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June 1, 2016

Mr. Dale Myers
Site Manager
Toxics Cleanup Program
Washington State Department of Ecology – Northwest Regional Office
3190 160th Ave SE
Bellevue, WA 98008-5452

Re: Feasibility Study with Disproportionate Cost Analysis
Yarrow Bay Yacht Basin and Marina
5207 Lake Washington Boulevard NE
Kirkland, Washington 98033
ATC Project No. Z076000030
Washington Department of Ecology VCP Project No: NW1791

Dear Mr. Myers:

ATC Group Services, LLC. (ATC) is pleased to submit this Feasibility Study (FS) along with a Disproportionate Cost Analysis (DCA) on behalf of Mr. and Mrs. Bortko for the above referenced facility (Site). The objective of this FS is to present a brief screening of remedial alternatives; select a remedial technology that is reasonable and necessary, technically feasible and cost effective through a DCA, and to achieve Site closure through the Washington State Department of Ecology's (Ecology) Model Toxics Control Act (MTCA) and its implementation regulations defined in Chapter 70.105D of the Revised Code of Washington (RCW) and WAC Chapter 173-340.

If any additional information is required regarding this report, please contact the undersigned at 206-781-1449.

Sincerely,

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CC: Mr. and Mrs. Bortko
File

FEASIBILITY STUDY WITH DISPROPORTIONATE COST ANALYSIS

Yarrow Bay Yacht Basin and Marina
5207 Lake Washington Boulevard Northeast
Kirkland, Washington 98033

Washington Department of Ecology VCP Project No: NW1791

Prepared for:
Mr. and Mrs. Bortko
Yarrow Bay Yacht Basin and Marina
Property Owners
5207 Lake Washington Boulevard NE
Kirkland, Washington 98033

Submitted by:
ATC Group Services, LLC.
6347 Seaview Avenue NW
Seattle, Washington 98107

ATC Project No. Z076000030
June 1, 2016

TABLE OF CONTENTS

TABLES

FIGURES

ATTACHMENTS

1.0 INTRODUCTION

1.1 SITE DESCRIPTION

The Yarrow Bay Yacht Basin and Marina is located at 5207 Lake Washington Boulevard NE in Kirkland, Washington (Site). The Site is identified as Tax Parcel No. 172505-9130, which is an irregular shaped lot that consists of approximately 44,797 square feet of commercial property, a portion of which extends into Lake Washington. Site features include a marina with boat repair and fueling facilities.

The Site location is shown relative to surrounding physical features in Figure 1. The layout of the Site is shown in Figure 2.

1.2 BACKGROUND AND PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

Environmental assessment activities were initiated in 2006, when subsurface investigations identified petroleum hydrocarbons present in Site soil and groundwater and carcinogenic polyaromatic hydrocarbons (cPAHs) and volatile organic compounds (VOCs) present in Site soil.

In June 2006, Sound Environmental Strategies (SES) provided oversight during the advancement of six soil borings (B-1 through B-6) at the Site. The soil borings were completed in accordance with the recommendations made during a Phase I Environmental Site Assessment, also conducted by SES, which identified recognized environmental concerns based on the historical use of the property as a boat repair facility and as a refueling station for boats. The soil borings were advanced to depths between 10 to 15 feet below ground surface (bgs) in the vicinity of the former fuel dispensers, former office building located near the southwest portion of the Site, former USTs near the northeast portion of the Site, and a structure (identified by SES as a 1950-vintage basement with apparent UST vent line) near the southeast corner of the Site. The locations of the soil borings are shown on SES's Figure 2 in Attachment A.

Analytical results from soil samples collected from each of the borings (between 3.5 and 14.5 feet below ground surface [bgs]) indicated petroleum hydrocarbons and related constituents were either not detected above the laboratory method reporting limits or were detected at concentrations below corresponding MTCA Method A cleanup levels. Soil analytical results are shown on SES's Figure 2 included in Attachment A.

Groundwater was encountered during the drilling activities from approximately 4 to 11 feet bgs. Analytical results from the groundwater sample collected from soil boring B-01 indicated the presence of diesel-range hydrocarbons (9,800 microgram per liter [µg/L]), heavy oil-range hydrocarbons (9,800 µg/L), gasoline-range hydrocarbons (1,400 µg/L), and benzene (270 µg/L). These results exceed the corresponding Model Toxics Control Act (MTCA) Method A cleanup levels. Soil boring B-01 was completed in the vicinity of the former dispensers. Additionally, diesel- and heavy oil-range hydrocarbons were detected at concentrations greater than the MTCA Method A cleanup levels in groundwater samples collected from soil borings B-02 and B-03. These soil borings were completed in the vicinity of the former structure located near the southwest portion of the Site. Petroleum hydrocarbons and related constituents were either not detected above the laboratories method reporting limits, or were detected at concentrations less than the corresponding MTCA Method A cleanup levels. Groundwater analytical results are shown on SES's Figure 2 included in Attachment A.

SES conducted a subsequent round of soil and groundwater assessment in October 2006 that consisted of installing 9 additional soil borings (B-7 through B-15). ATC could not identify the locations of these borings during preparation of this report. Seven of the soil borings were reportedly converted to groundwater monitoring wells (identified as MW-1 through MW07). The approximate locations of the monitoring wells are shown on Figure 2.

Soil samples were collected from each boring between approximately 3.0 and 14.5 feet bgs. Gasoline-range hydrocarbons (550 mg/kg) and diesel-range hydrocarbons (2,100 mg/kg) were detected in the soil sample collected from boring B-07 at a depth of approximately three feet. These concentrations exceed the corresponding MTCA Method A cleanup levels. Boring B-07 is located in the vicinity of the fuel dispensing pump. Analytical results from the remaining soil samples collected from each of the borings indicated petroleum

hydrocarbons and related constituents were either not detected above the laboratory method reporting limits or were detected at concentrations below corresponding MTCA Method A cleanup levels.

The groundwater sample collected from monitoring well MW-1, located in the vicinity of the fuel dispensing pump, exhibited concentrations of gasoline-range hydrocarbons (1,200 µg/L), diesel-range hydrocarbons (3,300 µg/L) and benzene (52 µg/L) at concentrations greater than the MTCA Method A cleanup levels. Additionally, the groundwater sample collected from monitoring well MW-7, located west of the former USTs, exhibited concentrations of diesel-range hydrocarbons (1,200 µg/L) exceeding the MTCA method A cleanup levels. Analytical results from the remaining groundwater samples collected from each of the monitoring wells indicated petroleum hydrocarbons and related constituents were either not detected above the laboratory method reporting limits or were detected at concentrations below corresponding MTCA Method A cleanup levels.

Remedial activities were conducted in March 2008 during removal of two underground storage tanks (USTs) formerly containing gasoline and diesel fuel to address the identified impacts during the 2006 assessments. The remedial actions included the removal of approximately 200 tons of petroleum and cPAH impacted soil from an area proximate to the current fuel dispenser. The approximate lateral excavation limits are shown on Figure 2, and on Farallon Consulting's Figure 3, included as Attachment B.. Contaminated soils were removed to a depth of 5 to 6 feet bgs along the bulkhead and from 8 to 9 feet bgs in other areas. The excavated impacted soil was removed and replaced with imported backfill material. Laboratory analytical data from confirmation soil samples indicated that cPAH impacted soils had been successfully removed by the March 2008 remedial excavation. Diesel-range hydrocarbons (2,000 mg/kg), gasoline-range hydrocarbons (1,100 mg/kg), benzene (2.4 mg/kg), toluene (8.1 mg/kg), ethylbenzene (10 mg/kg), and xylene (57 mg/kg) were detected in confirmation sample EX1-BTM-NW (collected near the fuel dispenser) at a depth of 6 feet bgs. These analytical results exceed the corresponding MTCA Method A cleanup levels. Benzene (1.4 mg/kg), ethylbenzene (6.9 mg/kg), and xylenes (23.6 mg/kg) were also detected in confirmation sample EX1-SD-N (collected east of the fuel dispenser) at a depth of 5 feet bgs. These concentrations exceed the corresponding MTCA Method A cleanup levels. Petroleum hydrocarbons from the remaining confirmation soil samples collected from the limits of the 2008 remedial excavation (between 4 to 9 feet bgs) were either not detected above the laboratory method reporting limits or were detected below MTCA Method A cleanup levels (Attachment B). It was necessary to leave petroleum hydrocarbon impacted soil at the locations of confirmation soil samples EX1-BTM-NW and EX1-SD-N due to structural limitations associated with undermining the marina bulkhead.

After the remedial activities in 2008, the property was redeveloped with a new boathouse and office building near the northeast corner of the Site in the area of the former USTs. The removed USTs and fuel dispenser were replaced with a single double-walled UST, new double-walled fuel lines, and new dispensers with sumps to prevent leakage to the environment. Three groundwater monitoring wells were installed at the property (MW-8 through MW-10).

Groundwater monitoring was conducted during four consecuative quarters at the newley installed groundwater monitoring wells. The analytical results indicated concentrations of diesel-range hydrocarbons, heavy oil-range hydrocarbons, gasoline-range hydrocarbons, and BTEX below MTCA method A Clean up levels at MW-1, MW-8, MW-9, and MW-10.

In 2010 all remedial actions were presented to Ecology with an application to their Voluntary Cleanup Program (VCP) in order to obtain an Opinion of NFA for the Site. The Site was accepted into the VCP, and assigned VCP No. NW1791. Ecology issued an Opinion Letter, dated November 3, 2010, indicating that the cPAH impacts to soil had been addressed. However, as a result of the residual petroleum impacted soil, Ecology requested quarterly groundwater sampling from a single onsite groundwater monitoring well (MW-1) located adjacent to the bulkhead as well as sediment sampling at three locations along the marina. Ecology stipulated an Opinion of NFA could be feasible if the concentrations of contaminants of concerns (COCs) remained below their respective MTCA Method A cleanup values for at least four consecutive quarters, and the property owner subsequently submitted the sampling data with a Feasibility Study and Disproportionate Cost Analysis. The NFA Opinion would include a restrictive covenant to address the residual petroleum impacted soil.

