FOCUSED FEASIBILITY STUDY

THE HUNGRY WHALE
1680 NORTH MONTESANO STREET
WESTPORT, WASHINGTON

Stantec

August 2013

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WESTPORT, WASHINGTON

Submitted by:
Stantec Consulting Services, Inc.
9400 SW Barnes Road Suite 200
Portland, Oregon 97225

Prepared for:
The Port of Grays Harbor
111 South Wooding Street
Aberdeen, Washington 98520

Date
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Prepared by:

Pat Vaughan, MS, CEM
Principal

Reviewed by:

Marc Sauze, PE
Senior Engineer

Table of Contents

Table of Contents

FIGURES

TABLES

1.0 INTRODUCTION

This report presents a Focused Feasibility Study (FFS) for an area of shallow groundwater impacted with petroleum hydrocarbons beneath the Hungry Whale property located at 1680 North Montesano Street, Westport, Grays Harbor County, Washington (the "Site"). This FFS includes a summary of contamination known to be present; available information about the source of the contaminants; results of the previous investigations completed to define the extent of the impacted area; and the potential routes of exposure and human health risk resulting from the contamination. The FFS describes several potential alternative approaches for cleanup actions; evaluates the technical feasibility, effectiveness, protectiveness and cost of each alternative; and identifies a preferred remedial alternative.

The FFS was prepared to address requirements under the Washington Model Toxics Cleanup Act (MTCA), as outlined in Washington Administrative Code (WAC) Chapter 173-340-350.

1.1 SUBJECT PROPERTY DESCRIPTION

The Site is owned by the Port of Grays Harbor (The Port) and is leased as a retail gasoline fueling station. The Site is located at the intersection of North Montesano Street and Wilson Avenue in Westport, Washington (Figure 1). Improvements include a convenience store and a retail gasoline station, equipped with a fuel delivery system that includes three underground storage tanks (USTs) containing gasoline, and one dispenser island, equipped with four fuel dispensers. The surface of the Site consists of weathered asphalt and/or concrete.

For the purposes of this report, Wilson Avenue is assumed to run an east-west direction along the north side of the Site, and Montesano Street is assumed to run a north-south direction along the western boundary of the Site. A generalized Site plan is included on Figure 2.

A storage building and a single-family residence are located on the adjacent parcels to the east, and Kings Restaurant and Sports Bar is located approximately 100 feet east of the Site. The undeveloped land located to the west and south of the Site is owned by the Port. Westport Shipyard occupies several large warehouse structures to the north of the Site.

2.0 REMEDIAL INVESTIGATION SUMMARY

Results of the prior Remedial Investigations performed by Stantec are presented in detail in the following reports, previously submitted to the Washington Department of Ecology (Ecology):

- *Supplemental Remedial Investigation Report*, Stantec, January 22, 2012;
- *Soil Gas Sampling and Groundwater Monitoring Assessment*, Stantec, January 25, 2012; and,
- *Indoor/Outdoor Air Sampling Report,* Stantec, April 25, 2012.

2.1 OVERVIEW OF PRIOR INVESTIGATIONS

The following presents a summary of the historical environmental investigations completed by Stantec and others to date.

2.1.1 Previous Subsurface Investigations

In March 1991, following the reported release of approximately 2,000 gallons of gasoline from a leaking product delivery line, two existing USTs were decommissioned; one 2,000 gallon gasoline UST was decommissioned by removal, and one 6,000-gallon gasoline UST was decommissioned in place (interior of UST was cleaned and filled with a sand and concrete slurry). Both USTs were reportedly located immediately to the southwest of the convenience store building.

In November 1991, following the UST removal, UST in-place closure, and limited remedial excavation (as described in section 2.1.2), Ecology contracted with Science Applications International Corporation (SAIC) to conduct a remedial investigation/feasibility study (RI/FS). SAIC installed a total of six groundwater monitoring wells to determine the extent of groundwater impacts. Laboratory analysis of groundwater samples identified total petroleum hydrocarbons, quantified in the gasoline range (TPH-G), and benzene, toluene, ethylbenzene, and total xylenes (collectively BTEX) at concentrations exceeding MTCA Method A Cleanup Levels. SAIC installed three additional monitoring wells in May 1992 to further characterize the Site and to collect data to aid in remedial system design. At that time, floating petroleum product was observed on the water table.

Four groundwater monitoring events were conducted by Development, Planning Research and Analysis (DPRA) and SAIC between 1991 and 1993 (DPRA and SAIC 1993). Laboratory analysis of groundwater samples collected from the groundwater monitoring well network contained concentrations of TPH-G and BTEX well above applicable cleanup levels for unrestricted land use. Measurable SPH was observed in groundwater monitoring wells located in the central and northwestern portions of the Site and in a monitoring well located north of the on-Site storage building.

In August 1993, Ecology approached the Port of Grays Harbor and requested that they assume responsibility for Site cleanup.

Between July 1997 and October 1999, a biosparge remediation system was operated at the Site (discussed further in section 2.1.2 of this document). Contaminant concentrations exhibited an initial decline; however concentrations rebounded to pre-treatment levels in November 2000.

Based on the November 2000 contaminant rebound, in 2004 Ecology requested an additional investigation to establish baseline concentrations of TPH-G and BTEX in both soil and groundwater. In January 2005, Urban Redevelopment, LLC (UR) advanced six soil borings on-Site, five of which were completed as groundwater monitoring wells. A metal culvert located at the southwest corner of the Site was punctured during advancement of a boring. SPH was noted floating on the water within the culvert. The thickness of the SPH was not specified. The highest concentrations of TPH-G and BTEX in groundwater were detected in samples collected from the southwestern portion of the Site during the January 2005 investigation. In general, concentrations of these compounds were similar to those prior to installation and operation of the biosparge remediation system.

In April 2007, Sound Environmental Strategies (SES) conducted a remedial investigation of the Site in order to identify the source(s) of the contamination beneath the site; more fully assess the vertical and lateral extent of the contamination; and, assist in the development of a remedial action. Field activities were conducted by SES between April and October 2007 and consisted of:

- Sampling and analysis of soil samples from seven on-Site soil borings;
- Completion of six of the borings as groundwater monitoring wells;
- Collection and analysis of groundwater samples from 16 monitoring wells;
- Advancement of nine Geoprobe borings within public right-of-ways in North Montesano Street and Wilson Avenue to delineate the extent of soil contamination previously identified along northern and western Site boundaries;
- Recovery of SPH within the culvert; and,
- Collection of water samples from a drinking water well located at a nearby residence.

SES noted that laboratory analysis identified TPH-G and benzene in one or more soil samples collected on-Site at concentrations above their respective MTCA Method A cleanup levels. Soil contamination was also found to extend beneath much of the North Montesano Street and Wilson Avenue right-of-ways to the west and north of the Site, but was not encountered in soil samples collected from borings advanced further west and north of the North Montesano Street and Wilson Avenue right-of-ways.

During a June 2007 groundwater monitoring event, SPH was recorded in monitoring wells MW-04 and MW-09. In addition, concentrations of TPH-G and one or more of the BTEX constituents were detected in excess of their respective MTCA Method A cleanup levels in groundwater samples collected from seven of the remaining 16 wells. The contaminant distribution in groundwater closely resembled the distribution of PCS and did not appear to extend to the west or north of the adjacent right-of-ways or to the south or east of the Site.

On December 12, 2011, Stantec supervised the installation of seven shallow soil gas probes to evaluate the possible presence of subsurface soil gas impacted by petroleum hydrocarbons originating from past or current releases. Stantec collected soil vapor samples from the shallow soil vapor probes on December 20, 2011. Laboratory analysis of soil vapor samples indicated that detected concentrations of BTEX, 1,2,4-Trimethylbenzene, and 1,3,5-Trimethylbenzene exceeded their respective Table B-1 Screening Levels in five of the seven soil vapor samples. Results of the shallow soil vapor assessment are presented as Table 2.

Due to elevated concentrations of volatile organic compounds (VOCs) detected in the soil vapor samples collected in close proximity to the building, Ecology recommended collecting indoor air samples to evaluate for possible vapor intrusion[1]. On March 21, 2012, Stantec collected two indoor and two outdoor ambient air samples. Laboratory analysis of ambient air samples indicated that none of the VOCs analyzed were detected at concentrations at or above the Method C indoor air screening levels presented in Table B-1 of the *Washington Department of Ecology Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action, Review Draft, October 2009*. Results of the ambient air sampling event are presented as Table 3.

2.1.2 Previous Remedial Measures: 1991 through 1999

Remedial Excavation – 1991

During the March 1991 UST decommissioning activities conducted by Olympus Environmental, petroleum contaminated soil (PCS) was observed in the vicinity of the USTs. The accessible PCS was excavated from beneath and around the former USTs. The amount of PCS removed has not been identified in documents made available for review by Stantec. Test pits were excavated in 1991 by Olympus Environmental on the Site and across Wilson Avenue to the north. The test pit located across Wilson Avenue was excavated to evaluate the potential risk for impacts that may have resulted from a Cardtrol facility that formerly operated on the north-adjacent property. No evidence of contamination was reportedly encountered in the vicinity of the former Cardtrol facility. During tank removal in March 1991, floating petroleum product was observed floating on the water table in one excavation. PCS was reportedly encountered at concentrations in excess of MTCA Method A Cleanup Levels for TPH-G, lead, and BTEX.

There are no historical records of remedial efforts at the Site between 1991 and 1997.

[1] Ecology has not developed guidance to assess vapor intrusion at sites where workers are exposed to the same chemicals in the work place (e.g., gasoline filling stations)

Biosparge Remediation – 1997 - 1999

A biosparge remediation system was installed by Hobby, Ltd. in June 1997 and was operated between July 1997 and October 1999. Biosparging is an in situ remediation technology that uses indigenous microorganisms to biodegrade organic constituents in the saturated zone. In biosparging, air (or oxygen) is injected into the saturated zone to increase the biological activity of the indigenous microorganisms. Biosparging can be used to reduce concentrations of petroleum constituents that are dissolved in groundwater, adsorbed to soil below the water table, and within the capillary fringe.

The system installed at the Site operated between July 1997 and October 1999. The system consisted of a series of injection wells situated in the central portion of the Site and eleven extraction wells surrounding the injection wells at the outer periphery of the Site. The extracted groundwater was pumped through a combustion engine intended to heat the groundwater and facilitate the volatization of contaminants. Following treatment, the groundwater was reinjected into the subsurface via an infiltration gallery consisting of five injection wells located on the central and northeastern portions of the Site. It is presumed that the purpose of the injection wells was to reduce contaminate concentrations through breakdown by microorganisms and through volatization. The extraction wells were presumably in place to increase the effect of injection activities by pulling groundwater toward the edges of the Site in all directions and to recover contaminated groundwater. Substantial declines in TPH-G and BTEX were initially observed during operation of the remediation system; however, contaminant concentrations exhibited a rebound to pretreatment levels in November 2000, after the system had been shut down.

Stantec is not aware of any in-situ remedial action at the Site since the biosparging system was discontinued in October 1999.

Metal Culvert Investigation (2005) and Interim Remedial Action (2007)

As a result of the rebound in contaminant concentrations, Ecology requested additional Site investigation to establish baseline soil and groundwater concentrations. Additional soil borings were advanced in early 2005 in various locations and, during these soil boring activities, a metal culvert was encountered near the southwest corner of the Site. The soil boring punctured the top of the culvert, and what appeared to be a layer of SPH was noted floating on the water that had collected in the culvert.

The subsurface culvert was eventually unearthed in 2007 as part of an interim remedial action. SPH was noted in the culvert at an approximate thickness of two inches. A mixture of weathered gasoline and water was removed through vacuum extraction. The contents of the culvert, estimated at approximately 1,620 gallons of liquid, were removed. Approximately 400 gallons of this total was considered SPH in the form of weathered gasoline.

2.1.3 Analysis of Previous Remedial Measures

The two historical remedial measures (soil excavation and biosparging) have been partially successful at long-term remediation of the hydrocarbon contamination in the subsurface soil and groundwater. The interim remedial action (removal of SPH from the culvert in 2007) addressed the culvert as a source area and reduced additional impacts to groundwater from SPH seeping from the culvert into the groundwater.

The soil excavation measures reportedly removed soils associated with the 2,000 and 6,000 gallon gasoline USTs (SES Draft RI 2008). The removed soils would have been limited to the immediate vicinity of the USTs and would not have included contaminated soils in the source areas. The limited excavation of contaminated soils, followed by backfilling with clean material at the Site, was likely an effective near-source interim and short term remedial measure.

Implementation of biosparging was likely intended to increase the biological activity of indigenous microorganisms, generally found in the saturated zone, through injection of air to enhance aerobic biodegradation of petroleum hydrocarbons. Biosparging can be used to reduce concentrations of petroleum constituents dissolved in groundwater; adsorbed to soil below the water table; and within the capillary fringe. Based on reductions in concentrations of petroleum hydrocarbons, it appears that this measure was initially effective; however, groundwater contaminant concentrations in monitored portions of the site eventually rebounded to previous levels. This rebound is likely attributed to hydrocarbons adsorbed to soil within the vadose zone; the presence of a smear zone created during prolonged low water table elevations; and/or SPH in saturated soil and on the water table. Biosparging is not recommended where free product is present since it can create groundwater mounding, potentially causing free product migration and further spread of contamination. This may be one cause of the apparent anomalous detections of petroleum constituents in MW-23, located near injection well IW-2. Seepage of SPH in the culvert was likely an ongoing contributor of petroleum hydrocarbons to the groundwater. The contaminated, vadose, and saturated zone soils also continued to contribute petroleum hydrocarbons to the groundwater through seasonal groundwater fluctuations in the smear zone.

