.R. 761.61). This is a total value for all PCBs.

q **Tetrachloroethylene.** Cleanup level based on protection of ground water for drinking water use, using the procedures described in WAC 173-340-747(4).

r **Toluene.** Cleanup level based on protection of ground water for drinking water use, using the procedures described in WAC 173-340-747(4).

s **Total Petroleum Hydrocarbons (TPH).**
TPH cleanup values have been provided for the most common petroleum products encountered at contaminated sites. Where there is a mixture of products or the product composition is unknown, samples must be tested using both the NWTPH-Gx and NWTPH-Dx methods and the lowest applicable TPH cleanup level must be met.

- **Gasoline range organics** means organic compounds measured using method NWTPH-Gx. Examples are aviation and automotive gasoline. The cleanup level is based on protection of ground water for noncarcinogenic effects during drinking water use using the procedures described in WAC 173-340-747(6). Two cleanup levels are provided. The lower value of 30 mg/kg can be used at any site. When using this lower value, the soil must also be tested for and meet the benzene soil cleanup level. The higher value of 100 mg/kg can only be used if the soil is tested and found to contain no benzene and the total of ethyl benzene, toluene and xylene are less than 1% of the gasoline mixture. No interpolation between these cleanup levels is allowed. In both cases, the soil cleanup level for any other carcinogenic components of the petroleum [such as EDB and EDC], if present at the site, must also be met. Also, in both cases, soil cleanup levels for any noncarcinogenic components [such as toluene, ethylbenzene, xylenes, naphthalene, and MTBE], also must be met if these substances are found to exceed ground water cleanup levels at the site. See Table 830-1 for the minimum testing requirements for gasoline releases.
- **Diesel range organics** means organic compounds measured using method NWTPH-Dx. Examples are diesel, kerosene, and #1 and #2 heating oil. The cleanup level is based on preventing the accumulation of free product on the ground water, as described in WAC 173-340-747(10). The soil cleanup level for any carcinogenic components of the petroleum [such as benzene and PAHs], if present at the site, must also be met. Soil cleanup levels for any noncarcinogenic components [such as toluene, ethylbenzene, xylenes and naphthalenes], also must be met if these substances are found to exceed the ground water cleanup levels at the site. See Table 830-1 for the minimum testing requirements for diesel releases.
- **Heavy oils means** organic compounds measured using NWTPH-Dx. Examples are #6 fuel oil, bunker C oil, hydraulic oil and waste oil. The cleanup level is based on preventing the accumulation of free product on the ground water, as described in WAC 173-340-747(10) and assuming a product composition similar to diesel fuel. The soil cleanup level for any carcinogenic components of the petroleum [such as benzene, PAHs and PCBs], if present at the site, must also be met. Soil cleanup levels for any noncarcinogenic components [such as toluene, ethylbenzene, xylenes and naphthalenes], also must be met if found to exceed the ground water cleanup levels at the site. See Table 830-1 for the minimum testing requirements for heavy oil releases.
- **Mineral oil** means non-PCB mineral oil, typically used as an insulator and coolant in electrical devices such as transformers and capacitors, measured using NWTPH-Dx. The cleanup level is based on preventing the accumulation of free product on the ground water, as described in WAC 173-340-747(10). Sites using this cleanup level must also analyze soil samples and meet the soil cleanup level for PCBs, unless it can be demonstrated that: (1) The release originated from an electrical device that was manufactured after July 1, 1979; or (2) oil containing PCBs was never used in the equipment suspected as the source of the release; or (3) it can be documented that the oil released was recently tested and did not contain PCBs. Method B must be used for releases of oils containing greater than 50 ppm PCBs. See Table 830-1 for the minimum testing requirements for mineral oil releases.

t **1,1,1 Trichloroethane.** Cleanup level based on protection of ground water for drinking water use, using the procedures described in WAC 173-340-747(4).

u **Trichloroethylene.** Cleanup level based on protection of ground water for drinking water use, using the procedures described in WAC 173-340-747(4).

v **Xylenes.** Cleanup level based on protection of ground water for drinking water use, using the procedures described in WAC 173-340-747(4). This is a total value for all xylenes.

Table 830-1
Required Testing for Petroleum Releases.