Quarterly groundwater monitoring and sampling began in November 2010, subsequent to entering the VCP. Heavy oil-range hydrocarbons were detected at concentrations greater than MTCA Method A cleanup levels in the groundwater samples collected from MW-1 during the February and March 2011 events. Due to these exceedances, Ecology determined that additional sampling of groundwater would be necessary to meet the requirements for the NFA determination for the Site. Additionally, Ecology recommended that one additional sediment sampling event be completed to verify the status of the sediment conditions at the Site. Ecology issued an Opinion letter, dated July 21, 2014, requesting a status update regarding the remedial actions performed at the Site.

ATC prepared and submitted a Groundwater Monitoring Program and Sediment Sampling Work Plan, dated October 20, 2014, to Ecology in response to their July 21, 2014 Opinion Letter. Ecology reviewed the work plan, and approved the scope of work via email in January 2015.

Groundwater samples collected during four consecutive quarterly groundwater monitoring and sampling events, completed in June, September and December 2015, and February 2016, did not indicate concentrations of petroleum hydrocarbons or BTEX compounds above MTCA Method A cleanup levels. Additionally, results of the sediment sampling did not indicate petroleum hydrocarbons or BTEX compounds above MTCA Method A cleanup levels. Groundwater analytical results are presented on Table 1. Sediment analytical results are presented on Table 2. The groundwater and sediment results are also shown on Figure 3.

2.0 REGIONAL AND SITE GEOLOGY

Based on a review of the Washington State Division of Geology and Earth Resources *Geologic Map of Washington* by J. Eric Schuster (2002), the Site lies within the Puget Sound Lowland physiographic province, a broad low lying region bordered by the Puget Sound saltwater inlet to the west and the Cascade Mountains to the east. The Puget Sound Lowlands underwent a series of geologic and physiographic changes as a result of the advance and retreat of continental ice sheets. The most recent (Fraser) glaciation reached its peak about 14,000 years ago. The Fraser ice sheet extended to Littlerock, south of Olympia. Maximum ice thickness during the Fraser Glaciation was approximately 1,000 feet at Olympia, 3,000 feet at Seattle, and over 5,000 feet at Bellingham. The Fraser ice retreated quickly, leaving behind a landscape sculpted by glacial erosion and covered by newly deposited glacial drift. The location of present-day waterways and river drainages was established by the pattern of Fraser glacial erosion and deposition.

Site Soil Conditions

Lithological logs prepared during previous soil investigations show that the soil beneath the Site consists predominantly of fill materials consisting of fine sand, silt and gravel from the ground surface to approximately 15 feet bgs.

Groundwater Conditions

According to the USGS *Groundwater Atlas of the United States - Idaho, Oregon, Washington*, the Site overlies the Puget-Willamette Trough regional aquifer system. In the King County area, the system is filled with unconsolidated deposit aquifers that collectively are as much as 3,000 feet thick and could potentially be consolidated in their lower part. Perched aquifers can exist in shallow subsurface. Previous investigations indicated that depth to the groundwater beneath the site is between approximately 3 and 11 feet bgs. The shallow groundwater flow direction generally follows the local topography and may be affected by localized conditions. Based on the topography, the inferred local direction of groundwater flow is to the west toward Lake Washington.

Natural Resources and Ecological Receptors

A completed terrestrial ecological evaluation (TEE) is provided in Attachment C. Since there is less than 1.5 contiguous acres of undeveloped land within 500 feet of the Site, the Site qualifies for the undeveloped land exemption under WAC 173-340-7491. The 500-foot radius surrounding the Site is also included with the TEE in Attachment C.

3.0 LAKE WASHINGTON WATER QUALITY

Lake Washington is 20.6 feet above mean lower low water (MLLW) in Puget Sound and is connected to the Puget Sound Central Basin via Lake Union and the Lake Washington Ship Canal. Mercer Island lies in the southern half of the lake, separated from the east shore by a relatively shallow and narrow channel and from the west shore by a much wider and deeper channel. The basin of Lake Washington is a deep, narrow glacial trough with steeply sloping sides. The lake received untreated water and primary and secondary treated wastewater between 1941 and 1963, which resulted in eutrophication and declined water quality. Wastewater was diverted from the lake and discharge of untreated effluent, except for combined sewer overflows (CSOs), was reduced to zero by 1968.

Review of historical resources indicated that property north of the Yarrow Bay Yacht Basin and Marina, in an area today known as Carillon Point in Kirkland, Washington, was utilized as a shipyard. During the 1920's, the shipyard made the transition from wooden boat building to steel shipbuilding and constructed a number of steel auto ferries. The shipyard expanded greatly between 1939 and 1942, and Lake Washington Shipyards built 29 ships for the Navy and repaired nearly 500 vessels over the course of the war. Even though there were no available studies to evaluate the effects of the historical use of the Lake Washington Shipyard facility and its operations as manufacturing and repairs to the property, it is likely that the historical Lake Washington Shipyard facility impacted near shore sediments at the adjacent properties, including Yarrow Bay Yacht Basin and Marina. The potential contaminants included tri-butyl tin, heavy metals, PAHs, and semi-volatile organic compounds.

Furthermore, according to *A Sediment Triad Analysis of Lake Sammamish, Washington, and Union*, by King County Department of Natural resources and Parks, dated 2004, the historical sources of sediment contamination in Lake Washington are historical wood processing plants (J.H. Baxter and Quendall Terminals) formerly located near the southeast corner of Lake Washington, approximately two miles away from the Yarrow Bay Yacht Basin and Marina. These historical facilities contaminated soil, groundwater, surface water, and sediments with PAHs and the volatile organic compounds (VOCs) including BTEX. However, there are no available studies to evaluate the current impacts of these historical facilities and their effects on Lake Washington water quality as well as the nearby near-shore properties.

4.0 CONSTITUENTS OF CONCERN

Previous investigations identified the presence of diesel- and gasoline-range hydrocarbons, and BTEX compounds above MTCA Method A cleanup levels in soil and groundwater in the vicinity of the former fuel dispenser. Specifically, diesel- and gasoline-range hydrocarbons and one or more BTEX compounds exceed MTCA Method A cleanup levels at the locations of former confirmation soil samples EX1-BTM-NW (at a depth of 6 feet bgs) and EX1-SD-N (at a depth of 5 feet bgs). Consequently, diesel- and gasoline-range hydrocarbons and BTEX compounds have been identified as COCs.

5.0 REMEDIAL AREA IDENTIFICATION

Based on historical analytical laboratory data obtained from previous investigations, one area of petroleum impacted soil remains present beneath the site. Based on the proximity of the impacted soil to the bulkhead, depth to the groundwater, and the Lake Washington waterfront, it appears that even though the contaminant mass is confined, it is located in a relatively saturated zone.

Lateral delineation of the petroleum hydrocarbon impacted soil is delineated by the bulkheads to the west and north, and confirmation samples EX1-BTM-PLT (collected at 4 feet bgs), EX1-SD-E (collected at 5 feet bgs), EX1-SD-C (collected at 9 feet bgs) and EX1-SD-W (collected at 6 feet bgs). This laterally delineated area equates to approximately 250 square feet. Assuming the thickness of the soil impacts above the MTCA Method A cleanup levels is 4.5 feet (the difference between the “average” upper interval of impact [6.5 feet] and the lower interval of impact [11 feet - the lowest measured depth of groundwater during drilling]), the remedial area equates to approximately 1,125 cubic feet, or approximately 42 cubic yards.

6.0 REMEDIAL ACTION OBJECTIVES

The intent of the remedial action is to address identified residual petroleum hydrocarbons and BTEX compounds in soil with regard to the protection of human health and the environment, and to comply with applicable state and federal laws by means of a Restrictive Covenant through Ecology.

The primary remedial action objectives (RAOs) for the remedial area at the Site are to:

- Remove, treat, or assess potential risks of the identified mass of petroleum impacted soil within the saturated soil in the identified remedial area.

6.1 SCREENING OF POTENTIAL REMEDIAL ACTION ALTERNATIVES

Remedial action alternatives were screened based on the RAOs and data obtained during previous site assessments. These included: 1) source (soil) treatment technologies; and 2) source removal technologies. Both of these alternatives would reduce the concentration of identified petroleum hydrocarbons present in Site soil.

The suitable remedial action technologies include:

- Natural attenuation (NA) with institutional controls and Restrictive Covenant.
- Air Sparging and Soil vapor extraction (AS/SVE).
- Soil removal (by excavation) and onsite treatment.
- Soil removal (by excavation) and offsite disposal.

6.2 REMEDIAL ACTION ALTERNATIVE ANALYSIS

The remedial action technologies identified above were analyzed against the minimum screening criteria as outlined in Washington Administrative Code (WAC) 173-340-360(3)(f) which includes:

- Protectiveness.
- Permanence.
- Cost.
- Effectiveness over the long term.
- Management of short-term risks.
- Technical and administrative implement ability.
- Consideration of public concerns.

In addition to meeting the threshold requirements outlined in WAC 173-340-360(2)(a), the selected remedial action technology must also provide for a reasonable restoration time frame.

A brief description of each remedial action technology, compared with the minimum screening criteria listed above, is discussed below.