The remedial measures may have been more effective if the source areas (culvert and soils) had been removed prior to implementation of biosparging. By removing the source areas, residual dissolved-phase hydrocarbons present in groundwater would likely have been reduced significantly during biosparge remediation efforts.

2.2 GROUNDWATER MONITORING

Groundwater monitoring activities have been completed at the Site intermittently since November 1991. To date, Stantec has completed five groundwater monitoring events at the Site (fourth quarter 2011, first through third quarters 2012 and second quarter 2013). Each quarterly groundwater monitoring event included purging and sampling of the following wells: MW02 (UR), MW04, MW07, MW09, MW10, MW22, and MW23. Additionally, during recent quarterly groundwater monitoring events, groundwater samples were collected from the following wells:

- Fourth Quarter 2011: MW03, MW05 (UR), MW06, MW11 through MW14, MW21, MW24, and MW25;
- First and Second Quarter 2012: MW12;
- Third Quarter 2012: MW03 and MW05; and,
- Second Quarter 2013: MW02(UR), MW03(UR), MW04(UR), MW05 through MW14, and MW21 through MW25.

Based on the groundwater elevation measurements collected during the most recent groundwater monitoring event (Second Quarter 2013), groundwater flow direction is to the southeast with an average gradient of approximately 0.01 feet per foot, as depicted on Figure 3.

Prior to well purging and sampling, Groundwater monitoring wells were gauged for the presence of separate phase hydrocarbons (SPH) and depth-to-groundwater. SPH was detected in the following wells during recent groundwater monitoring events completed by Stantec:

- Fourth Quarter 2011 event:
  - MW04: 0.10 feet SPH; and,
  - MW09: 0.01 feet SPH.
- First Quarter 2012 event:
  - MW04: 0.01 feet SPH; and,
  - MW09: 0.01 feet SPH.
- Second Quarter 2012 event:
  - No SPH detected in wells included in groundwater monitoring event.
- Third Quarter 2012 event:
  - MW04: 0.15 feet SPH;
  - MW07: 0.05 feet SPH;
  - MW12: 0.97 feet SPH; and,
  - MW23: 0.15 feet SPH.
- Second Quarter 2013
  - No SPH detected in wells.

Groundwater samples collected in 2011 and 2012 were submitted to Kiff Analytical, LLC of Davis, California for analysis of VOCs (including BTEX), using USEPA Method 8260B, and

TPH-g by NWTPH-Gx. Additionally, selected wells were sampled for the following geochemical parameters: dissolved oxygen, nitrate as NO_3 and sulfates as SO_4 (both by EPA Method 300), total alkalinity (SM 2320B), dissolved methane (RSK 175M), and ferrous iron as Fe+2 (SM 3500). Groundwater samples collected in 2013 were submitted to TestAmerica Inc. in Portland, Oregon for similar analysis.

Reported groundwater concentrations are relatively consistent with other recent reporting periods. The spatial distribution of groundwater impacts indicates the highest contaminant concentrations are in the south/southeast portion of the Site and in the northeast portion (MW-02). Although BTEX and TPH-G were detected for the first time in upgradient MW-05 during the October 2012 sampling event, subsequent laboratory analysis of samples collected in June 2013 did not detect these compounds above laboratory reporting limits. Accordingly, there continues to be no evidence of off-site migration. These results are consistent with historical results of groundwater monitoring.

A summary of recent groundwater monitoring results is presented as Table 1. Groundwater analytical results are presented on Figure 4. Complete analytical reports, including chain-of-custody information, is included as Appendix C.

2.3 VAPOR INTRUSION RISK SCREENING

As discussed in Stantec's April 25, 2012 *Indoor/Outdoor Air Sampling Report – The Hungry Whale*, on December 20, 2011, Stantec collected soil vapor samples from the seven shallow soil vapor probes installed at the Site at the locations depicted on Figure 2. Additionally, on March 21, 2012, Stantec collected two indoor and two outdoor ambient air samples over an approximate eight hour sample interval.

Laboratory analysis of the shallow soil vapor samples indicated that no VOCs were detected at concentrations at or above Table B-1 soil gas screening levels (Method B or C) in samples collected from probes SG-1 and SG-7, located to the north of the on-Site convenience store and approximately 40 feet to the southeast of Wilson Avenue. However, elevated VOC concentrations were reported in analytical results from samples collected from probes SG-2 through SG-6. Results of the shallow soil vapor assessment are included as Table 2.

In response to elevated concentrations of VOCs in the samples collected from the shallow soil vapor probes, Ecology recommended collecting indoor air samples to evaluate for possible vapor intrusion.

Laboratory analysis of the ambient air samples indicated that all chemicals identified (TPH-G and BTEX) in indoor air were well below the 95th percentile concentrations of VOCs in indoor air established as part of national studies[2]. Indoor air results indicate that none of the VOCs analyzed were detected at concentrations at or above the Method C indoor air screening levels

[2] *Background Indoor Air Concentrations of Volatile Organic Compounds in North American Residences (1990-2005): A compilation of Statistics for Assessing Vapor Intrusion*, U.S. EPA OSWER 530-R-10-001, June 2011.

presented in Table B-1 of the *Washington Department of Ecology Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action, Review Draft, October 2009.* Results of the indoor and outdoor ambient air samples are included as Table 3.

2.4 PROPERTY DEVELOPMENT AND HISTORY

The following information has been directly excerpted from the Sound Environmental Strategies (SES) *Draft Final Remedial Investigation Report,* dated June 5, 2008 (2008 SES RI). Information regarding the following history of land uses in the area was reportedly gathered through SES interpretation of aerial photographs of the Site locality, dated 1976, 1981, 1990, and 2000, and is included within this report for completeness.

- 1976: The western portion of the existing Hungry Whale building is visible, and a single fuel-dispensing pump island is located to the west of the building. The location of the USTs on the Site is not evident in the photo. The Site appears to be unpaved. A residence and commercial structures are located on the property adjacent to the east of the Site and what appears to be a commercial structure is located on the Site to the south. Across Wilson Avenue to the north of the Site is what appears to be either a sign or a fuel-dispensing pump island. A concrete pad, similar in appearance to those that commonly cover USTs, is located to the north of the sign/pump island. The land across North Montesano Street, to the west of the Site, is undeveloped.

- 1981: An addition has been made to the eastern portion of the Hungry Whale building, and a canopy now extends over the pump island from the west side of the building. A concrete UST pad is clearly visible extending from the southern side of the Hungry Whale building. Boats and other debris are scattered on the Site and to the southeast of the Site. The pump island/sign and concrete pad remain visible on the property adjacent to the north. No other significant changes are noted.

- 1990: No significant changes are visible on the Site. The sign/pump island and concrete pad have been removed from the Site to the north.

- 1991: In 1991, two USTs located immediately to the south of the convenience store were decommissioned; a 2,000 gallon UST was reportedly excavated and removed from the Site; and a 6,000 gallon UST was closed in place to prevent structural instability of the convenience store. Although the previous reports indicate the former presence of only two USTs, current Ecology records indicate that three USTs have been removed or closed in place at the Site. No information regarding the location, capacity, or content of the third UST was observed in the available public record. Following the closure of the USTs described above, three USTs were installed beneath the central portion of the Site and remain in use today.

- 2000: The concrete pad that formerly extended from the south side of the Hungry Whale building has been removed, and a new concrete pad is visible over the location of the current USTs. The structure to the south of the Site has been removed and a large parking lot has been paved to the southeast. The existing warehouse buildings have been constructed on the property across Wilson Avenue to the north of the Site.

- 2011-2013: At the time of Stantec's visits, the Site remained essentially unchanged from the 2000 SES observations.

2.5 PHYSICAL SETTING OF PROPERTY

2.5.1 Topography

The Site is located on a large barrier beach (i.e. spit) within a low-lying coastal area. The topographic surface at the Site is relatively flat with a gently undulating surface in portions of the surrounding areas. The elevation of the Site ranges from approximately 10 to 15 feet above mean sea level (amsl).

2.5.2 Geology

Based on observations made during previous investigations conducted at the Site, the geology at the Site consists predominately of fine- to medium-grained sand interpreted to be eolian and/or shallow marine deposits. Fine-grained sand and silt encountered in the shallow subsurface was interpreted to be fill or marsh deposits. A silty clay layer was observed beneath portions of the Site and was believed to be representative of dredged marsh or tidal flat sediments that were historically imported as fill.

2.5.3 Hydrogeology

The Site is located on a peninsula surrounded by Grays Harbor (approximately 800 feet to the east) and the Pacific Ocean (approximately 0.8 mile to the west). Tidal flats along Grays Harbor are present to the south and east of the Site. During previous investigations conducted at the Site by UR, DPRA, SAIC, SES, and Stantec, groundwater is generally encountered between 4 to 8 feet below ground surface (bgs), and the flow direction appeared to be variable based on seasonality. A hydrogeologic survey was conducted in 1991 to evaluate diurnal changes in groundwater elevations and flow directions in relation to tidal cycles. The preparers of the survey concluded that the elevation changes measured were insignificant and that tidal influence at the Site was minimal (DPRA and SAIC 1993). During the recent groundwater monitoring event (Stantec October 2012) groundwater flow direction was to the south with an average gradient of approximately 0.01 feet per foot.

3.0 REVISED CONCEPTUAL SITE MODEL

A conceptual Site model (CSM) was developed by SES in their original RI Report (SES 2008). The CSM has been updated in general accordance with the American Society for Testing and Materials (ASTM) Standard Guide E1689-95 (2003) *Developing Conceptual Site Models for Contaminated Sites*. The model is based on the data obtained in site investigations to date, as described in sections 2.1 through 2.3. The CSM is dynamic and will be updated with additional information as it is obtained. A graphical depiction of the Conceptual Site Model is provided in Figure 6.

3.1 AREA OF CONCERN

For purposes of the CSM, the Area of Concern (AOC) is defined as the extent of shallow groundwater (approximately 3 to 6 feet bgs) beneath the Site, where contaminants of potential concern (COPCs) have been detected at concentrations exceeding the MTCA Method A Clean Up Levels. This would include groundwater represented by monitoring wells MW-23 to the north; MW-10 to the west; MW-09, MW-12, MW-07, MW-20 and MW-04 to the south; and MW-02 to the east. The extent of impacts to soil and groundwater from TPH-G and benzene appears to be confined to the Site and its immediate vicinity (less than 50 feet beyond the Site boundary in any direction).

3.2 AFFECTED MEDIA

Affected media include on-Site soil, groundwater and soil vapor.

3.3 CONTAMINANTS OF POTENTIAL CONCERN

The primary COPCs at the site include TPH-G, naphthalene, and BTEX constituents (benzene and naphthalene are the primary risk drivers). These COPCs have been selected based on the historical use of the Site as a retail gasoline service station, as well as the findings of the subsurface investigations that have been conducted on the Site to date.

3.4 POTENTIAL SOURCES OF CONTAMINATION

Based on our review of the available historical information, along with the current distribution of contamination in both soil and groundwater, the primary source areas appear to be the former UST systems located along the south side of the convenience store and the reported 2,000-gallon release from a leaking product line in 1985. Additional potential contaminant sources include surface spills that may have occurred in previously unpaved portions of the Site, as well as more recent minor spills that have likely occurred near the dispenser island in the course of the normal operation of a retail gasoline station. The source of the contaminated soil and groundwater encountered at and near monitoring well MW-23 has not been determined. MW-23 is located upgradient of the UST systems and product lines relative to measured groundwater flow direction across the site and it is therefore not confirmed that impacts in MW-23 originated from the sources.

Regular tightness tests performed on the current USTs and product delivery lines have not indicated a release (SES 2008). Despite these results, significant contaminant levels have historically been observed in groundwater collected in the vicinity of the operational USTs and associated product lines.

3.5 CONTAMINANT FATE AND TRANSPORT

3.5.1 Transport Mechanisms Affecting Distribution of Contaminants

One of the primary mechanisms of contaminant transport at the Site appears to be the lateral migration of separate-and dissolved-phase hydrocarbons near the top of the water table. Site geology is characterized by sandy fill materials and extensive native sand deposits, which provide a relatively permeable medium through which contaminants can migrate. Despite the geologic conditions, the relatively shallow hydraulic gradient appears to have limited the lateral extent of contaminants and confined the bulk of petroleum hydrocarbon contamination to within the boundaries of the Site.

The subsurface culvert present beneath the western boundary of the Site appears to represent a significant preferential pathway for the historic migration of SPH and dissolved-phase hydrocarbons. (SPH within the culvert has reportedly been removed.) The results of subsurface investigations performed by SES indicate that petroleum impacted soil and groundwater remain present within the vicinity of the culvert; however, the full extent of the culvert has not been identified.