	Gasoline Range Organics (GRO) (1)	Diesel Range Organics (DRO) (2)	Heavy Oils (DRO) (3)	Mineral Oils (4)	Waste Oils and Unknown Oil (5)
Volatile Petroleum Compounds					
Benzene	X (6)	X (7)			X (8)
Toluene	X (6)	X (7)			X (8)
Ethyl benzene	X (6)	X (7)			X (8)
Xylenes	X (6)	X (7)			X (8)
n-Hexane	X (9)				
Fuel Additives and Blending Compounds					
Dibromoethane, 1-2 (EDB); and Dichloroethane, 1-2 (EDC)	X (10)				X (8)
Methyl tertiary-butyl ether (MTBE)	X (11)				X (8)
Total Lead and Other Additives	X (12)				X (8)
Other Petroleum Components					
Carcinogenic PAHs		X (13)	X (13)		X (8)
Naphthalenes	X (14)	X (14)	X (14)		X (14)
Other Compounds					
Polychlorinated Biphenyls (PCBs)			X (15)	X (15)	X (8)
Halogenated Volatile Organic Compounds (VOCs)					X (8)
Other	X (16)	X (16)	X (16)	X (16)	X (16)
Total Petroleum Hydrocarbons Methods					
TPH Analytical Method for Total TPH (Method A Cleanup Levels) (17)	NWTPH-Gx	NWTPH-Dx	NWTPH-Dx	NWTPH-Dx	NWTPH-Gx & NWTPH-Dx
TPH Analytical Methods for TPH fractions (Methods B or C) (17)	VPH	EPH	EPH	EPH	VPH and EPH

[Editor's Note: See next page for the footnotes associated with Table 830-1.]

Use of Table 830-1: An "X" in the box means that the testing requirement applies to ground water and soil if a release is known or suspected to have occurred to that medium, unless otherwise specified in the footnotes. A box with no "X" indicates (except in the last two rows) that, for the type of petroleum product release indicated in the top row, analyses for the hazardous substance(s) named in the far-left column corresponding to the empty box are not typically required as part of the testing for petroleum releases. However, such analyses may be required based on other site-specific information. Note that testing for Total Petroleum Hydrocarbons (TPH) is required for every type of petroleum release, as indicated in the bottom two rows of the table. The testing method for TPH depends on the type of petroleum product released and whether Method A or Method B or C is being used to determine TPH cleanup levels. See WAC 173-340-830 for analytical procedures. **The footnotes to this table are important for understanding the specific analytical requirements for petroleum releases.**

Footnotes:

(1) The following petroleum products are common examples of GRO: automotive and aviation gasolines, mineral spirits, stoddard solvents, and naphtha. To be in this range, 90 percent of the petroleum components need to be quantifiable using the NWTPH-Gx; if NWTPH-HCID results are used for this determination, then 90 percent of the "area under the TPH curve" must be quantifiable using NWTPH-Gx. Products such as jet fuel, diesel No. 1, kerosene, and heating oil may require analysis as both GRO and DRO depending on the range of petroleum components present (range can be measured by NWTPH-HCID). (See footnote 17 on analytical methods.)

(2) The following petroleum products are common examples of DRO: Diesel No. 2, fuel oil No. 2, light oil (including some bunker oils). To be in this range, 90 percent of the petroleum components need to be quantifiable using the NWTPH-Dx quantified against a diesel standard. Products such as jet fuel, diesel No. 1, kerosene, and heating oil may require analysis as both GRO and DRO depending on the range of petroleum components present as measured in NWTPH-HCID.

(3) The following petroleum products are common examples of the heavy oil group: Motor oils, lube oils, hydraulic fluids, etc. Heavier oils may require the addition of an appropriate oil range standard for quantification.

(4) Mineral oil means non-PCB mineral oil, typically used as an insulator and coolant in electrical devices such as transformers and capacitors.

(5) The waste oil category applies to waste oil, oily wastes, and unknown petroleum products and mixtures of petroleum and nonpetroleum substances. Analysis of other chemical components (such as solvents) than those listed may be required based on site-specific information. Mixtures of identifiable petroleum products (such as gasoline and diesel, or diesel and motor oil) may be analyzed based on the presence of the individual products, and need not be treated as waste and unknown oils.