Natural Attenuation with Institutional Controls and Restrictive Covenant

Natural attenuation (NA) relies on natural processes (biodegradation, dispersion, sorption, and volatilization) to achieve the RAO. Although NA without an institutional control or restrictive covenant would likely require a lengthy period of time to achieve the RAO, this remedial action remains feasible due to the inaccessibility of the residual impacted soil within the remedial area (approximately 42 cubic yards) and the limited risk to human health, based on the NA that has already occurred over time. Analytical results from the current sediment sampling along the bulkhead, and recent quarterly groundwater monitoring and sampling events indicate a relatively stable to declining plume. These findings suggests that the historically impacted soil concentrations in the remedial area may have naturally attenuated to concentrations less than the MTCA Method A cleanup levels as well. The surface area at this location of the property is paved concrete, which acts as an institutional control to protect human health from direct contact and potential vapor inhalation. It is understood that should this remedial action be implemented, Yarrow Bay Yacht Basin and Marina will obtain a Restrictive Covenant from Ecology regarding site impacts that remain above MTCA Method A cleanup levels.

Air Sparging with Soil Vapor Extraction

Air sparging (AS) in conjunction with soil vapor extraction (SVE) is considered a viable technology for this site. AS technology can be used in a variety of geological and hydrogeological settings, as well as at sites with varying concentrations and aerial distributions of petroleum hydrocarbons. The primary remedial processes promoted by AS are in-situ stripping of dissolved hydrocarbons with sufficiently high Henry's Law constants, enhanced aerobic biodegradation of dissolved phase contaminants due to increased dissolved oxygen levels, and volatilization of adsorbed phase constituents. At this Site, within the remediation area, petroleum hydrocarbons and BTEX are highly amenable to remediation by AS and SVE processes due to their volatility, strippability and aerobic biodegradability characteristics. Diesel-range hydrocarbons, although not as volatile, can be considered amenable to remediation by AS and SVE, but to a lesser degree than gasoline-range hydrocarbons.

An SVE system is typically used in conjunction with AS to remediate the vadose and groundwater fluctuation zones as well as to recover vapors generated during AS. SVE uses an induced vacuum to remove petroleum hydrocarbons from the soil. The extracted vapor phase contaminants are then treated at the surface using granulated activated carbon or thermal destruction. Similar to AS, the primary remedial processes promoted by SVE are stripping, volatilization and biodegradation.

Utilizing AS with SVE as a remediation alternative would require the installation of AS and SVE wells and additional equipment to treat recovered vapor. This technology would also require permitting with local air agencies. The uncertainty associated with the soil conditions (i.e., are subsurface conditions conducive to vapor flow), disproportionate carbon footprint, and limited accessibility for a AS/SVE well network make the effectiveness and reliability of these technologies unknown over the long term. The time frame to achieve the RAO would likely be several years (estimated to be between two and four years). Furthermore, remediation by SVE has a disproportionate cost-effectiveness (i.e., the costs would not be proportionate to the benefits) as the remaining contaminant mass contains limited concentrations of contaminants of concern and is of limited volume.

Soil Removal (by Excavation) and Onsite Treatment

Soil removal by excavation and onsite treatment involves excavating the petroleum hydrocarbon impacted soil from the remediation area and treating it onsite. This remedial technology would not be effective in meeting the RAO as it would not be possible to perform on-site treatment (via biological land farming, aeration, or bio mounding) with the soil removed due to the immediate need to return the site to an operations state. Land farming and aeration treatment would require the regular use of tilling equipment and an estimated treatment time frame of two to three years. Bio mounding would require venting equipment (blower), maintenance, and potential permits. The treatment time frame for this method is estimated to be between

one and two years and therefore the carbon footprint for this option will exceed the benefit. Furthermore, remediation by soil removal with onsite treatment has a disproportionate cost-effectiveness (i.e., the costs would not be proportionate to the benefits).

Soil Removal (by Excavation) and Offsite Disposal

Soil removal by excavation and offsite disposal involves excavating the petroleum hydrocarbon impacted soil from the remediation area and transporting it offsite for disposal at a landfill or other suitable disposal facility. Although this remedial technology would be effective in meeting the RAO, remediation by soil removal and offsite disposal has a disproportionate cost-effectiveness and carbon footprint as the remaining contaminant mass contains limited concentrations of contaminants of concern and is of limited volume. Further, the original remedial excavation could not be expanded due to structural limitations associated with undermining the marina bulkhead. Engineering controls, such as shoring, would likely be required to allow further excavation.

7.0 DISPROPORTIONATE COST ANALYSIS

The MTCA disproportionate cost analysis (DCA) is used to evaluate which of the cleanup action alternatives that meet threshold requirements are permanent to the maximum extent practicable. A threshold compliance evaluation for each alternative is presented in the table below:

	Alternative 1: **Natural Attenuation with Institutional Controls and Restrictive Covenant**	**Alternative 2:** **Air Sparging with Soil Vapor Extraction**	**Alternative 3:** **Soil Removal (by Excavation) and Onsite Treatment**	**Alternative 4:** **Soil Removal (by Excavation) and Offsite Disposal**
Description	Since impacted soil is not in contact with groundwater it is kept capped with institutional controls and concentrations are allowed to degrade by natural processes.	Concentrations of petroleum hydrocarbons in impacted soil are reduced by extracted vapor phase petroleum hydrocarbons	Soil impacted with petroleum hydrocarbons are removed and then land farmed on site in order to reduce petroleum hydrocarbon concentrations	Soil impacted with petroleum hydrocarbons are removed and then disposed at a permitted facility.
Protection of Human Health and the Environment	Yes – Alternative will protect human health and the environment through engineering and institutional controls	Yes – Alternative will protect human health and the environment – treats soil contamination	Yes – Alternative will protect human health and the environment by removing secondary source (soil)	Yes – Alternative will protect human health and the environment by removing secondary source (soil)
Compliance with Applicable State and Federal Laws	Yes	Yes	Yes	Yes
Provisions for Compliance Monitoring	Yes – collection and analysis of soils from impacted areas can be performed and compared to previous results to ascertain effectiveness of natural attenuation	Yes – system operations and maintenance will provide compliance monitoring data	Yes – soil samples collected from excavation and land-farming will provide compliance monitoring	Yes – soil samples collected from excavation will provide compliance monitoring
Restoration Time Frame	Unknown - ongoing	Restoration time from 1 year for design and construction and up to 5 years to ensure compliance	Restoration time is 1 year for implementation and up to 3 years for compliance	Restoration time is 1 year for implementation and compliance

This DCA analysis involves comparing the costs and benefits of the alternatives and selecting the most permanent alternative whose incremental costs are not disproportionate to the incremental benefits. The

evaluation criteria for the disproportionate cost analysis are specified in Section 4.2 and in WAC 173-340-360(3)(f), and include:

1. Protectiveness: overall protectiveness of human health and the environment.

2. Permanence: the degree to which the alternative permanently reduces the toxicity, mobility or volume of hazardous substances.

3. Effectiveness over the long term: consideration of the following types of cleanup action components, when assessing the relative degree of long-term effectiveness:

- Reuse or recycling;
- destruction or detoxification;
- immobilization or solidification;
- on-site or offsite disposal in an engineered, lined and monitored facility;
- on-site isolation or containment with attendant engineering controls; and
- institutional controls and monitoring.

4. Management of short-term risks: The risk to human health and the environment associated with the alternative during construction and implementation.

5. Technical and administrative implementability: ability to be implemented, including consideration of whether the alternative is technically possible.

6. Consideration of public concerns: whether the community has concerns regarding the alternative and, if so, the extent to which the alternative addresses those concerns.

7. Cost: the cost to implement the alternative.

MTCA provides a methodology that uses the criteria listed above and presented in the table below to assess whether the costs associated with each cleanup alternative are disproportionate relative to the incremental benefit of each alternative as compared to the next lowest-cost alternative.

As shown in the table below, each criterion for each alternative was ranked with a numerical “score” between 0 and 10, with 0 indicating the cleanup action alternative does not at all fit the specific criterion and 10 indicating the cleanup action alternative fits the specific criterion to the maximum extent. In order to assess the benefits represented by each particular criterion, the evaluation presented in this DCA uses a “weighting” system. The first three criteria associated with higher degrees of environmental benefits are more highly weighted (assigned 30%, 20% and 20%, respectively) than the other three criteria that are associated with non-environmental factors (10% each). Cost is not weighted. The Overall Alternative Ranking is determined by multiplying each value by the weighting factor and summing the weighted scores to determine the overall weighted benefit score for each alternative.

	Alternative 1: **Natural Attenuation with Institutional Controls and Restrictive Covenant**	**Alternative 2:** **Air Sparging with Soil Vapor Extraction**	**Alternative 3:** **Soil Removal (by Excavation) and Onsite Treatment**	**Alternative 4:** **Soil Removal (by Excavation) and Offsite Disposal**
Protectiveness (30% weighted factor)	This alternative will achieve overall protection with restrictive covenant (6) **Weighted Score = 1.8**	This alternative will achieve overall protection by treating contaminated soil (7) **Weighted Score = 2.1**	This alternative will achieve overall protection by removing contaminated soil (9) **Weighted Score = 2.7**	This alternative will achieve overall protection by removing contaminated soil (9) **Weighted Score = 2.7**
Permanence (20% weighted factor)	Impacted soils are contained and are not considered a risk to groundwater (6) **Weighted Score = 1.2**	Concentrations are reduced and not considered risk to groundwater (8) **Weighted Score = 1.6**	Impacted soils are removed and replaced (9) **Weighted Score = 1.8**	Impacted soils are removed and replaced (9) **Weighted Score = 1.8**
Long-Term Effectiveness (20% weighted factor)	Alternative relies on containment and natural attenuation (6) **Weighted Score = 1.2**	Alternative relies on effectiveness of installed system (7) **Weighted Score = 1.4**	Alternative relies on removal of impacted soil (9) **Weighted Score = 1.8**	Alternative relies on removal of impacted soil (9) **Weighted Score = 1.8**
Short-Term Risk Management (10% Weighted Factor)	Minimal disturbance to property (9) **Weighted Score = 0.9**	Moderate Disturbance to property (5) **Weighted Score = 0.5**	High disturbance to property; (3) **Weighted Score = 0.3**	High disturbance to property; (3) **Weighted Score = 0.3**
Implementability (10% weighted factor)	Most implementable (9) **Weighted Score = 0.9**	Moderately Implementable – although will create disturbance to property and current business operations (7) **Weighted Score = 0.7**	Least Implementable – will create disturbance to property and current business operations; (4) **Weighted Score = 0.4**	Least Implementable – will create disturbance to property and current business operations; (5) **Weighted Score = 0.5**
Public Concerns (10% weighted Factor)	Alternative does not remove impacted soil – restrictive covenant may be less desirable, low to	Alternative will make use of an operating system, likely for several years, low to	Alternative will create disturbance to property and current business, high risk to public (4)	Alternative will create disturbance to property and current business, but will

	moderate risk to public (6) **Weighted Score = 0.6**	moderate risk to public (6) **Weighted Score = 0.6**	**Weighted Score = 0.4**	remove and replace impacted soil (5) **Weighted Score = 0.4**
Overall Alternative Ranking	**6.6**	**6.9**	**7.4**	**7.5**