3.5.2 Environmental Fate of Contaminants

All of the primary COPCs at the site (TPH-G, BTEX, and naphthalene) have the potential to be degraded in the environment. Once contaminants are released to the environment, they are subject to various processes that can naturally attenuate these compounds over time, including biological and physical processes. Beginning in the first quarter 2012, Stantec began collecting Monitored Natural Attenuation (MNA) groundwater samples to evaluate the effectiveness of contaminant attenuation beneath the Site. Selected groundwater monitoring wells are sampled for MNA parameters including:

- Dissolved oxygen (DO) and oxygen reduction potential (ORP);
- Nitrate as NO_3;
- Sulfate as SO_4;
- Total alkalinity;

- Dissolved methane; and,
- Ferrous iron as Fe^{+2}.

Results of recent MNA parameter analysis indicate that biodegradation is occurring. However, based on the lack of significant decrease in contaminant concentrations in groundwater, subsurface conditions are not particularly favorable for contaminant reductions through biodegradation.

3.6 CONCEPTUAL SITE MODEL

The evaluation of exposure pathways described herein presents the estimated risk to human health and the environment presented by contaminated media based on typical activities performed at the Site. In the event that Site land use or work outside of the typical scope of on-Site activities is performed (e.g., construction, soil excavation, utility repair), the potential routes of exposure should be re-evaluated within the context of those activities.

3.6.1 Direct Contact with Soil

Elevated contaminant concentrations in soil have been encountered during subsurface environmental investigations from depths extending from 0 to 15 bgs in various portions of the Site (SES 2008). However, areas exhibiting elevated concentrations of COPCs are generally limited to areas of the Site paved with asphalt or concrete. A change in Site use, redevelopment or construction activities may bring receptors in contact with petroleum impacted soils. As such, the direct contact pathway for soils (e.g., dermal absorption, incidental ingestion of soil) is considered to be complete.

3.6.2 Groundwater

High concentrations of COPCs have been detected in shallow groundwater beneath the Site. Although the groundwater plume is generally confined beneath areas of the Site paved with asphalt or concrete, historical depths to groundwater are relatively shallow (3 to 7 feet). Accordingly, the direct contact with groundwater pathway (dermal contact, incidental ingestion and inhalation of VOCs partitioning from groundwater) is considered complete for construction/excavation worker scenarios.

3.6.3 Drinking Water

Drinking water to the Site is provided by the City of Westport, and no municipal supply wells are located in the vicinity of the Site. Drinking water samples collected from a residence located adjacent to the east of the Site did not contain detectable concentrations of TPH-G or BTEX constituents. Since there is no documented use of shallow groundwater as potable water supply, ingestion of groundwater (including volatilization of contaminants in tap water) is not considered complete.

3.6.4 Vapor Intrusion Pathway

The presence of contamination in exploratory locations immediately surrounding the on-Site building performed by SES suggests that the contamination extends beneath the building.

Soil vapor samples collected on-Site have identified high concentrations of COPCs (above MTCA Table B-1 Screening Levels) in soil vapor across the Area of Concern. However, indoor air samples collected by Stantec from within the on-Site building have not detected elevated concentrations of COPCs in indoor air at levels consistent with those concentrations detected in outdoor air. The vapor intrusion pathway is thus considered incomplete. However, re-evaluation of this pathway should be performed if any re-development of the site is considered including those activities which may create a preferential pathway from subsurface soil vapor to indoor air.

3.6.5 Terrestrial Ecological Evaluation

Data regarding potential ecological impacts is limited. Information collected to date indicates that existing contamination, including contamination noted in the storm water culvert located on the western boundary of the Site, has likely not migrated off-Site. Based on this data, the potential ecological risk to off-Site receptors is low to non-existent, and this pathway is considered to be incomplete.

3.7 CLEANUP STANDARDS

Washington MTCA regulations define Cleanup Standards for contaminated groundwater and soil in WAC 173-240-700 and 173-340-720. A Cleanup Standard consists of three distinct elements:

- Cleanup Levels (CUL), expressed as allowable concentrations of hazardous substances present in Site groundwater;
- Point of Compliance, the location(s) where groundwater quality is monitored to determine the need for, and effectiveness of, any cleanup action; and,
- Any other applicable state and federal laws

3.7.1 Cleanup Levels

Cleanup levels may be established under MTCA regulations using one of the three following methods:

- Method A CUL for Potable Groundwater are determined using lookup tables published by Ecology with allowable concentrations of several common contaminants. These concentrations must be at least as stringent as concentrations specified in any applicable state or federal laws (including, for example, Maximum Contaminant Levels (MCLs established under the federal Safe Drinking Water Act). In addition, Method A cleanup levels must not exceed natural background concentrations or the practical quantitation limit, whichever is higher.

  Sites that meet Method A CUL generally do not require any further actions or restrictions on future site use.

- Method B CUL for Potable Groundwater use a universal method for determining cleanup levels for all media at all sites. For individual carcinogens, the Method B calculation of CUL is based on not exceeding the upper bound of estimated excess cancer risk (ECR) of one in a million (1×10^{-6}). For non-carcinogenic substances, CUL concentrations are calculated to result in no acute or chronic toxic effects on human health (that is, a hazard quotient ≤ 1) and no significant adverse effects on the propagation of aquatic and terrestrial species. Site-specific risk assessments may be used in establishment of Method B CUL.

  Sites that comply with Method B cleanup levels generally do not require any further actions or restrictions on future site use.

- Method C CUL for Potable Groundwater are established to be protective of human health and the environment for certain specified site uses and conditions (such as, for example, property use limited to industrial activities). Method C CULs may be established and used if: 1) Method A and B CUL are below the naturally-occurring background concentrations; 2) Method A and B CUL have the potential for creating significantly higher health risks than a Method C level; or 3) Method A or B CUL are below technically possible concentrations.

In any event, Method C CUL must be at least as stringent as concentrations established under any other applicable federal or state laws (such as MCLs under the federal Safe Drinking Water Act).

MTCA regulations specify that all groundwater CULs must be based on estimates of the highest beneficial use of the groundwater. The default assumption stated in WAC 173-340-720(1)(a) is that the highest beneficial use of groundwater at most sites is as a source of drinking water, and exposure to hazardous substances through ingestion of drinking water represents the maximum exposure scenario. Alternate groundwater cleanup levels may be proposed if it can be shown that groundwater at a Site does not meet the criteria for potable water. Groundwater may be classified as non-potable if it is not currently used as a potable water source and is not suitable for future potable water use because:

- The groundwater is present in insufficient quantity (yield of 0.5 gallons per minute or less);
- The groundwater contains natural background concentrations of organic or inorganic constituents that make it unsuitable as a drinking water source; or,
- The depth of the groundwater makes it infeasible to recover and use.

Currently, the cleanup level for the Site has not been defined and will be determined based on future Site use

3.7.2 Points of Compliance

To develop a Cleanup Standard for the site, the location where the CUL must be met, defined as the Point of Compliance (POC), must be determined. Two options exist for identifying the POC, a Standard POC and a Conditional POC. WAC 173-340-720(6) defines a Standard POC for groundwater as "established throughout the site from the uppermost level of the saturated zone extending vertically to the lowest depth which could potentially be affected by the site."

When it is demonstrated under WAC 173-340-350 through 390 that it is not practicable to achieve the CUL throughout the site within a reasonable restoration time frame, a Conditional POC may be used. Factors such as potential risks posed by contamination at the site, current and potential future uses of the site, likely effectiveness of institutional controls, toxicity of hazardous substances at the site, and the likely natural attenuation of hazardous substances at the site are all considered in assessing whether a cleanup action provides for a reasonable restoration time frame.

As described in this document, it is not practicable at the Hungry Whale Site to achieve the groundwater CULs throughout the site within a reasonable restoration time frame, nor is it technically or economically feasible. Accordingly, a Conditional POC should be established using monitoring wells MW-3 and MW-4, which are located on the site near the south and southeast (downgradient) property boundaries.

4.0 FEASIBILITY STUDY

4.1 OVERVIEW OF EVALUATION CRITERIA FOR CLEANUP ACTION ALTERNATIVES

Based on available Site characterization data and previous experience with remediation of petroleum hydrocarbon impacted groundwater, a number of potential Site cleanup action alternatives were identified for consideration. Section 4.2 provides a general description of each of the cleanup action components under consideration and lists typical advantages and disadvantages associated with each technology. Section 4.3 presents a Site-specific evaluation of each of the proposed alternatives against the criteria listed in WAC 173-340-360.

These criteria include four threshold criteria (WAC 173-340-360(2)(a):

- Protective of human health and the environment;
- Complies with cleanup standards;
- Complies with applicable state and federal laws; and,
- Provides for compliance monitoring.

Any cleanup action alternative that fails to meet one or more of these threshold criteria was excluded from further detailed evaluation. Each of the alternatives that achieved these threshold requirements was then evaluated further against the following criteria (WAC 173-340-360(2)(b):

- Permanence;
- Long-Term Effectiveness;
- Management of Short-Term Risks;
- Technical Implementability;
- Administrative Implementability;
- Cost; and,
- Consideration of Public Concerns.

4.2 SUMMARY OF CLEANUP ACTION COMPONENTS

The following cleanup measures were considered:

- In-situ Treatment;
- Air Sparging and Soil Vapor Extraction;
- Groundwater Extraction and Treatment;
- Monitored Natural Attenuation;
- Interim Monitoring and Source Removal; and,
- Institutional Controls.

Institutional controls (IC) are included as a supplemental action to be implemented in conjunction with the other listed actions. Further details regarding the purpose of IC is provided in Section 4.2.5.

4.2.1 In Situ Treatment

In-situ treatment of the contaminated groundwater can be achieved using a carbon-based petroleum degradation product such as the proprietary product BOS-200®, an activated carbon/sulfate bioremediation compound. The activated carbon draws in the volatile contamination, and the sulfate salts create a sulfate-reducing environment to biodegrade the petroleum hydrocarbons, particularly benzene. The technology has proven effective in a reduced oxygen or anaerobic environment typically associated with a petroleum hydrocarbon plume.

The injected activated carbon is a mixture of approximately 80% powdered or granulated activated carbon that is combined with a blend of sulfate reduction material and micronutrients. The mixture traps subsurface contamination and the remediation ingredients immediately begin to degrade the contamination. This “treatment” occurs through a biological process that works with or without the presence of subsurface oxygen.

<u>Advantages:</u>

- Technology is appropriate for a gasoline-impacted groundwater;
- Contaminants reduced in-situ;
- Short treatment times under optimal conditions; and,

- No permanent or semi-permanent facilities required.

Disadvantages:

- Fairly new technology without the track record of more traditional remedial approaches;
- Carbon-based petroleum degradation product must come into contact with the contaminant to be effective, which can prove challenging if the exact location of the product is not fully known, resulting in untreated areas;
- For sites with substantial vadose or smear zone contamination, re-contamination of groundwater may occur; and,
- Costs associated with purchasing and injection of the product can be burdensome if multiple injections are required.

4.2.2 Air Sparging and Soil Vapor Extraction (AS/SVE)

Air sparging (AS) is an in-situ remedial technology which reduces concentrations of VOCs that are adsorbed to soils and/or dissolved in groundwater. AS technology involves the injection of air into the saturated zone enabling partitioning of contaminants from the dissolved phase to the vapor phase. Injected air moves vertically and horizontally through the saturated zone creating an underground air stripping process. Ultimately, the injected air migrates to the unsaturated zone where a soil vapor extraction (SVE) system creates negative pressure to capture stripped VOCs. AS can raise dissolved oxygen levels thereby enhancing potential for biodegradation of petroleum contaminants.

The effectiveness of an AS/SVE system is dependent on:

- Permeability of soil;
- Soil structure and stratification;
- Soil moisture; and,
- Depth to groundwater.

A pilot test is recommended for evaluating AS/SVE effectiveness, and developing required design parameters. The pilot test typically includes short term extraction of vapors from a single well (or existing monitoring well) and application of different extraction rates and wellhead vacuums.

Advantages:

- Proven technology, readily available equipment, easy installation;
- Minimal disturbance to site operations;
- Short treatment times (6 months to 2 years); and,
- Requires no removal, treatment, storage, or discharge considerations for groundwater.

Disadvantages:

- Concentration reductions >90% can be difficult to achieve;
- Potential for inducing migration of contaminants;
- Effectiveness may be reduced when applied to sites with low-permeable or stratified soil;
- May require treatment for discharge of extracted vapor to atmosphere; and,
- Air discharge permits generally required.

4.2.3 Groundwater Extraction and Treatment (GWET)

In general, a GWET (aka pump and treat) system is designed to remove contaminated groundwater through a series of extraction wells, pass extracted groundwater through a treatment device (e.g. granulated activated carbon), then discharge the treated groundwater to surface water, storm sewer or publicly owned treatment works (POTW). The technology has three components: groundwater extraction, groundwater treatment, and treated groundwater discharge.

Advantages:

- Proven and mature technology;
- Technology is appropriate for a variety of contaminants including petroleum hydrocarbons; and,
- May be used as a hydraulic barrier to prevent off-site migration of contaminant plumes.

Disadvantages:

- Attainment of cleanup levels typically takes a very long time;

- Pumping depresses the groundwater level leaving residuals sorbed to soil. When groundwater level returns to a normal static level, contaminants sorbed to soil may become dissolved (resulting in a rebound of contaminant concentrations in groundwater);

- Pump and Treat technology may not be feasible for sites with low-permeable zones (less than about 10^{-5} cm/sec) which restrict contaminant flow to extraction wells; and,

- Capital costs for installation and annual costs for O&M are high.