(6) When using Method A, testing soil for benzene is required. Furthermore, testing ground water for BTEX is necessary when a petroleum release to ground water is known or suspected. If the ground water is tested and toluene, ethyl benzene or xylene is in the ground water above its respective Method A cleanup level, the soil must also be tested for that chemical. When using Method B or C, testing the soil for BTEX is required and testing for BTEX in ground water is required when a release to ground water is known or suspected.

(7)(a) For DRO releases from other than home heating oil systems, follow the instructions for GRO releases in Footnote (6).

(b) For DRO releases from typical home heating oil systems (systems of 1,100 gallons or less storing heating oil for residential consumptive use on the premises where stored), testing for BTEX is not usually required for either ground water or soil. Testing of the ground water is also not usually required for these systems; however, if the ground water is tested and benzene is found in the ground water, the soil must be tested for benzene.

(8) Testing is required in a sufficient number of samples to determine whether this chemical is present at concentrations of concern. If the chemical is found to be at levels below the applicable cleanup level, then no further analysis is required.

(9) Testing for n-hexane is required when VPH analysis is performed for Method B or C. In this case, the concentration of n-hexane should be deleted from its respective fraction to avoid double-counting its concentration. n-Hexane's contribution to overall toxicity is then evaluated using its own reference dose.

(10) Volatile fuel additives (such as dibromoethane, 1-2 (EDB) (CAS# 106-93-4) and dichloroethane, 1-2 (EDC) (CAS# 107-06-2)) must be part of a volatile organics analysis (VOA) of GRO contaminated ground water. If any is found in ground water, then the contaminated soil must also be tested for these chemicals.

(11) Methyl tertiary-butyl ether (MTBE) (CAS# 1634-04-4) must be analyzed in GRO contaminated ground water. If any is found in ground water, then the contaminated soil must also be tested for MTBE.

(12)(a) For automotive gasoline where the release occurred prior to 1996 (when "leaded gasoline" was used), testing for lead is required unless it can be demonstrated that lead was not part of the release. If this demonstration cannot be made, testing is required in a sufficient number of samples to determine whether lead is present at concentrations of concern. Other additives and blending compounds of potential environmental significance may need to be considered for testing, including: tertiary-butyl alcohol (TBA); tertiary-amyl methyl ether (TAME); ethyl tertiary-butyl ether (ETBE); ethanol; and methanol. Contact the department for additional testing recommendations regarding these and other additives and blending compounds.

(b) For aviation gasoline, racing fuels and similar products, testing is required for likely fuel additives (especially lead) and likely blending compounds, no matter when the release occurred.

(13) Testing for carcinogenic PAHs is required for DRO and heavy oils, except for the following products for which adequate information exists to indicate their absence: Diesel No. 1 and 2, home heating oil, kerosene, jet fuels, and electrical insulating mineral oils. The carcinogenic PAHs include benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, benzo(k)fluoranthene, benzo(a)anthracene, and benzo(b)fluoranthene.

(14)(a) Except as noted in (b) and (c), testing for the non-carcinogenic PAHs, including the "naphthalenes" (naphthalene, 1-methyl-naphthalene, and 2-methyl-naphthalene) is not required when using Method A cleanup levels, because they are included in the TPH cleanup level.

(b) Testing of soil for naphthalenes is required under Methods B and C when the inhalation exposure pathway is evaluated.

(c) If naphthalenes are found in ground water, then the soil must also be tested for naphthalenes.

(15) Testing for PCBs is required unless it can be demonstrated that: (1) the release originated from an electrical device manufactured for use in the United States after July 1, 1979; (2) oil containing PCBs was never used in the equipment suspected as the source of the release (examples of equipment where PCBs are likely to be found include transformers, electric motors, hydraulic systems, heat transfer systems, electromagnets, compressors, capacitors, switches and miscellaneous other electrical devices); or, (3) the oil released was recently tested and did not contain PCBs.

(16) Testing for other possible chemical contaminants may be required based on site-specific information.

(17) The analytical methods NWTPH-Gx, NWTPH-Dx, NWTPH-HCID, VPH, and EPH are methods published by the Department of Ecology and available on the department's Internet web site: http://www.ecy.wa.gov/programs/tcp/cleanup.html.