8.0 CALCULATED COST/BENEFIT RATIO

The ratio of the estimated cost to the overall score is used to assist in evaluating which of the alternatives is permanent to the maximum extent practicable. The most cost-effective alternative is the alternative with the lowest calculated cost/benefit ratio. The cost to benefit ratio is calculated by dividing the estimated costs by the overall score, as summarized in the table below:

	Alternative 1: **Natural Attenuation with Institutional Controls and Restrictive Covenant**	**Alternative 2:** **Air Sparging with Soil Vapor Extraction**	**Alternative 3:** **Soil Removal (by Excavation) and Onsite Treatment**	**Alternative 4:** **Soil Removal (by Excavation) and Offsite Disposal**
Overall Alternative Ranking	**6.6**	**6.9**	**7.4**	**7.5**
Costs:	**$20,000 (compliance monitoring - completed)**	**$200,000**	**$250,000**	**$300,000**
Cost/Benefit Ratio	**3,030**	**28,986**	**33,784**	**40,000**

As shown in the table above, the approximate costs for Alternatives 1 through 4 are $20,000, $200,000, $250,000 and $300,000, respectively.

Considering the estimated costs for each Alternative, Alternative 1 has the lowest cost/benefit ratio of “3,030.” Although Alternative 1 scored as the least beneficial (with a score of 6.6, compared to the highest score of 7.5 for Alternative 4), Alternative 1 is found to be significantly more cost effective than Alternatives 2, 3 and 4. The incremental costs for Alternatives 2, 3 and 4 are considered disproportionate to the incremental degree of benefit achieved over that of Alternative 1.

8.0 SELECTION OF PREFERRED REMEDIATION TECHNOLOGY

Based on a comparative evaluation of the ability to attain the RAOs, and analysis of the screening criteria, and through a disproportionate cost analysis, NA with institutional controls and restrictive covenant is selected as the preferred technology. The degree of uncertainty regarding their reliability, combined with anticipated longer time frames to achieve the RAO and disproportionate cost effectiveness make the AS with SVE and soil removal technologies unfavorable.

9.0 CONCLUSIONS AND RECOMMENDATIONS

Based on previous investigations and remedial actions, a limited volume (estimated at 42 cubic yards) of petroleum-contaminted soil remains at the Site. However, the mass is confined and delineated laterally, and the residually impacted soil is not impacting groundwater or sediment conditions that would present unacceptable risk to human health. The remaining contaminant mass is not expected in increase in contaminant concentration. Furthermore the contaminant mass is currently located below concrete and asphalt paved surfaces, which will increase protection of human health and the environment. It is ATC's opinion that the appropriate monitoring and sampling has been completed to ensure that the natural attenuation process is taking place and that human health and the environment are protected.

Natural Attenuation with Institutional Controls and a Restrictive Covenant was selected as the preferred Alternative via the DCA. ATC requests Ecology to review this report and DCA, and provide an Opinion regarding the selection of this alternative. Should Ecology concur with this Alternative, ATC recommends Ecology issue an Opinion of NFA, with a restrictive covenant.

10.0 LIMITATIONS

This report has been prepared for the exclusive use of Mr. and Mrs. Bortko for Yarrow Bay Yacht Basin and Marina located at 5207 Lake Washington Boulevard NE in Kirkland, Washington. Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with customary principles and practices in the fields of environmental science and engineering. This warranty is in lieu of all other warranties either expressed or implied. This company is not responsible for the independent conclusions, opinions, or recommendations made by others based on the records review, site inspection, field exploration, and laboratory test data presented in this report.

It should be noted that all surficial environmental assessments are inherently limited in the sense that conclusions are drawn and recommendations developed from information obtained from limited research and site evaluation. For these types of evaluations, it is often necessary to use information prepared by others and ATC cannot be responsible for the accuracy of such information. In addition, the passage of time may result in a change in the environmental characteristics at this site and surrounding properties. This report does not warrant against future operations or conditions, nor does it warrant operations or conditions present of a type or at a location not investigated. This report is not a regulatory compliance audit and is not intended to satisfy the requirements of any state, federal, or local real estate transfer laws.

It must be noted that no investigation can absolutely rule out the existence of any hazardous materials at a given site. This assessment has been based upon prior site history, observable conditions, and the subsurface soil sampling described in this report. Existing hazardous materials and contaminants can escape detection using these methods

11.0 CERTIFICATIONS

The information provided in this *Feasibility Study with Disproportionate Cost Analysis* (dated June 1, 2016), for the Yarrow Bay Yacht Basin and Marina located at 5207 Lake Washington Boulevard NE in Kirkland, *Washington was prepared under the supervision of an ATC State of Washington Licensed Geologist.*

A professional geologist's certification of conditions comprises a declaration of his or her professional judgment. It does not constitute a warranty or guarantee, expressed or implied, nor does it relieve any other party of its responsibility to abide by contract documents, applicable codes, standards, regulations and ordinances.

We appreciate the opportunity to be of service in this matter. If you have questions regarding this report, please contact us at (206) 781-1449.

Sincerely,
ATC Group Services LLC

KYLE RAYMOND SATTLER

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12.0 REFRENCES

ATC Group Services, LLC, *2015 and 2016 Groundwater Monitoring and Sampling and Assessment of Sediment for Yarrow Bay Yacht Basin and Marina, Kirkland, Washington*, April 19, 2016.

Farallon Consulting, LLC, *Closure Report for Yarrow Bay Marina, Kirkland, Washington*, January 8, 2010.

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Sound Environmental Strategies, *Phase I, Environmental Site Assessment for Yarrow Bay Marina-Western Parcel, Kirkland, Washington*, August 17, 2006.

Sound Environmental Strategies, *Subsurface Investigation Report for Yarrow Bay Marina-Western Parcel, Kirkland, Washington*, August 15, 2006.

Sound Environmental Strategies, *Subsurface Investigation Report for Yarrow Bay Marina-Western Parcel, Kirkland, Washington*, November 13, 2007.

Schuster, Eric J., 2002 Washington State Division of Geology and Earth Resources *Geologic Map of Washington.*

TABLES

Table 1 - Summary of Analytical Results - Groundwater (2010 through 2016)
Yarrow Bay Yacht Basin and Marina
5207 Lake Washington Boulevard NE
Kirkland, Washington
ATC Project No. Z076000030

Sample No.	Sample Date	Total Petroleum Hydrocarbons[1] in µg/L						Volatile Organic Compounds[2] in µg/L			
		Diesel	Diesel Range Organics (DRO) C12-C24	Mineral Oil	Heavy Oil	Heavy Fuel Oil	Gasoline Range Hydrocarbons (GRO)	Benzene	Toluene	Ethylbenzene	Xylenes (total)
MW-1-1110	11/04/10	<50	--	--	--	--	<50	<1.0	<1.0	<1.0	<2.0
MW-1-0211	02/10/11	<50	--	<50	**2,670**	--	<50	<1.0	<1.0	<1.0	<2.0
MW-1-0311	03/07/11	<50	--	<50	**2,480**	--	<50	<1.0	<1.0	<1.0	<2.0
MW-1-0511	05/27/11	<50.0	232	--	<100	--	<50.0	<1.0	<1.0	<1.0	<2.0
MW-1(-0811)	08/23/11	<51.0	--	--	<102	--	<50.0	<1.0	<1.0	<1.0	<2.0
MW-1(-1111)	11/29/11	<50.0	--	--	<100	--	<50.0	<1.0	<1.0	<1.0	<2.0
MW-1-0212	02/14/12	<50.0	137	--	<100	--	<50.0	<1.0	<1.0	<1.0	<2.0
MW-1(-0512)	05/30/12	**655**	--	--	<100	--	<50.0	<1.0	<1.0	<1.0	<2.0
MW-1-0812	08/30/12	<50.0	--	--	<100	**2,060**	<50.0	<1.0	<1.0	<1.0	<2.0
YB-1-01 (MW-1)	09/30/14	312	--	--	<100	--	<50.0	<1.0	<1.0	<1.0	<1.0
YB-2-01 (MW-1)	12/03/14	<50.1	--	--	275	--	<50.0	<1.0	<1.0	<1.0	<1.0
YB-3-01 (MW-1)	02/12/15	<50.0	--	--	**1,500**	--	<50.0	<1.0	<1.0	<1.0	<1.0
YB-0630 (MW-1)	06/30/15	397	--	--	<100	--	<50.0	<1.0	<1.0	<1.0	<1.0
YB-02-MW1 (MW-1)	09/30/15	484	--	--	<99.9	--	<50.0	<1.0	<1.0	<1.0	<1.0
YB-03-MW1 (MW-1)	12/16/15	<49.9	--	--	327	--	<50.0	<1.0	<1.0	<1.0	<1.0
YB-04-MW1 (MW-1)	02/29/16	<49.9	82.6	--	415	--	<50.0	<1.0	<1.0	<1.0	<1.0
MTCA-Method A Groundwater Cleanup Limit		**500**	**500**	**500**	**500**	**500**	**800/1,000[3]**	**5**	**1,000**	**700**	**1,000**