4.2.4 Monitored Natural Attenuation (MNA)

The term "natural attenuation" refers to the reduction in mass or concentration of a compound in groundwater over time due to naturally-occurring physical, chemical and/or biological processes. Physical processes include dispersion, dilution, sorption, and volatilization of dissolved compounds to the vapor phase (e.g., atmosphere or soil gas). Typical chemical mechanisms include ion-exchange reactions (e.g., oxidation, reduction), hydrolysis, and abiotic transformations. Biological degradation and/or transformation occur primarily by aerobic and anaerobic microbial processes, although plant uptake also occurs in some situations.

Ecology (July 2005) has established a five-step process for determining the feasibility of natural attenuation as a remedial alternative. The feasibility of MNA includes evaluation of the following:

- Status of the groundwater plume (e.g., is the plume geometry known and considered to be stable, shrinking, or expanding?). Sites where the contaminant plume is shrinking or no longer increasing in extent would be the most appropriate candidates for MNA;

- Whether site characteristics and the nature of the contaminants indicate that chemical or biological degradation are potential mechanisms of natural attenuation;

- The estimated time frame;

- Whether natural attenuation will be protective of human health and the environment during the estimated remediation time; and,

- Whether source control been implemented to the maximum extent possible.

<u>Conceptual MNA Approach</u>

A conceptual MNA approach for the Site would include monitoring and sampling all existing wells on a semi-annual basis for a period of two years (a total of four events) to confirm the groundwater plume is stable and shrinking. Groundwater samples from monitoring wells would be submitted semi-annually for VOC analysis. Annually, the VOC analysis would be supplemented with the following parameters:

- Field analysis of dissolved oxygen (DO) by USEPA Method 360.1;
- Oxidation-reduction potential (ORP) by American Public Health Association (APHA) Method 2580;
- pH by USEPA Method 150.1;
- Alkalinity by SM20 Method 2320 B;
- Nitrate by USEPA Method 353.2 and sulfate by USEPA Method 300.0;
- Dissolved manganese and iron by USEPA Method 6010;
- Phosphorous by USEPA Method 365.1;
- Ferrous iron by SM20 Method 3500 Fe B Modified; and,
- Total organic carbon (TOC) by SM20 Method 5310 B/C.

The groundwater monitoring data would be evaluated on a semi-annual basis to confirm delineation of the plume, track concentration trends, and evaluate the progress of MNA in achieving the remedial objectives.

Following the completion of four monitoring events and confirmation of plume stability and contaminant reduction, monitoring events would be continued on an annual basis until groundwater quality meets acceptable standards.

4.2.5 Interim Monitoring and Source Removal

The Interim Monitoring and Source Removal alternative comprises interim groundwater monitoring combined with Institutional Controls followed by remedial action as part of an anticipated change in use.

The Site owner, Port of Grays Harbor, leases the Site to a tenant who operates the active retail gasoline fueling station. The lease terminates in 2020. Upon termination of the lease, and as part of the Interim Monitoring and Source Removal alternative, the Port will endeavor to alter the Site use and discontinue operation of the fueling station. The change in Site use will include removal of all fuel storage and distribution infrastructure, at which time the remedial activities will be implemented. Remediation will consist of removing impacted soils in the source areas previously identified and pumping contaminated groundwater. Removing source soils and pumping contaminated groundwater will eliminate a significant portion of contaminant mass and will result in a substantial decrease in concentrations of dissolved petroleum in groundwater beneath the Site. Pumped contaminated groundwater will be treated to remove contaminants prior to discharge to the appropriate conveyance.

In the interim, and prior to change in use in 2020, bi-annual groundwater monitoring will be implemented to confirm the groundwater impacts have remained static and not migrated off-site. Institutional Controls will be employed to restrict groundwater use and require implementation of a contaminated media management plan during any construction activities involving disturbance of the subsurface.

Groundwater monitoring will continue bi-annually for two years following source removal to track decreasing contaminant concentrations.

4.2.6 Institutional Controls (IC)

IC are administrative and/or legal controls that prevent exposure to constituents by limiting land use. To preclude consumption or other use of groundwater at the Site, an IC (e.g., deed restriction) would be placed on the property to increase protectiveness of human health and the environment throughout the duration of the remedial action. Use of IC would be combined with a groundwater monitoring program to confirm delineation and stability of the VOC impacted area (i.e., demonstrate that the plume does not spread) and demonstrate declining concentrations in historically impacted wells. The monitoring program would continue until the groundwater criteria were achieved allowing removal of the institutional control from the Site. Applied to this Site, a restrictive covenant would include the following elements:

- A restriction on installation of drinking water wells in the shallow aquifer on-Site while contaminant concentrations in groundwater exceed applicable Federal Maximum Contaminant Levels (MCLs);
- A restriction on construction or relocation of buildings on-Site that would prevent proper monitoring of groundwater concentrations or result in unacceptable risks from inhalation of vapors containing petroleum hydrocarbons; and,
- A requirement to limit property zoning and use to commercial/industrial activities consistent with the current zoning and uses.

While restrictive covenants have been used for many years, they have sometimes been rendered unenforceable under common law (e.g., waiver, abandonment, acquiescence, adverse possession, foreclosure of a tax lien, the rule against perpetuities, and requirements for privity or appurtenance, etc.). However, in 2007, Washington State enacted the Uniform Environmental Covenants Act (UECA), which establishes environmental covenants for sites in Washington that are remediated under oversight of Ecology or USEPA. Environmental covenants created under the UECA contain activity or land use restrictions on real property that legally stay with the land, regardless of changes of property ownership. The covenants are based on traditional property law principles and are recorded in local land records, thereby binding successive owners of the property. The purpose of the UECA is to ensure that environmental covenants created for a particular Site are not invalidated by conflicts or misunderstandings with other local, state, or federal regulations. The UECA provides clear rights for Ecology to create, record, monitor, enforce, modify, and terminate environmental covenants, and thereby ensure with greater certainty the protection of human health and the environment throughout the life of the environmental covenant, including during real estate transactions or legal actions. Ecology has updated the language in its Model Restrictive (Environmental) Covenant to be consistent with the UECA.

4.3 COMPARISON OF ALTERNATIVES

The overall remedial objective is to reduce hydrocarbon mass in the groundwater in a cost-effective and timely manner. A summary table comparing relative costs is provided in Table 4, attached. The table below defines how each alternative performs in relative terms, in comparison to the overall remediation goals.

Comparison of Alternatives

Technology	Technical Effectiveness	Economics	Ability to Implement
In-Situ Treatment	Good No significant issues suspected with achieving desired injection depths or successfully injecting material into coarse-grained lithology.	Moderate Good cost to closure expected, provided follow-up injection event is not necessary.	Moderate Treatment injection requires contact with contamination to be effective. Paved surface will require re-surfacing at injection points.
AS/SVE	Good Relatively large ROI and adequate mass removal rates expected based on shallow depth to water and coarse-grained lithology.	Moderate AS/SVE equipment, AS/SVE wells, and other infrastructure likely required. O&M costs.	Moderate Procurement of equipment and installation of conveyance piping will be required. Testing and review required to make determination.
GWET	Moderate Less effective removal rates than using AS/SVE technology. Pump test required to determine shallow groundwater recovery.	Poor Costs effectiveness poorer than other alternatives.	Poor Same limitations as with AS/SVE with added issue of treating and discharging contaminated groundwater.

MNA	Poor Groundwater concentrations likely to decrease over medium to long term given the current lack of favorable conditions for MNA.	Moderate Depending on frequency of groundwater monitoring (semi-annual vs annual).	Good No equipment necessary. Monitoring program only.
Interim Monitoring and Source Removal	Good Groundwater concentrations will improve substantially once source is removed as part of Site alterations/redevelopment.	Moderate Depending on remedial excavation costs. Costs dependent on volume.	Good Very reliable remediation technique (source removal through excavation and pumping).

4.4 COST ANALYSIS

Estimated costs were developed for each remedial alternative. Costs were estimated using relative expenses based on our experience at similar sites. The total estimated cost for each alternative includes equipment, installation, sampling and monitoring, and operation and maintenance (O&M) for the anticipated life cycle of remediation. For the 'Interim Monitoring and Source Removal' alternative, costs include estimated costs for groundwater monitoring, remedial excavation, and pumping impacted groundwater.

COMPARISON OF ESTIMATED COSTS- CLEAN-UP ALTERNATIVES Clean-up Action	TOTAL
In-situ Treatment	$388,500
Air Sparge / Soil Vapor Extraction	$422,600
Groundwater Extraction and Treatment	$427,600
Monitored Natural Attenuation	$357,000
Interim Monitoring and Source Removal	$426,000

As shown in the table above, estimated costs are closely clustered, ranging from $357,000 for Monitored Natural Attenuation to $427,600 Groundwater Extraction and Treatment. Costs are sensitive to the estimated time intervals to complete remediation, Table 4, attached, provides a more detailed cost overview including projections of the time required to implement each alternative.

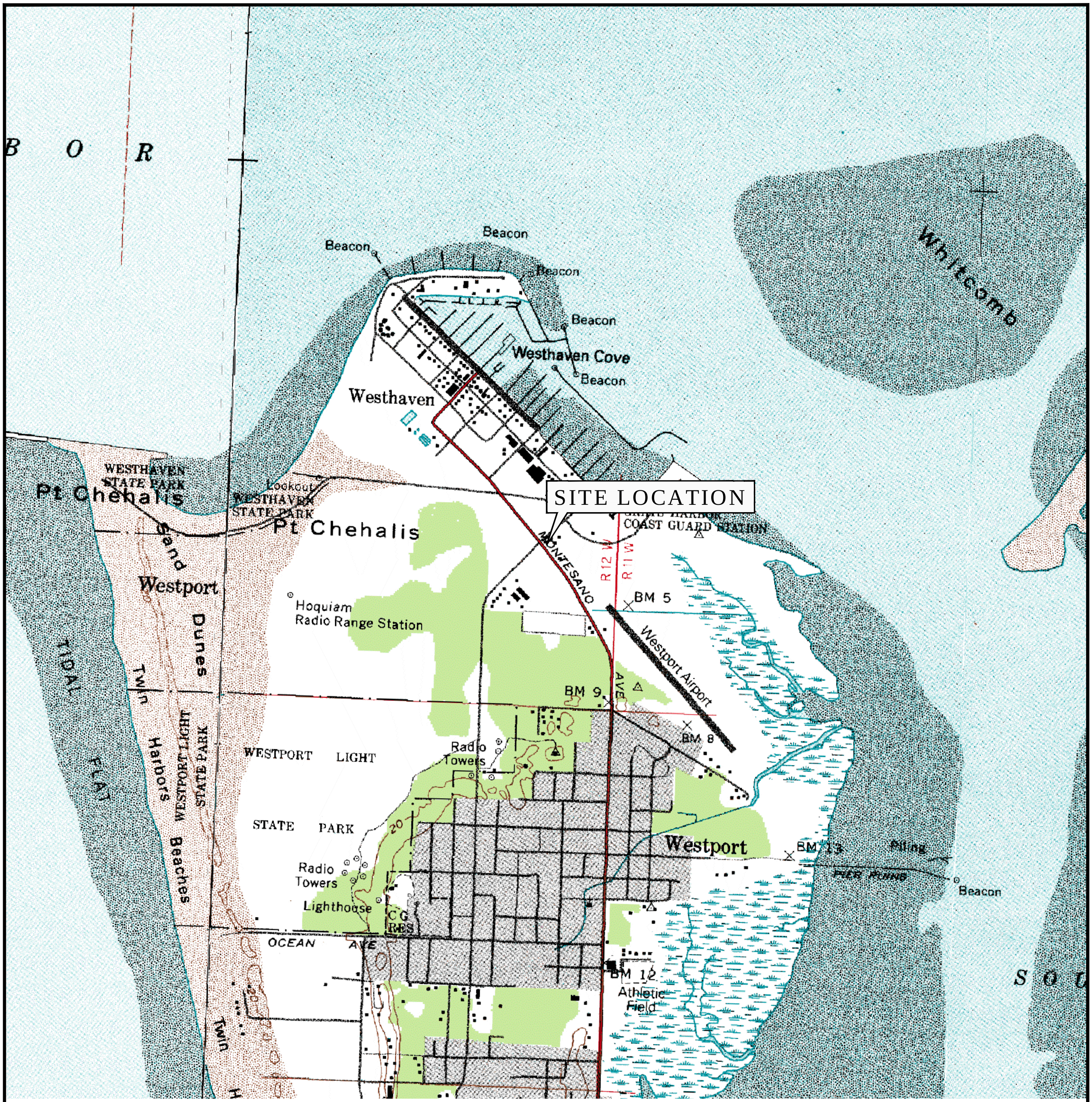
5.0 SELECTION OF PREFERRED CLEANUP ACTION ALTERNATIVE

Based on the evaluation of remedial alternatives, Interim Monitoring and Source Removal, following property change of use, combined with Intuitional Controls is recommended as the preferred Cleanup Action Alternative. As shown in the comparison table in the previous section, costs and clean-up time for this alternative are within range of the other alternatives. The recommendation is based on the most technically efficient and cost-effective approach to reducing contaminant concentrations and achieving site closure, defined as a No Further Action determination from Ecology.

The Interim Monitoring component of this approach will confirm that the impacted groundwater is limited to the Site boundaries and does not migrate off-site. Institutional controls (restricting groundwater use and managing contaminated media during subsurface disturbance activities) will reduce the risks to human health. Follow-up groundwater monitoring, for a period of two years, will be conducted following remedial activities to monitor groundwater quality and support a request for regulatory closure.

A draft Cleanup Action Plan (CAP) will be developed to implement the selected alternative. The draft CAP will include the elements required in Washington Administrative Code 173-340-380 and will be submitted to Ecology for review and approval. Upon review, the CAP will become final and will be considered the Site remedy.

FIGURES



1 1/2 0 1

SCALE IN MILE

1000 0 1000 2000 3000 4000 5000 6000 7000

SCALE IN FEET

REFERENCE: WA Digital Raster Graphics(http://rocky2.ess.washington.edu/data/raster/drgclip/index.html)
7.5 Minute Series, NAD27 WA State Planes, N Zone,Trimmed
Block o46119c3; Downloaded 4/1/10

Stantec
12034 134th COURT NORTHEAST
REDMOND, WASHINGTON 98052
PHONE: (425) 298-1000 FAX: (425) 298-1020

FOR:		SITE LOCATION MAP		FIGURE: 1
THE HUNGRY WHALE 1680 NORTH MONTESANO STREET WESPORT, WASHINGTON				
JOB NUMBER: 212302770	DRAWN BY: JCR	CHECKED BY:	APPROVED BY:	DATE: APRIL 2013

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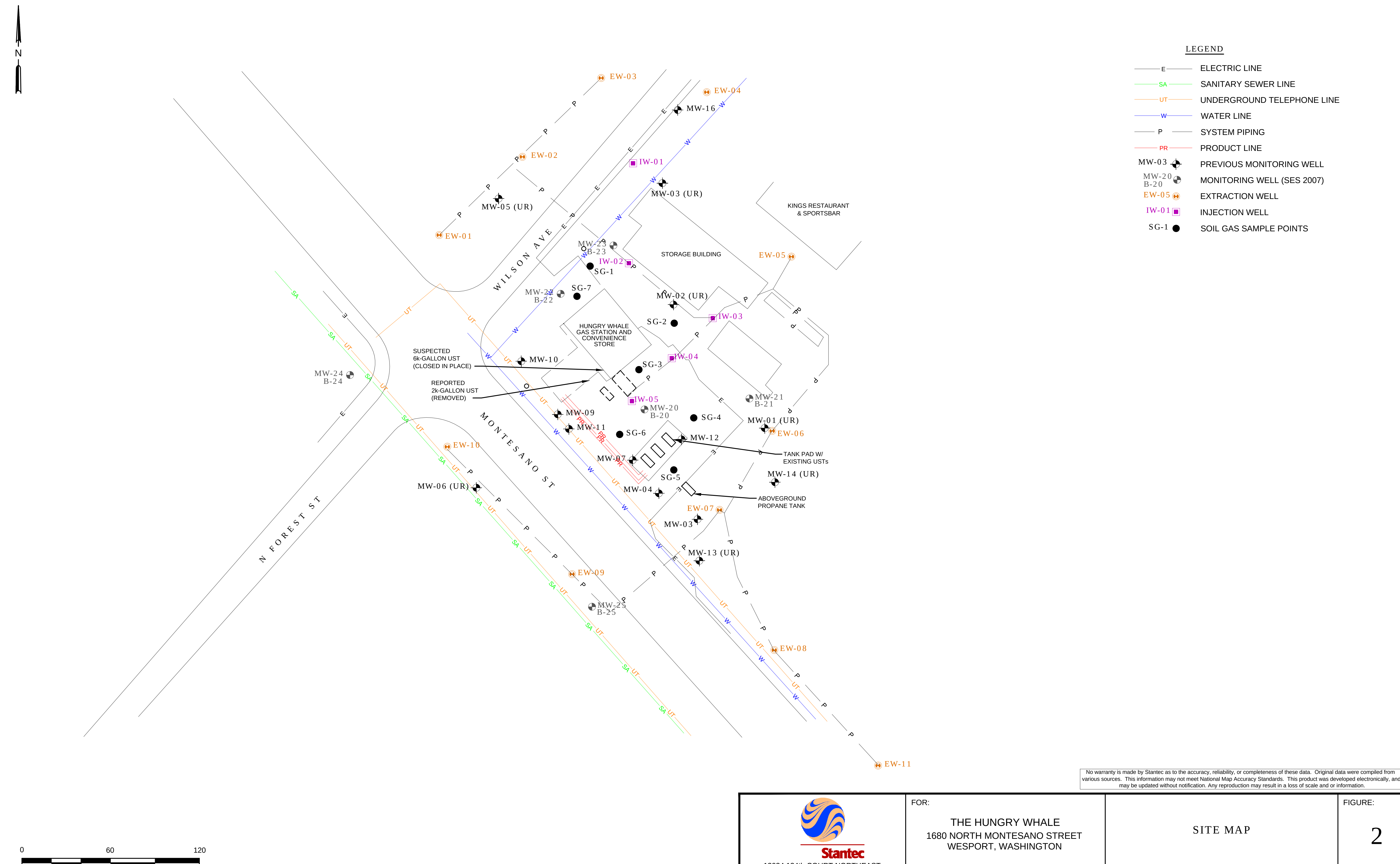

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REDMOND, WASHINGTON 98052
PHONE: (425) 298-1000 FAX: (425) 298-1020

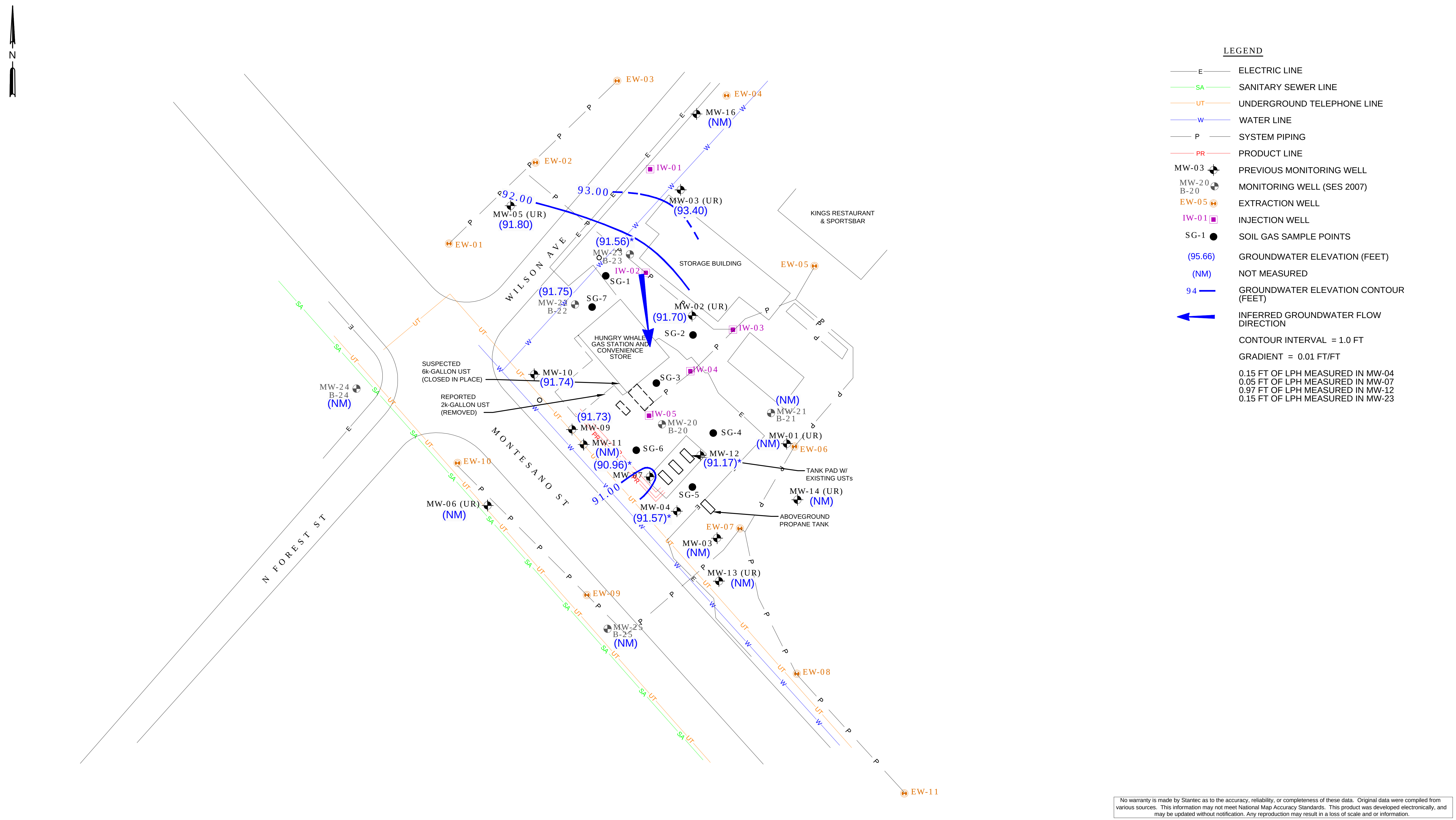
FOR:

THE HUNGRY WHALE
1680 NORTH MONTESANO STREET
WESPORT, WASHINGTON

SITE MAP

FIGURE: 2

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
212302770	JCR			APRIL 2013



0 60 120

APPROXIMATE SCALE IN FEET

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12034 134th COURT NORTHEAST
REDMOND, WASHINGTON 98052
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FOR:

THE HUNGRY WHALE
1680 NORTH MONTESANO STREET
WESPORT, WASHINGTON

GROUNDWATER GRADIENT MAP
(OCTOBER 4, 2012)

FIGURE: 3

JOB NUMBER:	DRAWN BY:	CHECKED BY:	APPROVED BY:	DATE:
212302770	JCR			APRIL 2013

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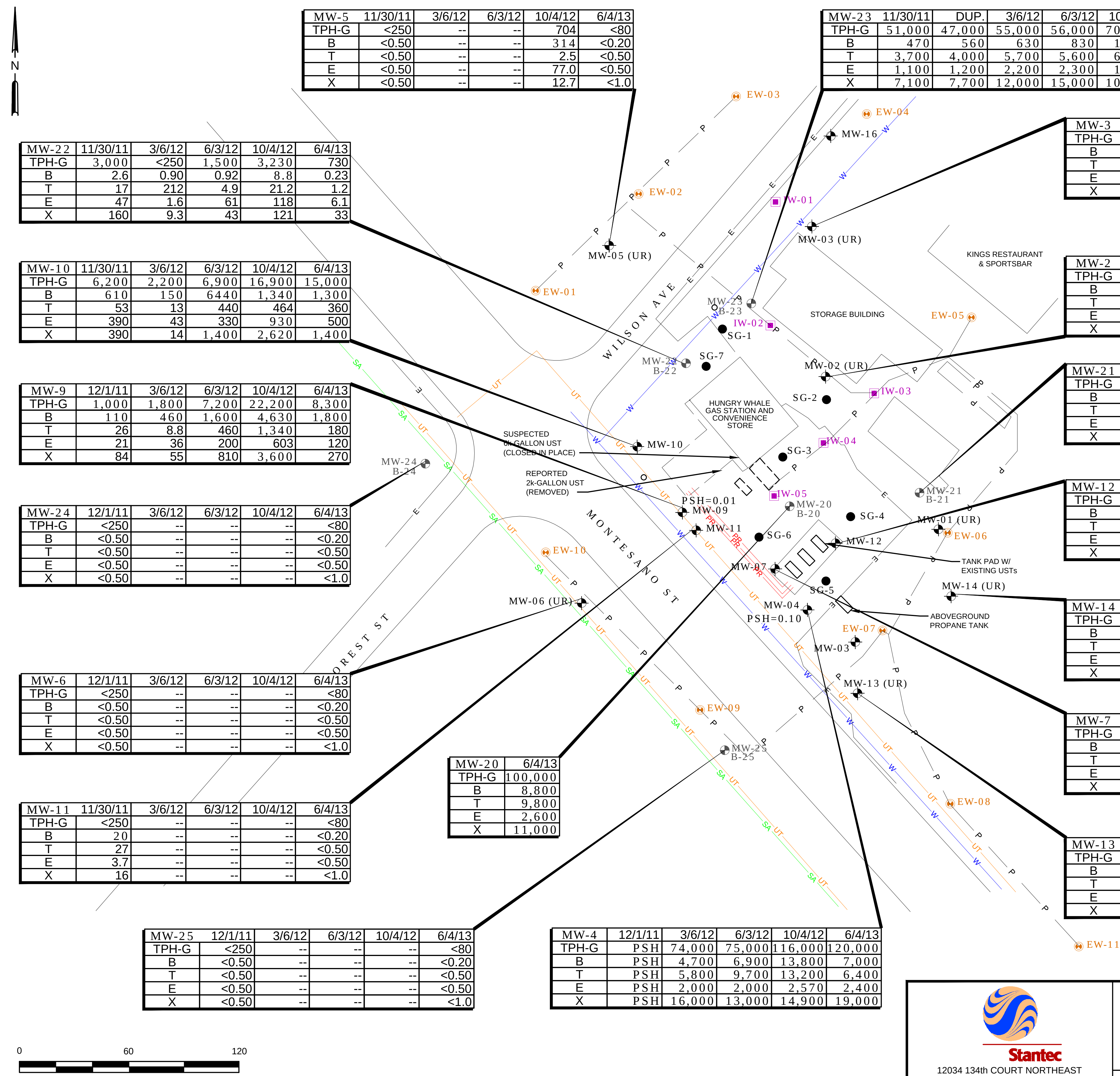