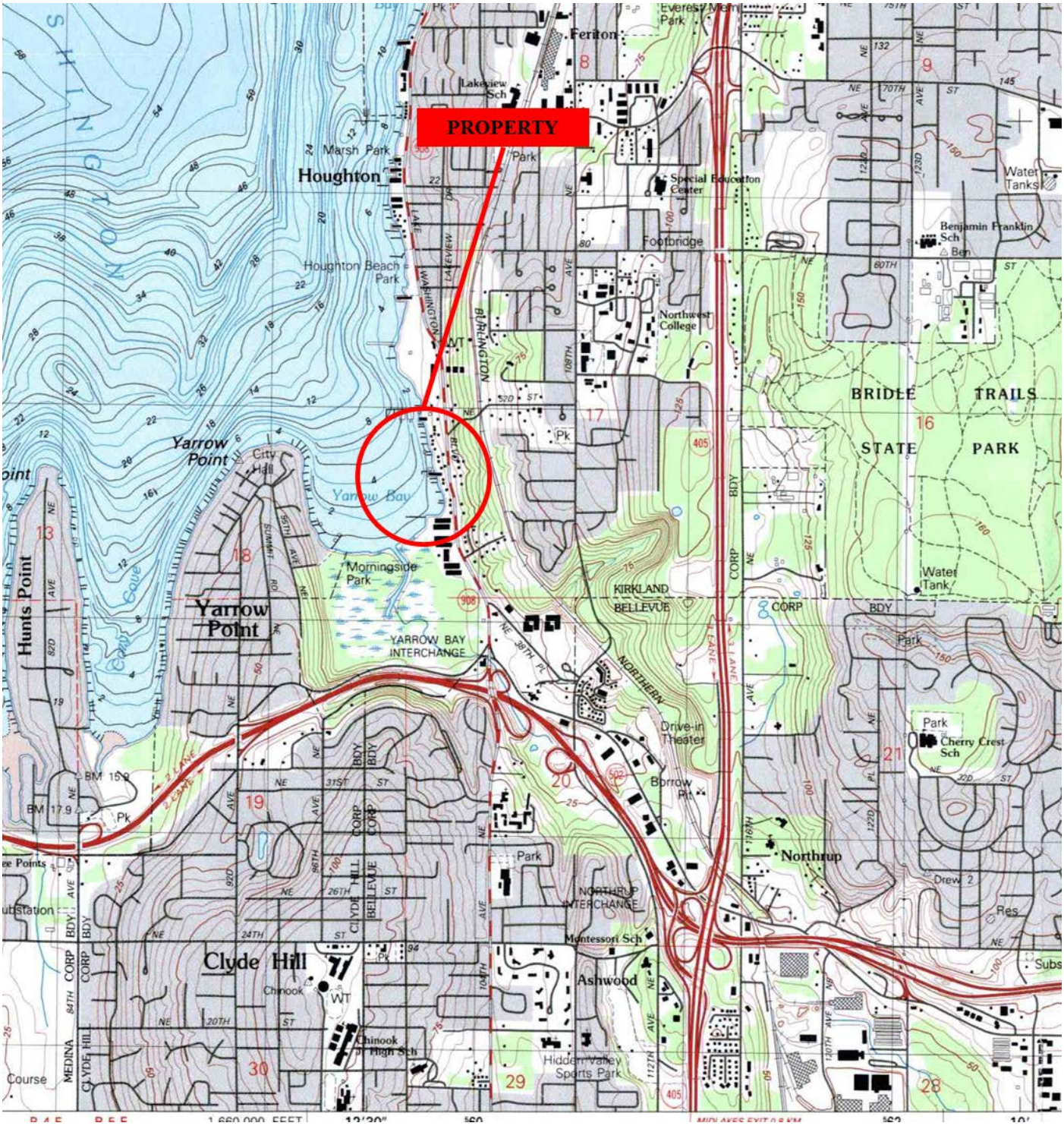
Notes:
µg/L = microgram per liter
-- = not analyzed
MTCA - Washington State Department of Ecology Model Toxics Control Act
Bold denotes concentration at or above regulatory cleanup level
1 = Analytical results by gas chromatography and mass spectrometry by Ecology Methods NWTPH-HCID, NWTPH-Gx, and/or NWTPH-Dx/Extended
2 = Analytical results by gas chromatography and mass spectrometry by United States Protection Agency Method 8260
3 = 800 µg/L cleanup level if benzene present in groundwater; 1,000 µg/L cleanup level when benzene is not detected in groundwater
All analytical results reported in micrograms per liter (µg/L) equivalent to parts per billion (ppb)
< = Less than stated laboratory method reporting limit.

Table 2 - Summary of Analytical Results - Sediment (2010 through 2016)
Yarrow Bay Yacht Basin and Marina
5207 Lake Washington Boulevard NE
Kirkland, Washington
ATC Project No. Z076000030

Sample No.	Sample Date	Total Petroleum Hydrocarbons[1] in mg/kg						Voaltile Organic Compounds[2] in mg/kg			
		Gasoline	Gasoline Range Hydrocarbons (GRO)	Diesel (Fuel Only)	Mineral Oil	Heavy Oil	Heavy Fuel Oil	Benzene	Toluene	Ethylbenzene	Xylenes (total)
SD-1	07/13/10	<5.0	<5.0	<20	<40	<50	--	<0.02	<0.05	<0.05	<0.15
SD-2	07/13/10	<5.0	<5.0	<20	<40	<50	--	<0.02	<0.05	<0.05	<0.15
SD-3	07/13/10	<5.0	<5.0	<20	<40	<50	--	<0.02	<0.05	<0.05	<0.15
SD-1-0711	07/26/11	**<134***	--	**<5,238***	--	<1,310*	--	**<0.534***	<0.534*	<0.801*	<1.068*
SD-2-0711	07/26/11	<14.0	--	<46.4	--	642	--	<0.0561	<0.0561	<0.0841	<0.112
SD-3-0711	07/26/11	<7.21	--	<23.8	--	<59.4	--	<0.0285	<0.0285	<0.0427	<0.057
SD-1	07/24/12	<5.77	--	<23.3	--	<58.2	<58.2	<0.0231	0.0266	<0.0346	<0.0462
SD-2	07/24/12	<5.43	--	<24.1	--	<60.3	72.1	<0.0217	<0.0217	<0.0326	<0.0434
SD-3	07/24/12	<8.30	--	<28.9	--	<72.3	322	<0.0332*	<0.0332	<0.0498	<0.0664
YB-S-01 (Sediment)	02/12/15	<5.89	--	<22.0	--	<54.9	--	<0.0236	<0.0236	0.0353	<0.0236
YB-S-02 (Sediment)	02/12/15	<4.48	--	<23.9	--	1,120	--	<0.0179	<0.0179	<0.0269	<0.0179
YB-S-03 (Sediment)	02/12/15	<6.28	--	<23.9	--	154	--	<0.0251	<0.0251	<0.0377	<0.0251
YB-02-SD1 (Sediment)	09/30/15	<5.70	--	<22.4	--	<56.0	--	<0.0228	<0.0228	<0.0342	<0.0228
YB-02-SD2 (Sediment)	09/30/15	<6.57	--	<25.4	--	240	--	<0.0263	<0.0263	<0.0394	<0.0263
YB-02-SD3 (Sediment)	09/30/15	<6.12	--	<22.6	--	64.1	--	<0.0245	<0.0245	<0.0367	<0.0245
MTCA Method A soil cleanup level for unresetricted land uses **		**100/30[3]**	**100/30[3]**	**2,000**	**2,000**	**2,000**	**2,000**	**0.03**	**7**	**6**	**9**

Notes:
mg/kg = milligram per kilogram
MTCA - Washington State Department of Ecology Model Toxics Control Act
-- = not analyzed
Bold denotes concentration at or above regulatory cleanup level
1 = Analytical results by gas chromatography and mass spectrometry by Ecology Methods NWTPH-HCID, NWTPH-Gx, and/or NWTPH-Dx/Extended
2 = Analytical results by gas chromatography and mass spectrometry by United States Environmental Protection Agency Method 8260
3 = 100 mg/kg cleanup level for gasoline mixtures without benzene and total ethylbenzene, toluene, and xylene concentration less than 1% of gasoline mixture; 30 mg/kg for all other gasoline mixtures
All analytical results reported in milligrams per kilogram (mg/kg) equivalent to parts per million (ppm)
* - Elevated detection limits are a result of high moisture content within the sample (96.3% moisture by weight)
** - Sediment cleanup values for petroleum hydrocarbons has not been determined by Ecology. Cleanup values for soil have been provided for comparison purposes.
< = Less than state laboratory method reporting limit.