MW-5	11/30/11	3/6/12	6/3/12	10/4/12	6/4/13
TPH-G	<250	--	--	704	<80
B	<0.50	--	--	314	<0.20
T	<0.50	--	--	2.5	<0.50
E	<0.50	--	--	77.0	<0.50
X	<0.50	--	--	12.7	<1.0

MW-23	11/30/11	DUP.	3/6/12	6/3/12	10/4/12	6/4/13
TPH-G	51,000	47,000	55,000	56,000	70,500	88,000
B	470	560	630	830	1,320	770
T	3,700	4,000	5,700	5,600	6,850	5,200
E	1,100	1,200	2,200	2,300	1,580	2,800
X	7,100	7,700	12,000	15,000	10,000	17,000

MW-22	11/30/11	3/6/12	6/3/12	10/4/12	6/4/13
TPH-G	3,000	<250	1,500	3,230	730
B	2.6	0.90	0.92	8.8	0.23
T	17	212	4.9	21.2	1.2
E	47	1.6	61	118	6.1
X	160	9.3	43	121	33

MW-3	12/1/11	3/6/12	6/3/12	10/4/12	6/4/13
TPH-G	<250	--	--	<50	<80
B	<0.50	--	--	<1	<0.20
T	<0.50	--	--	<1	<0.50
E	<0.50	--	--	<1	<0.50
X	<0.50	--	--	<3	<1.0

MW-10	11/30/11	3/6/12	6/3/12	10/4/12	6/4/13
TPH-G	6,200	2,200	6,900	16,900	15,000
B	610	150	6440	1,340	1,300
T	53	13	440	464	360
E	390	43	330	930	500
X	390	14	1,400	2,620	1,400

MW-2	11/30/11	3/6/12	6/3/12	10/4/12	6/4/13
TPH-G	43,000	6,200	14,000	51,500	21,000
B	3,700	1,400	1,400	5,990	1,600
T	5,800	68	1,800	5,100	2,800
E	1,600	250	550	1,780	750
X	6,100	230	1,500	6,810	2,500

MW-9	12/1/11	3/6/12	6/3/12	10/4/12	6/4/13
TPH-G	1,000	1,800	7,200	22,200	8,300
B	110	460	1,600	4,630	1,800
T	26	8.8	460	1,340	180
E	21	36	200	603	120
X	84	55	810	3,600	270

MW-21	11/30/11	3/6/12	6/3/12	10/4/12	6/4/13
TPH-G	<250	--	--	--	<80
B	<0.50	--	--	--	<0.20
T	<0.50	--	--	--	<0.50
E	<0.50	--	--	--	<0.50
X	<0.50	--	--	--	<1.0

MW-24	12/1/11	3/6/12	6/3/12	10/4/12	6/4/13
TPH-G	<250	--	--	--	<80
B	<0.50	--	--	--	<0.20
T	<0.50	--	--	--	<0.50
E	<0.50	--	--	--	<0.50
X	<0.50	--	--	--	<1.0

MW-12	11/29/11	3/6/12	6/3/12	10/4/12	6/4/13
TPH-G	130,000	100,000	100,000	PSH	160,000
B	9,000	8,900	6,800	PSH	8,600
T	20,000	24,000	19,000	PSH	21,000
E	2,700	2,700	2,500	PSH	2,400
X	20,000	22,000	21,000	PSH	22,000

MW-14	11/30/11	3/6/12	6/3/12	10/4/12	6/4/13
TPH-G	<250	--	--	--	<80
B	<0.50	--	--	--	<0.20
T	<0.50	--	--	--	<0.50
E	<0.50	--	--	--	<0.50
X	<0.50	--	--	--	<1.0

MW-6	12/1/11	3/6/12	6/3/12	10/4/12	6/4/13
TPH-G	<250	--	--	--	<80
B	<0.50	--	--	--	<0.20
T	<0.50	--	--	--	<0.50
E	<0.50	--	--	--	<0.50
X	<0.50	--	--	--	<1.0

MW-7	11/29/11	3/6/12	6/3/12	10/4/12	6/4/13
TPH-G	110,000	10,000	71,000	129,000	140,000
B	6,200	4,300	6,600	9,350	8,200
T	15,000	13,000	13,000	12,600	14,000
E	2,400	1,800	2,100	2,320	2,200
X	23,000	18,000	19,000	22,100	23,000

MW-20	6/4/13
TPH-G	100,000
B	8,800
T	9,800
E	2,600
X	11,000

MW-11	11/30/11	3/6/12	6/3/12	10/4/12	6/4/13
TPH-G	<250	--	--	--	<80
B	20	--	--	--	<0.20
T	27	--	--	--	<0.50
E	3.7	--	--	--	<0.50
X	16	--	--	--	<1.0

MW-13	11/30/11	3/6/12	6/3/12	10/4/12	6/4/13
TPH-G	<250	--	--	--	<80
B	<0.50	--	--	--	<0.20
T	<0.50	--	--	--	<0.50
E	<0.50	--	--	--	<0.50
X	<0.50	--	--	--	<1.0

MW-25	12/1/11	3/6/12	6/3/12	10/4/12	6/4/13
TPH-G	<250	--	--	--	<80
B	<0.50	--	--	--	<0.20
T	<0.50	--	--	--	<0.50
E	<0.50	--	--	--	<0.50
X	<0.50	--	--	--	<1.0

MW-4	12/1/11	3/6/12	6/3/12	10/4/12	6/4/13
TPH-G	PSH	74,000	75,000	116,000	120,000
B	PSH	4,700	6,900	13,800	7,000
T	PSH	5,800	9,700	13,200	6,400
E	PSH	2,000	2,000	2,570	2,400
X	PSH	16,000	13,000	14,900	19,000

LEGEND

- E — ELECTRIC LINE
- SA — SANITARY SEWER LINE
- UT — UNDERGROUND TELEPHONE LINE
- W — WATER LINE
- P — SYSTEM PIPING
- PR — PRODUCT LINE
- MW-03 — PREVIOUS MONITORING WELL
- MW-20 B-20 — MONITORING WELL (SES 2007)
- EW-05 — EXTRACTION WELL
- IW-01 — INJECTION WELL
- SG-1 — SOIL GAS SAMPLE POINTS

ANALYTE

WELL ID	
TPH-G	TOTAL PETROLEUM HYDROCARBONS GASOLINE RANGE
B	BENZENE
T	TOLUENE
E	ETHYL BENZENE
X	TOTAL XYLENES

- µg/L — MICROGRAMS PER LITER
- BOLD — EXCEEDS MTCA METHOD A CLEANUP LEVELS
- PSH — PHASE SEPARATE HYDROCARBONS (FEET)
- -- — NOT MEASURED OR ANALYZED
- <0.20 — NOT DETECTED ABOVE METHOD REPORTING LIMIT OF 0.20 µg/L

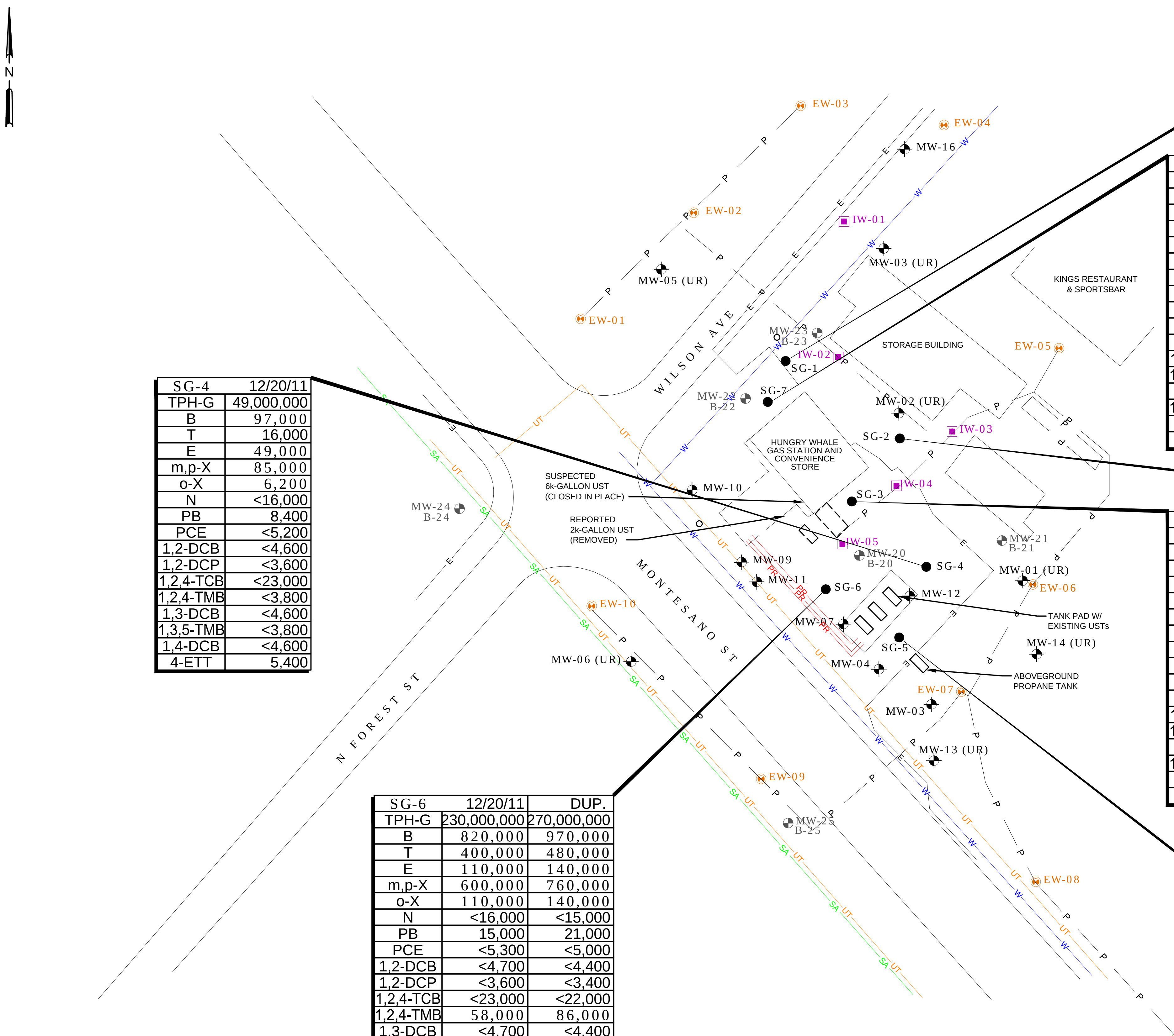
Stantec
12034 134th COURT NORTHEAST
REDMOND, WASHINGTON 98052
PHONE: (425) 298-1000 FAX: (425) 298-1020

FOR:
THE HUNGRY WHALE
1680 NORTH MONTESANO STREET
WESPORT, WASHINGTON

GROUNDWATER ANALYTICAL RESULTS

FIGURE: 4

JOB NUMBER: 212302770 | DRAWN BY: JCR | CHECKED BY: | APPROVED BY: | DATE: JUNE 2013



SG-1	12/20/11
TPH-G	1,800
B	<2.4
T	<2.8
E	<3.2
m,p-X	7.3
o-X	<3.2
N	<16
PB	<3.7
PCE	<5.0
1,2-DCB	<4.5
1,2-DCP	<3.4
1,2,4-TCB	<22
1,2,4-TMB	9.1
1,3-DCB	<4.5
1,3,5-TMB	7.8
1,4-DCB	<4.5
4-ETT	4.5

SG-7	12/20/11
TPH-G	650
B	<2.4
T	8.7
E	<3.3
m,p-X	9.2
o-X	<3.3
N	<16
PB	<3.8
PCE	<5.2
1,2-DCB	<4.6
1,2-DCP	<3.5
1,2,4-TCB	<23
1,2,4-TMB	3.9
1,3-DCB	<4.6
1,3,5-TMB	<3.8
1,4-DCB	<4.6
4-ETT	<3.8

SG-4	12/20/11
TPH-G	49,000,000
B	**97,000**
T	16,000
E	**49,000**
m,p-X	**85,000**
o-X	**6,200**
N	<16,000
PB	8,400
PCE	<5,200
1,2-DCB	<4,600
1,2-DCP	<3,600
1,2,4-TCB	<23,000
1,2,4-TMB	<3,800
1,3-DCB	<4,600
1,3,5-TMB	<3,800
1,4-DCB	<4,600
4-ETT	5,400

SG-2	12/20/11
TPH-G	11,000
B	58
T	35
E	87
m,p-X	140
o-X	34
N	<16
PB	14
PCE	<5.2
1,2-DCB	<4.6
1,2-DCP	<3.5
1,2,4-TCB	<23
1,2,4-TMB	40
1,3-DCB	<4.6
1,3,5-TMB	130
1,4-DCB	<4.6
4-ETT	36

SG-3	12/20/11
TPH-G	170,000,000
B	**370,000**
T	**380,000**
E	**310,000**
m,p-X	**1,100,000**
o-X	**270,000**
N	<16,000
PB	28,000
PCE	<5,200
1,2-DCB	<4,600
1,2-DCP	<3,600
1,2,4-TCB	<23,000
1,2,4-TMB	**63,000**
1,3-DCB	<4,600
1,3,5-TMB	**32,000**
1,4-DCB	<4,600
4-ETT	100,000

SG-5	12/20/11
TPH-G	190,000,000
B	**460,000**
T	**1,200,000**
E	**260,000**
m,p-X	**1,200,000**
o-X	**350,000**
N	<16,000
PB	28,000
PCE	<5,200
1,2-DCB	<4,600
1,2-DCP	<3,500
1,2,4-TCB	<22,000
1,2,4-TMB	**99,000**
1,3-DCB	<4,600
1,3,5-TMB	**47,000**
1,4-DCB	<4,600
4-ETT	140,000

SG-6	12/20/11	DUP.
TPH-G	230,000,000	270,000,000
B	**820,000**	**970,000**
T	**400,000**	**480,000**
E	**110,000**	**140,000**
m,p-X	**600,000**	**760,000**
o-X	**110,000**	**140,000**
N	<16,000	<15,000
PB	15,000	21,000
PCE	<5,300	<5,000
1,2-DCB	<4,700	<4,400
1,2-DCP	<3,600	<3,400
1,2,4-TCB	<23,000	<22,000
1,2,4-TMB	**58,000**	**86,000**
1,3-DCB	<4,700	<4,400
1,3,5-TMB	**28,000**	**40,000**
1,4-DCB	<4,700	<4,400
4-ETT	86,000	120,000

LEGEND

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- MW-03 — PREVIOUS MONITORING WELL
- MW-20 B-20 — MONITORING WELL (SES 2007)
- EW-05 — EXTRACTION WELL
- IW-01 — INJECTION WELL
- SG-1 — PROPOSED SOIL GAS SAMPLE POINTS

ANALYTE

WELL ID	
TPH-G	TOTAL PETROLEUM HYDROCARBONS GASOLINE RANGE
B	BENZENE
T	TOLUENE
E	ETHYL BENZENE
X	TOTAL XYLENES
m,p-X	m,p-XYLENE
o-X	o-XYLENE
N	NAPHTHALENE
PB	PROPYLBENZENE
PCE	TETRACHLOROETHANE
1,2-DCB	1,2-DICHLOROBENZENE
1,2-DCP	1,2-DICHLOROPROPANE
1,2,4-TCB	1,2,4-TRIMCHLOROBENZENE
1,2,4-TMB	1,2,4-TRIMETHYLBENZENE
1,3-DCB	1,3-DICHLOROBENZENE
1,3,5-TMB	1,3,5-TRIMETHYLBENZENE
1,4-DCB	1,4-DICHLOROBENZENE
4-ETT	4-ETHYLTOLUENE

µg/m³ MICROGRAMS PER CUBIC METER

RESULTS OR REPORTING LIMITS IN **BOLD** EXCEED THE TABLE B-1 SCREENING LEVELS

Stantec
12034 134th COURT NORTHEAST
REDMOND, WASHINGTON 98052
PHONE: (425) 298-1000 FAX: (425) 298-1020

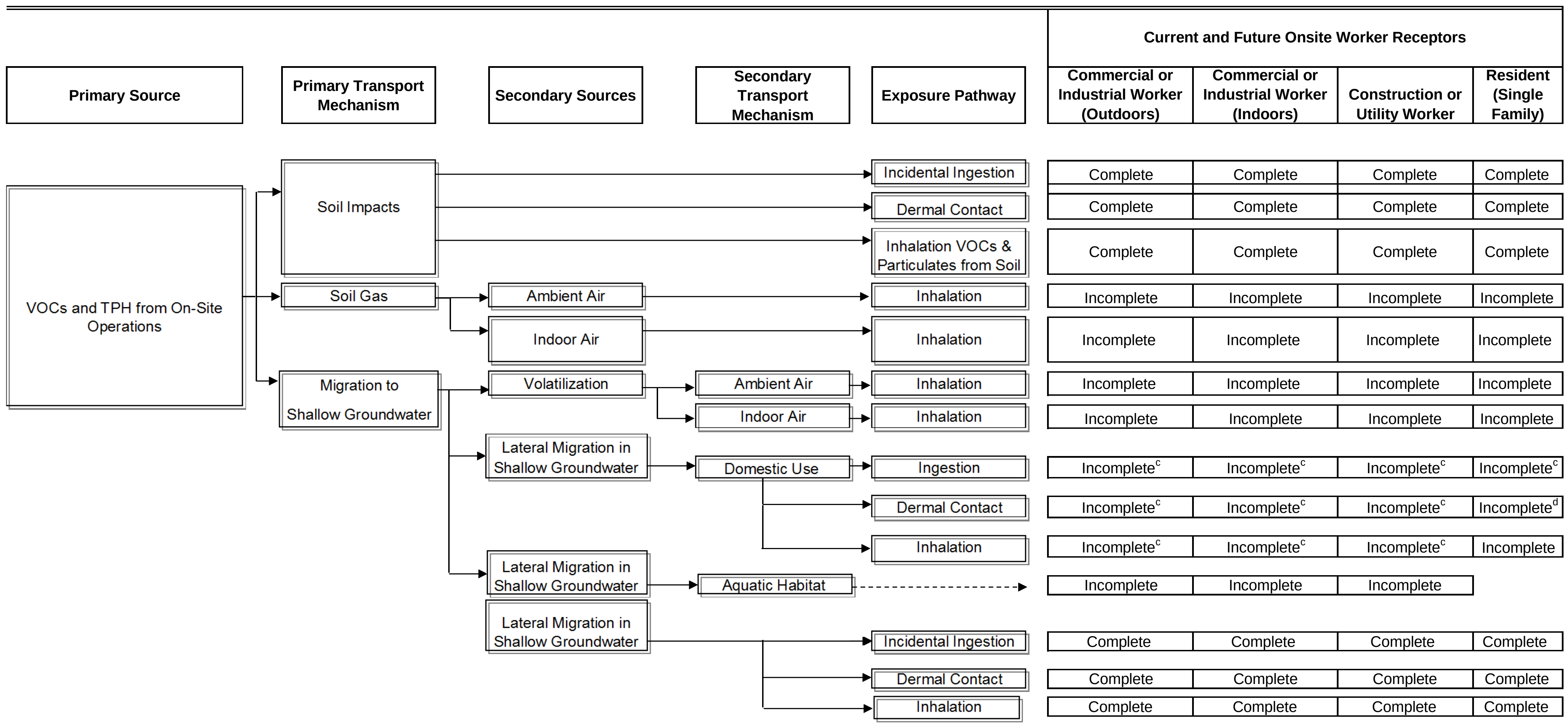
FOR:
THE HUNGRY WHALE
1680 NORTH MONTESANO STREET
WESPORT, WASHINGTON

SOIL GAS RESULTS

FIGURE: 5

JOB NUMBER: 212302770
DRAWN BY: JCR
CHECKED BY:
APPROVED BY:
DATE: JANUARY 2012

FIGURE 6
Potential Exposure Pathways Flow Chart
Current and Future Onsite Receptors
The Hungry Whale
1680 North Montesano Streeet
Westport, Washington



Complete	Receptor likely to be exposed via this route, so exposure pathway is considered potentially complete.
Incomplete	Pathway is incomplete; one or more of the components required for a complete pathways is not present.

UST = Underground storage tank
[a] Although volatilization to ambient air is possible, the concentrations and risks are typically much lower than those resulting from vapor intrusion into buildings.
[b] The indoor or outdoor air pathway assessed via soil gas and indoor air sampling.
[c] Groundwater is considered non-potable at this time.
[d] In shallow open construction or utility trenches.

TABLES

Table 1. Summary of Groundwater Analytical Results - TPH, VOCs and Geochemical Parameters
The Hungry Whale
1680 North Montesano Street
Westport, Washington