FIGURES



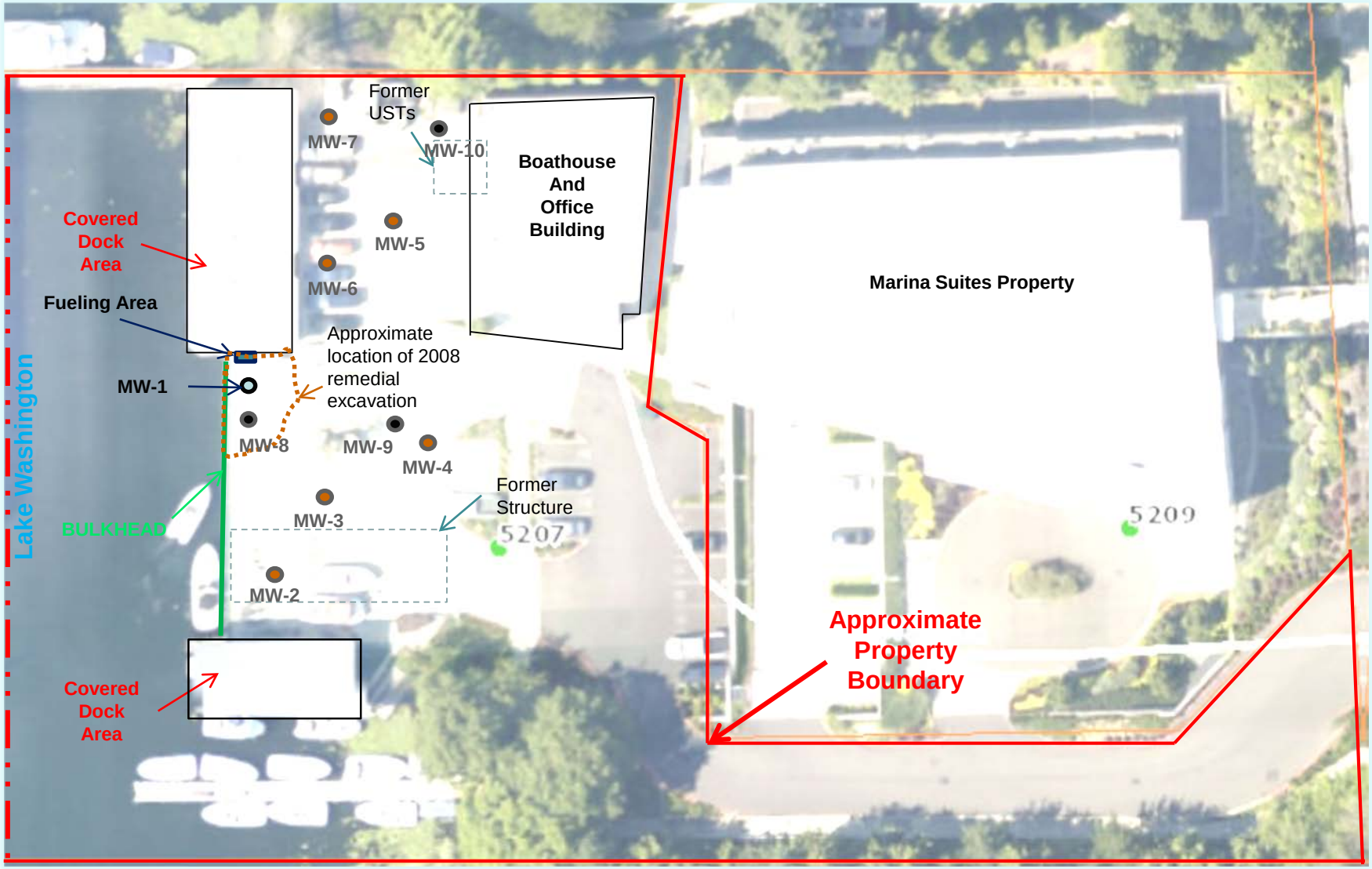
SOURCE: USGS Topographic Map, Bellevue South, WA Quadrangle, 7.5 Minute Series, Dated 1982

6347 Seaview Avenue NW
Seattle, Washington 98107
(206) 781-1449

FIGURE 1

YARROW BAY YACHT BASIN AND MARINA
5207 LAKE WASHINGTON BOULEVARD NE
KIRKLAND, WASHINGTON

PROJECT NO.: Z076000030		
APPENDIX A	SCALE:N/A	REVIEWED BY: NB
DRAWN BY: N/A	DATE: 4/2016	FILE: SITE VICINITY



- Existing Monitoring Well Location (MW-1)
- 2006 Monitoring Wells Locations (MW-1 through MW-7)
- 2008 Monitoring Wells Locations (MW-8 through MW-10)

Reference: King County iMap 2013

N

ATC

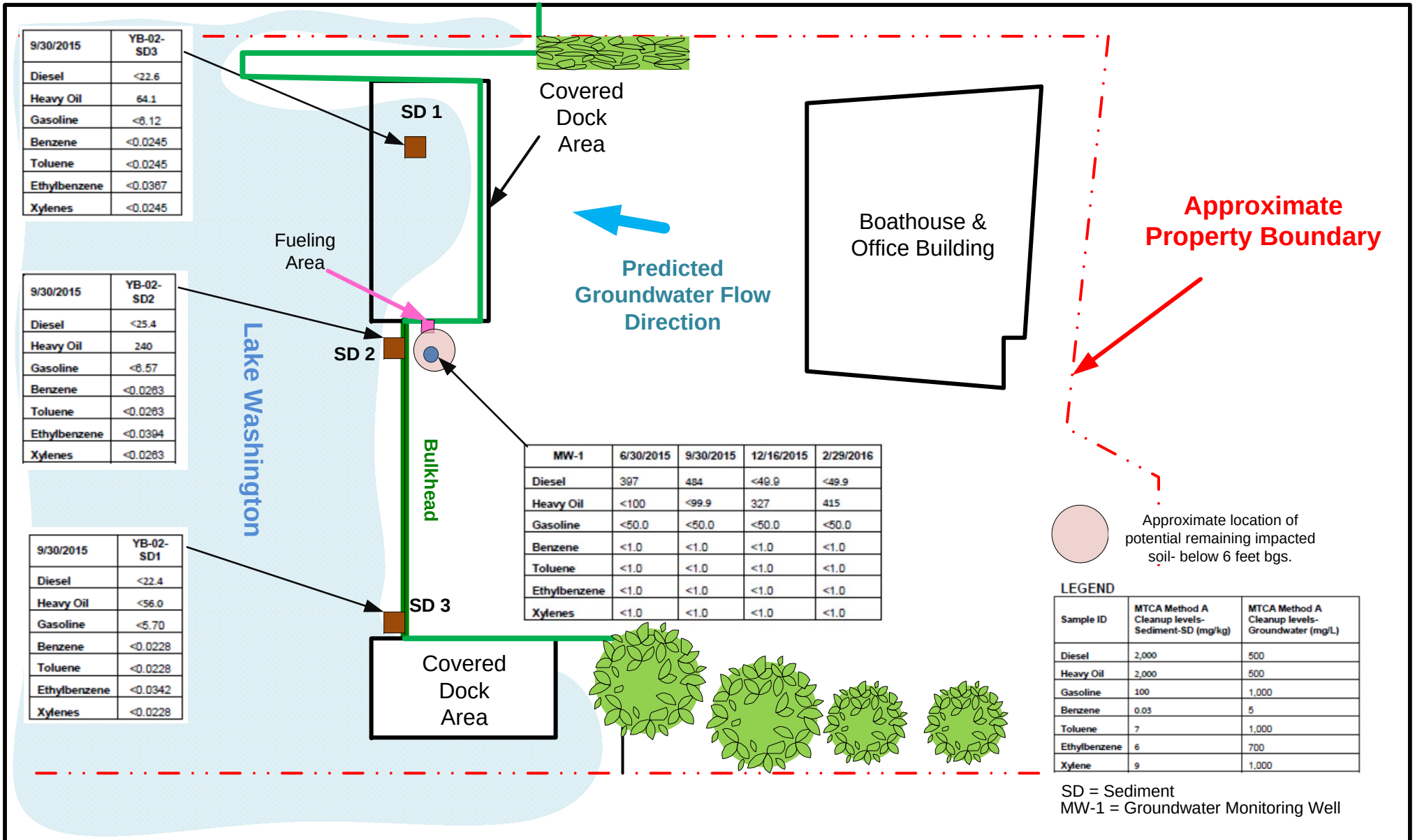
6347 Seaview Avenue
Northwest
Seattle, WA 98107

PROJECT NUMBER: Z076000030

DESIGNED BY: ATC	SCALE: NTS	REVIEWED BY: TM
DRAWN BY: NB	DATE: 05//2016	FIGURE 2

FIGURE 2
SITE PLAN

Yarrow Bay Yacht Basin And Marina
5207 Lake Washington Boulevard NE
Kirkland, Washington 98033



ATC
6347 Seaview Avenue NW
Seattle, WA 98107
(206) 781-1449

Figure 3
Groundwater and Sediment Analytical Data

Yarrow Bay Yacht Basin & Marina
5207 Lake Washington Boulevard NE
Kirkland, Washington

PROJECT NO. Z076000030		
ANALYTICAL DATA	SCALE: NTS	REVIEWED BY: N/A
DRAWN BY: NB		FIGURE 3

ATTACHMENTS

Voluntary Cleanup Program

Washington State Department of Ecology
Toxics Cleanup Program

TERRESTRIAL ECOLOGICAL EVALUATION FORM

Under the Model Toxics Control Act (MTCA), a terrestrial ecological evaluation is necessary if hazardous substances are released into the soils at a Site. In the event of such a release, you must take one of the following three actions as part of your investigation and cleanup of the Site:

1. Document an exclusion from further evaluation using the criteria in WAC 173-340-7491.
2. Conduct a simplified evaluation as set forth in WAC 173-340-7492.
3. Conduct a site-specific evaluation as set forth in WAC 173-340-7493.

When requesting a written opinion under the Voluntary Cleanup Program (VCP), you must complete this form and submit it to the Department of Ecology (Ecology). The form documents the type and results of your evaluation.

Completion of this form is not sufficient to document your evaluation. You still need to document your analysis and the basis for your conclusion in your cleanup plan or report.

If you have questions about how to conduct a terrestrial ecological evaluation, please contact the Ecology site manager assigned to your Site. For additional guidance, please refer to www.ecy.wa.gov/programs/tcp/policies/terrestrial/TEEHome.htm.