Well Number	Sample Date	Depth to Groundwater (feet)	Groundwater Elevation (feet)	TPH-G[1] (µg/L)	Volatile Organic Compounds[2] (VOCs)				Geochemical Parameters							
					Benzene (µg/L)	Toluene (µg/L)	Ethyl-benzene (µg/L)	Total Xylenes (µg/L)	Dissolved Oxygen[3] (mg/L)	Oxygen Reduction Potential (ORP)[4] (mV)	Ferrous Iron[5] (mg/L)	Nitrate[6] as NO_3 (mg/L)	Sulfate[6] as SO_4(mg/L)	Methane[7] (µg/L)	Total Alkalinity[8] as $CaCO_3$ (mg/L)	Manganese[9], Dissolved (µg/L)
MW01 (UR) No elevation	Not Located															
MW02 (UR)	11/30/11	4.55	95.45	**43,000**	**3,700**	**5,800**	**1,600**	**6,100**	4.90 H	-196	5.6 H	<0.100	11.0	--	--	--
100.00	3/6/12	4.61	95.39	**6,200**	**1,400**	68	250	230	0.79	-92	17.4	0.141	6.8	642	246	--
	6/13/12	5.60	94.40	**14,000**	**1,400**	**1,800**	550	**1,500**	3.36	-88.2	16 H	<0.50	3.6	817	228	--
	10/4/12	--	--	**51,500**	**5,990**	**5,100**	**1,780**	**6,810**	2.88	-120.4	27.2	<0.20	<1.0	3,320	297	257
	6/4/13	5.98	94.02	**21,000**	**2,500**	**2,800**	**750**	**2,500**	--	--	--	--	--	--	--	--
MW03 (UR)	12/1/11	4.74	95.66	<250	<0.50	<0.50	<0.50	<0.50	--	-121	--	--	--	--	--	--
	3/6/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
100.40	6/13/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	10/4/12	7.00	93.40	<50	<1	<1	<1	<3	2.30	-30.8	0.21	<0.20	2.4	<6.6	17.3	35.0
	6/4/13	6.28	94.12	<80	<0.20	<0.50	<0.50	<1.0	--	--	--	--	--	--	--	--
MW04 (UR)	12/1/11	4.20	94.97	**PSH**	**PSH**	**PSH**	**PSH**	**PSH**	--	--	--	--	--	--	--	--
	3/6/12	4.16	95.01	**74,000**	**4,700**	**5,800**	**2,300**	**16,000**	0.26	-80	--	--	--	--	--	--
99.17	6/13/12	5.10	94.07	**75,000**	**6,900**	**9,700**	**2,000**	**13,000**	1.64	-19.0	--	--	--	--	--	--
	10/4/12	7.62	91.55	**116,000**	**13,800**	**13,200**	**2,570**	**14,900**	3.79	-39.4	39.6	<0.20	<1.0	13,000	283	13,000
	6/4/13	5.51	93.66	**120,000**	**7,000**	**6,400**	**2,400**	**19,000**	--	--	--	--	--	--	--	--
MW05	11/30/11	3.55	96.05	<250	<0.50	<0.50	<0.50	<0.50	10.1 H	-113	0.15 H	0.104	5.26	--	--	--
	3/6/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
99.6	6/13/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	10/4/12	--	--	704	**314**	2.5	77.0	12.7	4.79	-114.2	2.5	0.30	19.1	293	150	92.2
	6/4/13	5.14	94.46	<80	<0.20	<0.50	<0.50	<1.0	--	--	--	--	--	--	--	--
MW06	12/1/11	3.14	95.38	<250	<0.50	<0.50	<0.50	<0.50	--	-137	--	--	--	--	--	--
	3/6/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
98.52	6/13/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	10/4/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/4/13	4.46	94.06	<80	<0.20	<0.50	<0.50	<1.0	--	--	--	--	--	--	--	--
MW07	11/29/11	4.48	95.25	**110,000**	**6,200**	**15,000**	**2,400**	**23,000**	7.70 H	-114	5.1 H	<0.100 H	2.10 H	--	--	--
	3/6/12	4.50	95.23	**100,000**	**4,300**	**13,000**	**1,800**	**18,000**	0.29	25	10.0	<0.100	0.60	692	53.0	--
99.73	6/13/12	5.40	94.33	**71,000**	**6,600**	**13,000**	**2,100**	**19,000**	8.60	-24.8	31	<0.50	<0.50	1,490	160	--
	10/4/12	8.28	91.45	**129,000**	**9,350**	**12,600**	**2,320**	**22,100**	14.02	98.7	39.3	<0.20	<1.0	4,730	230	4,730
	6/4/13	5.80	93.93	**140,000**	**8,200**	**14,000**	**2,200**	**23,000**	--	--	--	--	--	--	--	--
MW09	12/1/11	3.57	95.44	**1,000**	**110**	26	21	84	--	636	--	--	--	--	--	--
	3/6/12	3.55	95.46	**1,800**	**460**	8.8	36	55	0.14	-135	--	--	--	--	--	--
99.01	6/13/12	4.50	94.51	**7,200**	**1,600**	460	200	810	1.10	-79.90	--	--	--	--	--	--
	10/4/12	7.28	91.73	**22,200**	**4,630**	**1,340**	603	**3,600**	1.14	-13.8	26.4	<0.20	<1.0	7,190	164	7,190
	6/4/13	4.92	94.09	**8,300**	**1,800**	180	120	270	--	--	--	--	--	--	--	--
MW10	11/30/11	3.59	95.59	**6,200**	**610**	53	390	390	4.80 H	-103	7.0 H	<0.100	9.99	--	--	--
	3/6/12	3.53	95.65	**2,200**	**150**	13	43	140	0.00	-125	9.10	<0.100	4.0	1,330	105	--
	3/6/12 DUP	N/A	N/A	**2,100**	**180**	20	68	210	--	--	--	--	--	--	--	--
99.18	6/13/12	4.50	94.68	**6,900**	**640**	440	330	**1,400**	0.92	-82.4	30 H	<0.50	<0.50	1,450	185	--
	10/4/12	7.50	91.68	**16,900**	**1,340**	464	**930**	**2,620**	1.60	32.40	40.1	<0.20	4.3	7,750	250	1,460
	6/4/13	4.94	94.24	**15,000**	**1,300**	360	500	**1,400**	--	--	--	--	--	--	--	--
MW11	11/30/11	4.37	94.60	<250	**20**	27	3.7	16	5.70 H	128	0.090 H	<0.100	6.63	--	--	--
	3/6/12	--	--	--	**--**	--	--	--	--	--	--	--	--	--	--	--
98.97	6/13/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	10/4/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/4/13	5.73	93.24	<80	<0.20	<0.50	<0.50	<1.0	--	--	--	--	--	--	--	--
MW12	11/29/11	5.01	95.16	**130,000**	**9,000**	**20,000**	**2,700**	**20,000**	2.90 H	627	5.8 H	<0.100 H	0.447 H	--	--	--
	3/6/12	5.12	95.05	**100,000**	**8,900**	**24,000**	**2,700**	**22,000**	0.54	-139	--	--	--	--	--	--
100.17	6/13/12	6.20	93.97	**100,000**	**6,800**	**19,000**	**2,500**	**21,000**	2.74	-105.8	--	--	--	--	--	--
	10/4/12	9.00	91.17	**PSH**	**PSH**	**PSH**	**PSH**	**PSH**	--	--	--	--	--	--	--	--
	6/4/13	6.40	93.77	**160,000**	**8,600**	**21,000**	**2,400**	**22,000**	--	--	--	--	--	--	--	--
MW13 (UR)	11/30/11	5.55	93.15	<250	<0.50	<0.50	<0.50	<0.50	10.6 H	-105	0.070 H	<0.100	1.81	--	--	--
	3/6/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
98.7	6/13/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	10/4/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/4/13	4.99	93.71	<80	<0.20	<0.50	<0.50	<1.0	--	--	--	--	--	--	--	--
MW14 (UR)	11/30/11	4.44	95.09	<250	<0.50	<0.50	<0.50	<0.50	--	76	--	--	--	--	--	--
	3/6/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
99.53	6/13/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	10/4/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/4/13	5.91	93.62	<80	<0.20	<0.50	<0.50	<1.0	--	--	--	--	--	--	--	--
MW16 No elevation	Not Located															
MW20 100.09	Not Located															
	6/4/13	6.21	93.88	**100,000**	**8,800**	**9,800**	**2,600**	**11,000**	--	--	--	--	--	--	--	--
MW21	11/30/11	4.82	95.06	<250	<0.50	<0.50	<0.50	<0.50	--	138	--	--	--	--	--	--
	3/6/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
99.88	6/13/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	10/4/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/4/13	6.22	93.66	<80	<0.20	<0.50	<0.50	<1.0	--	--	--	--	--	--	--	--
MW22	11/30/11	4.50	95.59	**3,000**	2.6	17	47	160	6.10 H	125	4.4 H	<0.100	9.30	--	--	--
	3/6/12	4.50	95.59	<250	0.90	2.2	1.6	9.3	0.57	-31	--	--	--	--	--	--
100.09	6/13/12	5.45	94.64	**1,500**	0.92	4.9	61	43	2.38	-209.7	--	--	--	--	--	--
	10/4/12	8.36	91.73	**3,230**	**8.8**	21.2	118	121	2.52	-158.3	1.5	<0.20	5.2	1,910	230	136
	6/4/13	5.82	94.27	730	0.23	1.2	6.1	33	--	--	--	--	--	--	--	--
MW23	11/30/11	3.92	95.65	**51,000**	**470**	**3,700**	**1,100**	**7,100**	--	-121	--	--	--	--	--	--
99.57	11/30/11 DUP	N/A	N/A	**47,000**	**560**	**4,000**	**1,200**	**7,700**	--	--	--	--	--	--	--	--
	3/6/12	3.95	95.62	**55,000**	**630**	**5,700**	**2,200**	**12,000**	0.56	-107	12.6	<0.100	6.6	527	136	--
	6/13/12	4.95	94.62	**56,000**	**830**	**5,600**	**2,300**	**15,000**	1.28	-103.7	15 H	<0.50	12	387	169	--
	10/4/12	7.98	91.59	**70,500**	**1,320**	**6,850**	**1,580**	**10,000**	3.86	-112.8	13.5	<0.20	1.6	2,170	176	219
	6/4/13	5.40	94.17	**88,000**	**770**	**5,200**	**2,800**	**17,000**	--	--	--	--	--	--	--	--
MW24	12/1/11	2.14	95.79	<250	<0.50	<0.50	<0.50	<0.50	--	-133	--	--	--	--	--	--
	3/6/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
97.93	6/13/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	10/4/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/4/13	3.47	94.46	<80	<0.20	<0.50	<0.50	<1.0	--	--	--	--	--	--	--	--
MW25	12/1/11	3.68	95.06	<250	<0.50	<0.50	<0.50	<0.50	--	123	--	--	--	--	--	--
	3/6/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
98.74	6/13/12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	6/4/13	5.02	93.72	<80	<0.20	<0.50	<0.50	<1.0	--	--	--	--	--	--	--	--
MTCA Method A Cleanup Levels[10]		N/A	N/A	800/1,000[11]	5	1,000	700	1,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

NOTES:

µg/L = micrograms per liter

mV = millivolts

mg/L = milligram per liter

"--" = Not measured or analyzed

J = The value reported is below the routine reporting limit, but exceeds the detection limit threshold, and should be considered an estimate.

B = The analyte of interest was detected in both the sample and the associated method blank and is applied without regard to the relative concentrations reported in the sample and in the blank.

BOLD = value exceeds cleanup levels

N/A = Not applicable

<0.20 = Analyte not detected a method reporting limit of 0.20 µg/L.

H = Holding time for sample preparation or analysis exceeded

[1] TPH as Gasoline (TPH-G) analysis by Method NWTPH-Gx.

[2] VOC analysis by EPA Method 8260B, 8260C, or 8021B.

[3] Dissolved Oxygen analysis collected as a field parameter

[4] Oxygen Reduction Potential collected as a field parameter

[5] Ferrous Iron analysis by Method SM3500-Fe B

[6] Nitrate and Sulfate analysis by Ion Chromatography by EPA Method 300.0

[7] Methane analysis by Method RSK-175M

[8] Total Alkalinity analysis by Method SM 2320B

[9] Manganese analysis bu EPA Method 6010

[10] Washington State Department of Ecology Model Toxics Control Act (MTCA) Method A Cleanup Level for groundwater. November 2007.

[11] MTCA Method A Cleanup Level for TPH-Gasoline is 800 µg/L if benzene is detected, and 1,000 µg/L if benzene is not detected, in groundwater.

PSH = Phase separated hydrocarbons

Table 2
Soil Gas Sample Results
The Hungry Whale

Compound	Table B-1 Screening Levels[1] (µg/m³)	Sample # and Reported Concentration (µg/m³)							
		SG-1	SG-2	SG-3	SG-4	SG-5	SG-6	SG-7[3]	SG-6-DUP
		12/20/2011	12/20/2011	12/20/2011	12/20/2011	12/20/2011	12/20/2011	12/20/2011	12/20/2011
TPH-g	NE[2]	1,800	11,000	170,000,000	49,000,000	190,000,000	230,000,000	650	270,000,000
Benzene	32	<2.4	**58**	**370,000**	**97,000**	**460,000**	**820,000**	<2.4	**970,000**
Toluene	49,000	<2.8	35	**380,000**	16,000	**1,200,000**	**400,000**	8.7	**480,000**
Ethylbenzene	10,000	<3.2	87	**310,000**	**49,000**	**260,000**	**110,000**	<3.3	**140,000**
m,p-Xylene	1,000	7.3	140	**1,100,000**	**85,000**	**1,200,000**	**600,000**	9.2	**760,000**
o-Xylene	1,000	<3.2	34	**270,000**	**6,200**	**350,000**	**110,000**	<3.3	**140,000**
Naphthalene	30	<16	<16	<16,000	<16,000	<16,000	<16,000	<16	<15,000
Propylbenzene	NE	<3.7	14	28,000	8,400	28,000	15,000	<3.8	21,000
Tetrachloroethane	42	<5.0	<5.2	<5,200	<5,200	<5,200	<5,300	<5.2	<5,000
1,2-Dichlorobenzene	1,400	<4.5	<4.6	<4,600	<4,600	<4,600	<4,700	<4.6	<4,400
1,2-Dichloropropane	40	<3.4	<3.5	<3,600	<3,600	<3,500	<3,600	<3.5	<3,400
1,2,4-Trichlorobenzene	2,000	<22	<23	<23,000	<23,000	<22,000	<23,000	<23	<22,000
1,2,4-Trimethylbenzene	60	9.1	40	**63,000**	<3,800	**99,000**	**58,000**	3.9	**86,000**
1,3-Dichlorobenzene	NE	<4.5	<4.6	<4,600	<4,600	<4,600	<4,700	<4.6	<4,400
1,3,5-Trimethylbenzene	60	7.8	**130**	**32,000**	<3,800	**47,000**	**28,000**	<3.8	**40,000**
1,4-Dichlorobenzene	8,000	<4.5	<4.6	<4,600	<4,600	<4,600	<4,700	<4.6	<4,400
4-Ethyltoluene	NE	4.5	36	100,000	5,400	140,000	86,000	<3.8	120,000
Helium (%)	NE	<0.074	<0.076	<0.078	<0.078	<0.076	<0.078	5.6	<0.074
Oxygen (%)	NE	20	17	2.4	1.5	1.4	2.6	19	2.0
Carbon Dioxide (%)	NE	1.0	3	9.1	12	10	10	0.65	11
Methane (%)	NE	<0.00015	0.00024	3.9	0.64000	4.4	5.6	<0.00015	5.8

Notes:

[1] - Sub-Slab Soil Gas Screening Levels; Washington Department of Ecology Model Toxics Control Act (MTCA), Method C Clean Up Levels (CUL), Review Draft October 2009

[2] - MTCA Method C CUL not established for this analyte.

[3] - Sample possibly biased low due to detection of tracer gas (Helium) in sample.

Analytical values in **BOLD** indicate a value exceeding Table B-1 Screening Level

He, O_2, CO_2 and CH_4 analysis by ASTM D-1946

Table 3
Indoor/Outdoor Air Sample Results
The Hungry Whale
Westport, Washington

Compound	Table B-1 Indoor Air Screening Levels[1] (µg/m³)	Sample # and Reported Concentration (µg/m³)			
		OA-1	OA-2	IA-1	IA-2
		3/21/2012	3/21/2012	3/21/2012	3/21/2012
TPH-g	NE[2]	<62	<65	280	110
Benzene	3.2	0.38	0.40	1.2	0.59
Toluene	4,900	0.55	0.30	13	2.1
Ethylbenzene	1,000	<0.13	<0.14	0.81	0.32
4-Ethyltoluene	NE[2]	<0.75	<0.78	1.2	<0.78
m,p-Xylene	100	<0.26	<0.27	3.7	1.7
o-Xylene	100	<0.13	<0.14	1.3	0.59
Propylbenzene	NE[2]	<0.75	<0.78	<0.79	<0.78
1,3,5-Trimethylbenzene	6	<0.75	<0.78	<0.79	<0.78
1,2,4-Trimethylbenzene	6	<0.75	<0.78	1.5	0.85

Notes:
All analysis by EPA Method TO-15 GC/MS SIM/Full Scan
[1] - Washington Department of Ecology Method C Indoor Air Screening Levels, Table B-1, Review Draft October 2009
[2] - MTCA Method C CUL not established for this analyte.
OA = Outdoor Air
IA = Indoor Air
Analytical values in **BOLD** indicate a value exceeding Table B-1 Screening Level

TABLE 4							
COST COMPARISON - CLEAN-UP ALTERNATIVES							
Clean-up Action	Fixed Costs Remediaton	Annual Costs			Total Annual	Est. Years	TOTAL COSTS
		Operation & Maintenance	Monitoring	Regualory Interaction			
In-situ Treatment	$280,000	$0	$17,500	$4,200	$21,700	5	$388,500
Air Sparge / Soil Vapor Extraction	$260,000	$35,000	$15,000	$4,200	$54,200	3	$422,600
Groundwater Extraction and Treatment	$265,000	$35,000	$15,000	$4,200	$54,200	3	$427,600
Monitored Natural Attenuation	$0	$0	$31,500	$4,200	$35,700	10	$357,000
Interim Monitoring and Source Removal	$300,000	$0	$15,000	$3,000	$18,000	7	$426,000