Step 1: IDENTIFY HAZARDOUS WASTE SITE	
Please identify below the hazardous waste site for which you are documenting an evaluation.	
Facility/Site Name: Yarrow Bay Yacht Sales & Svc	
Facility/Site Address: 5207 Lake Washington Boulevard NE	
Facility/Site No: 33911356	VCP Project No.: NW1791

Step 2: IDENTIFY EVALUATOR			
Please identify below the person who conducted the evaluation and their contact information.			
Name: Nasrin Bastami			Title: Project Manager
Organization: ATC Group Services LLC			
Mailing address: 6347 Seaview Avenue NW			
City: Seattle		State: WA	Zip code: 98107
Phone: 206-781-1449	Fax: 206-781-1543	E-mail: nasrin.bastami@atcassociates.com	

Step 3: DOCUMENT EVALUATION TYPE AND RESULTS

A. Exclusion from further evaluation.

1. Does the Site qualify for an exclusion from further evaluation?

☒ Yes *If you answered **"YES,"** then answer **Question 2**.*

☐ No or Unknown *If you answered **"NO" or "UKNOWN,"** then skip to **Step 3B** of this form.*

2. What is the basis for the exclusion? *Check all that apply. Then skip to **Step 4** of this form.*

Point of Compliance: WAC 173-340-7491(1)(a)

☐ All soil contamination is, or will be,* at least 15 feet below the surface.

☐ All soil contamination is, or will be,* at least 6 feet below the surface (or alternative depth if approved by Ecology), and institutional controls are used to manage remaining contamination.

Barriers to Exposure: WAC 173-340-7491(1)(b)

☐ All contaminated soil, is or will be,* covered by physical barriers (such as buildings or paved roads) that prevent exposure to plants and wildlife, and institutional controls are used to manage remaining contamination.

Undeveloped Land: WAC 173-340-7491(1)(c)

☐ There is less than 0.25 acres of contiguous[#] undeveloped[±] land on or within 500 feet of any area of the Site and any of the following chemicals is present: chlorinated dioxins or furans, PCB mixtures, DDT, DDE, DDD, aldrin, chlordane, dieldrin, endosulfan, endrin, heptachlor, heptachlor epoxide, benzene hexachloride, toxaphene, hexachlorobenzene, pentachlorophenol, or pentachlorobenzene.

☒ For sites not containing any of the chemicals mentioned above, there is less than 1.5 acres of contiguous[#] undeveloped[±] land on or within 500 feet of any area of the Site.

Background Concentrations: WAC 173-340-7491(1)(d)

☐ Concentrations of hazardous substances in soil do not exceed natural background levels as described in WAC 173-340-200 and 173-340-709.

* An exclusion based on future land use must have a completion date for future development that is acceptable to Ecology.

[±] "Undeveloped land" is land that is not covered by building, roads, paved areas, or other barriers that would prevent wildlife from feeding on plants, earthworms, insects, or other food in or on the soil.

[#] "Contiguous" undeveloped land is an area of undeveloped land that is not divided into smaller areas of highways, extensive paving, or similar structures that are likely to reduce the potential use of the overall area by wildlife.

B. Simplified evaluation.

1. Does the Site qualify for a simplified evaluation?

☐ Yes *If you answered **"YES,"** then answer **Question 2** below.*

☐ No or Unknown *If you answered **"NO"** or **"UNKNOWN,"** then skip to **Step 3C** of this form.*

2. Did you conduct a simplified evaluation?

☐ Yes *If you answered **"YES,"** then answer **Question 3** below.*

☐ No *If you answered **"NO,"** then skip to **Step 3C** of this form.*

3. Was further evaluation necessary?

☐ Yes *If you answered **"YES,"** then answer **Question 4** below.*

☐ No *If you answered **"NO,"** then answer **Question 5** below.*

4. If further evaluation was necessary, what did you do?

☐ Used the concentrations listed in Table 749-2 as cleanup levels. *If so, then skip to **Step 4** of this form.*

☐ Conducted a site-specific evaluation. *If so, then skip to **Step 3C** of this form.*

5. If no further evaluation was necessary, what was the reason? *Check all that apply. Then skip to **Step 4** of this form.*

Exposure Analysis: WAC 173-340-7492(2)(a)

☐ Area of soil contamination at the Site is not more than 350 square feet.

☐ Current or planned land use makes wildlife exposure unlikely. Used Table 749-1.

Pathway Analysis: WAC 173-340-7492(2)(b)

☐ No potential exposure pathways from soil contamination to ecological receptors.

Contaminant Analysis: WAC 173-340-7492(2)(c)

☐ No contaminant listed in Table 749-2 is, or will be, present in the upper 15 feet at concentrations that exceed the values listed in Table 749-2.

☐ No contaminant listed in Table 749-2 is, or will be, present in the upper 6 feet (or alternative depth if approved by Ecology) at concentrations that exceed the values listed in Table 749-2, and institutional controls are used to manage remaining contamination.

☐ No contaminant listed in Table 749-2 is, or will be, present in the upper 15 feet at concentrations likely to be toxic or have the potential to bioaccumulate as determined using Ecology-approved bioassays.

☐ No contaminant listed in Table 749-2 is, or will be, present in the upper 6 feet (or alternative depth if approved by Ecology) at concentrations likely to be toxic or have the potential to bioaccumulate as determined using Ecology-approved bioassays, and institutional controls are used to manage remaining contamination.

C. Site-specific evaluation. A site-specific evaluation process consists of two parts: (1) formulating the problem, and (2) selecting the methods for addressing the identified problem. Both steps require consultation with and approval by Ecology. *See* WAC 173-340-7493(1)(c).

1. Was there a problem? *See* WAC 173-340-7493(2).

☐ Yes *If you answered **"YES,"** then answer **Question 2** below.*

☐ No *If you answered **"NO,"** then identify the reason here and then skip to **Question 5** below:*

- ☐ No issues were identified during the problem formulation step.
- ☐ While issues were identified, those issues were addressed by the cleanup actions for protecting human health.

2. What did you do to resolve the problem? *See* WAC 173-340-7493(3).

- ☐ Used the concentrations listed in Table 749-3 as cleanup levels. *If so, then skip to **Question 5** below.*
- ☐ Used one or more of the methods listed in WAC 173-340-7493(3) to evaluate and address the identified problem. *If so, then answer **Questions 3 and 4** below.*

3. If you conducted further site-specific evaluations, what methods did you use?
Check all that apply. See WAC 173-340-7493(3).

- ☐ Literature surveys.
- ☐ Soil bioassays.
- ☐ Wildlife exposure model.
- ☐ Biomarkers.
- ☐ Site-specific field studies.
- ☐ Weight of evidence.
- ☐ Other methods approved by Ecology. If so, please specify:

4. What was the result of those evaluations?

- ☐ Confirmed there was no problem.
- ☐ Confirmed there was a problem and established site-specific cleanup levels.

5. Have you already obtained Ecology's approval of both your problem formulation and problem resolution steps?

☐ Yes If so, please identify the Ecology staff who approved those steps:

☐ No

Step 4: SUBMITTAL

Please mail your completed form to the Ecology site manager assigned to your Site. If a site manager has not yet been assigned, please mail your completed form to the Ecology regional office for the County in which your Site is located.

Northwest Region: Attn: VCP Coordinator 3190 160th Ave. SE Bellevue, WA 98008-5452	**Central Region:** Attn: VCP Coordinator 15 W. Yakima Ave., Suite 200 Yakima, WA 98902
Southwest Region: Attn: VCP Coordinator P.O. Box 47775 Olympia, WA 98504-7775	**Eastern Region:** Attn: VCP Coordinator N. 4601 Monroe Spokane WA 99205-1295

SOURCE: King County iMap

6347 Seaview Avenue NW
Seattle, Washington 98107
(206) 781-1449

500 Feet Radius Map

YARROW BAY YACHT BASIN AND MARINA
5207 LAKE WASHINGTON BOULEVARD NE
KIRKLAND, WASHINGTON

PROJECT NO.: Z076000030		
APPENDIX A	SCALE:N/A	REVIEWED BY: NB
DRAWN BY: N/A	DATE: 4/2016	FILE: 500' Radius

TABLE 1
SOIL AND GROUNDWATER CLEANUP LEVELS

Constituent of Concern	Soil - MTCA Method A (Table Value)	Groundwater - MTCA Method A (Table Value)
	(mg/kg)	*(µg/L)*
TPH-G	30/100*	800/1,000*
TPH-D	2,000	500
TPH-O	2,000	500
Benzene	0.03	5
Toluene	7	1,000
Ethylbenzene	6	700
Total Xylenes	9	1,000
Lead	250	15

Notes:

MTCA = Model Toxics Control Act

TPH-G = Total Petroleum Hydrocarbons as Gasoline

TPH-D = Total Petroleum Hydrocarbons as Diesel

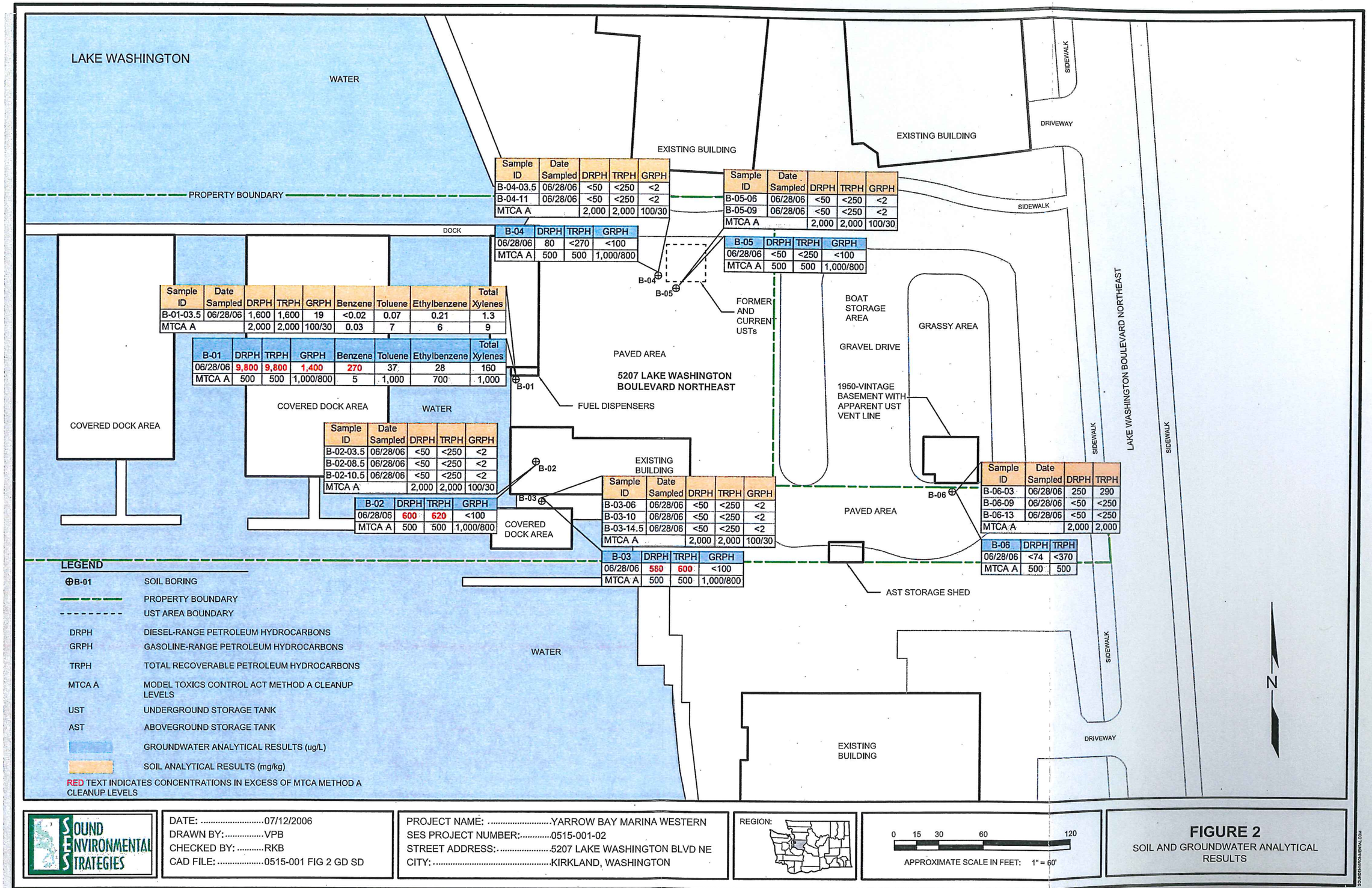
TPH-O = Total Petroleum Hydrocarbons as Oil

mg/kg = milligrams per kilogram

µg/L = micrograms per liter

***** = TPH-G cleanup level when benzene is not present

-- = MTCA Method A cleanup level not listed



Sample ID	Date Sampled	DRPH	TRPH	GRPH
B-04-03.5	06/28/06	<50	<250	<2
B-04-11	06/28/06	<50	<250	<2
MTCA A		2,000	2,000	100/30

B-04	DRPH	TRPH	GRPH
06/28/06	80	<270	<100
MTCA A	500	500	1,000/800

Sample ID	Date Sampled	DRPH	TRPH	GRPH
B-05-06	06/28/06	<50	<250	<2
B-05-09	06/28/06	<50	<250	<2
MTCA A		2,000	2,000	100/30

B-05	DRPH	TRPH	GRPH
06/28/06	<50	<250	<100
MTCA A	500	500	1,000/800

Sample ID	Date Sampled	DRPH	TRPH	GRPH	Benzene	Toluene	Ethylbenzene	Total Xylenes
B-01-03.5	06/28/06	1,600	1,600	19	<0.02	0.07	0.21	1.3
MTCA A		2,000	2,000	100/30	0.03	7	6	9

B-01	DRPH	TRPH	GRPH	Benzene	Toluene	Ethylbenzene	Total Xylenes
06/28/06	9,800	9,800	1,400	270	37	28	160
MTCA A	500	500	1,000/800	5	1,000	700	1,000

Sample ID	Date Sampled	DRPH	TRPH	GRPH
B-02-03.5	06/28/06	<50	<250	<2
B-02-08.5	06/28/06	<50	<250	<2
B-02-10.5	06/28/06	<50	<250	<2
MTCA A		2,000	2,000	100/30

B-02	DRPH	TRPH	GRPH
06/28/06	600	620	<100
MTCA A	500	500	1,000/800

Sample ID	Date Sampled	DRPH	TRPH	GRPH
B-03-06	06/28/06	<50	<250	<2
B-03-10	06/28/06	<50	<250	<2
B-03-14.5	06/28/06	<50	<250	<2
MTCA A		2,000	2,000	100/30

B-03	DRPH	TRPH	GRPH
06/28/06	580	600	<100
MTCA A	500	500	1,000/800

Sample ID	Date Sampled	DRPH	TRPH
B-06-03	06/28/06	250	290
B-06-09	06/28/06	<50	<250
B-06-13	06/28/06	<50	<250
MTCA A		2,000	2,000

B-06	DRPH	TRPH
06/28/06	<74	<370
MTCA A	500	500

LEGEND

⊕B-01	SOIL BORING
— — —	PROPERTY BOUNDARY
- - - - -	UST AREA BOUNDARY
DRPH	DIESEL-RANGE PETROLEUM HYDROCARBONS
GRPH	GASOLINE-RANGE PETROLEUM HYDROCARBONS
TRPH	TOTAL RECOVERABLE PETROLEUM HYDROCARBONS
MTCA A	MODEL TOXICS CONTROL ACT METHOD A CLEANUP LEVELS
UST	UNDERGROUND STORAGE TANK
AST	ABOVEGROUND STORAGE TANK
	GROUNDWATER ANALYTICAL RESULTS (ug/L)
	SOIL ANALYTICAL RESULTS (mg/kg)

RED TEXT INDICATES CONCENTRATIONS IN EXCESS OF MTCA METHOD A CLEANUP LEVELS

SOUND ENVIRONMENTAL STRATEGIES

DATE: 07/12/2006
DRAWN BY:.....VPB
CHECKED BY: .....RKB
CAD FILE: .....0515-001 FIG 2 GD SD

PROJECT NAME: .....YARROW BAY MARINA WESTERN
SES PROJECT NUMBER:.....0515-001-02
STREET ADDRESS:.....5207 LAKE WASHINGTON BLVD NE
CITY: .....KIRKLAND, WASHINGTON

REGION:

0 15 30 60 120
APPROXIMATE SCALE IN FEET: 1" = 60'

FIGURE 2
SOIL AND GROUNDWATER ANALYTICAL RESULTS

SOUNDENVIRONMENTAL.COM

DEPTH	DRO	ORO	GRO	B	T	E	X
5'	1,500	140	**<95**	**1.4**	3.2	**6.9**	**23.6**

COVERED DOCK

EX1–SD–N

DEPTH	DRO	ORO	GRO	B	T	E	X
4'	<28	94	<3.7	<0.020	<0.037	<0.037	<0.037

EX1–BTM–PLT

EX1–SD–E

DEPTH	DRO	ORO	GRO	B	T	E	X
5'	<28	<57	<4.0	<0.020	<0.040	<0.040	<0.040

DEPTH	DRO	ORO	GRO	B	T	E	X
6'	**2,000**	71	**1,100**	**2.4**	**8.1**	**10**	**57**

EX1–BTM–NW

LAKE WASHINGTON

DEPTH	DRO	ORO	GRO	B	T	E	X
9'	<33	<65	<5.3	<0.02	<0.053	<0.053	<0.053

EX1–SD–C

EX1–SD–S

DEPTH	DRO	ORO	GRO	B	T	E	X
4'	<27	59	<3.6	<0.02	<0.036	<0.036	<0.036

DEPTH	DRO	ORO	GRO	B	T	E	X
6'	<30	<60	<3.8	<0.020	<0.038	<0.038	<0.038

EX1–SD–W

EX1–BTM–SW

DEPTH	DRO	ORO	GRO	B	T	E	X
8'	<29	<58	<4.1	<0.020	<0.041	<0.041	<0.041

DEPTH	DRO	ORO	GRO	B	T	E	X
6'	<28	<56	<3.8	<0.020	<0.038	<0.038	<0.038

EX1–SD–SW

BULK HEAD

0 5

APPROXIMATE SCALE IN FEET

N

LEGEND

EX1–BTM–NW ● SOIL SAMPLE LOCATION

–·–·–·– LIMITS OF EXCAVATION

— — — HORIZONTAL TIE BACK CABLES

Ⓟ PILINGS

UST UNDERGROUND STORAGE TANK

SOIL ANALYTICAL RESULTS IN MILLIGRAMS PER KILOGRAM

DEPTH IN FEET BELOW GROUND SURFACE

GRO = TOTAL PETROLEUM HYDROCARBONS (TPH) AS GASOLINE-RANGE ORGANICS

DRO = TPH AS DIESEL-RANGE ORGANICS

ORO = TPH AS OIL-RANGE ORGANICS

B = BENZENE
T = TOLUENE
E = ETHYLBENZENE
X = TOTAL XYLENES

BOLD = INDICATES CONCENTRATIONS EXCEED WASHINGTON STATE DEPARTMENT OF ECOLOGY MODEL TOXICS CONTROL ACT CLEANUP REGULATION METHOD A CLEANUP LEVELS

< = INDICATES CONCENTRATIONS NOT DETECTED ABOVE THE STATED LABORATORY PRACTICAL QUANTITATION LIMIT

FARALLON CONSULTING
975 5th Avenue Northwest
Issaquah, WA 98027

FIGURE 3

FUEL DISPENSER EXCAVATION AREA
SHOWING ANALYTICAL RESULTS
YARROW BAY MARINA WESTERN PARCEL
5207 LAKE WASHINGTON BOULEVARD NE
KIRKLAND, WASHINGTON

FARALLON PN: 112–001

Drawn By: DEW | Checked By: DC | Date: 11/06/08 | Disk Reference: 112001