Work Plan
Soil and Groundwater Characterization
North Road Shop – Kitsap County Site
Poulsbo, Washington

November 26, 2019

Prepared for

Kitsap County
Department of Public Works

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North Road Shop – Kitsap County Site
Poulsbo, Washington

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LIST OF ABBREVIATIONS AND ACRONYMS

ALS	ALS Laboratories
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
City	City of Poulsbo, Washington
COC	chain of custody
County	Kitsap County
°C	degrees Celsius
Ecology	Washington State Department of Ecology
EPA	US Environmental Protection Agency
EPH	extractable petroleum hydrocarbons
ft	feet
Golder	Golder Associates
GPS	Global Position System
IDW	Investigation-Derived Waste
LAI	Landau Associates, Inc.
mL	milliliter
mL/min	milliliter per minute
MTCA	Model Toxics Control Act
NWTPH	Northwest total petroleum hydrocarbon
ORP	oxidation reduction potential
PID	photoionization detector
ppm	parts per million
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
Site	Kitsap County North Road Shop Site
TOPVC	top of PVC casing
TPH	total petroleum hydrocarbon
TPH-D	diesel-range total petroleum hydrocarbon
TPH-G	gasoline-range total petroleum hydrocarbon
TPH-O	oil-range total petroleum hydrocarbon
UST	underground storage tank
VOC	volatile organic compound
VPH	volatile petroleum hydrocarbons
WAC	Washington Administrative Code

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1.0 INTRODUCTION

This work plan presents the scope and procedures for conducting soil and groundwater characterization activities at the Kitsap County (County) North Road Shop Site (Site) in Poulsbo, Washington (Figure 1). The purpose of this characterization implementation is to address recommendations made by the Washington State Department of Ecology (Ecology) during the Site Periodic Review (Ecology 2018). This work plan addresses the recommendations made by Ecology to evaluate groundwater flow direction in the westernmost area of the Site. At the request of the County, this work plan also incorporates soil characterization focused on delineating the extent of contaminated soil that may be present at the Site.

1.1 Site Background

According to a letter prepared for the County by Golder Associates, Inc. (Golder 1996), we understand that contamination at the Site was first identified in June 1996 when near-surface soil samples were collected from bus parking areas to evaluate potential releases from the parked vehicles over unpaved ground. In June and August 1996, Golder conducted soil sampling activities at the Site using a direct-push drill rig. The soil sampling indicated that total petroleum hydrocarbon-gasoline range (TPH-G) was present up to 6 feet (ft) below ground surface (bgs) in some areas, and TPH-diesel range (TPH-D) and TPH–oil range (TPH-O) were present as deep as 2 ft bgs throughout much of the Site.

Groundwater samples were also collected to evaluate potential contamination associated with two former gasoline underground storage tanks (USTs) located to the north of Site buildings (Buildings 2 and 3), and two existing 12,000-gallon diesel USTs and one 6,000-gallon gasoline UST located to the south of Building 2. Both gasoline and diesel were detected in at least one of the samples collected during the 1996 investigation (Golder 1996).

After the 1996 investigation, the County decided to excavate and dispose of the contaminated soil offsite. An institutional control for contaminated soil that could not be removed, to avoid damaging onsite infrastructures (e.g., beneath utilities), was also implemented by applying a Site cap (i.e., pavement).

A subsequent remedial cleanup including multiple excavation areas, conducted by Golder in the summer of 1997, resulted in the removal of approximately 5,500 tons of petroleum-contaminated soils from the Site for disposal at a permitted landfill. The excavations generally extended 4 to 5 ft bgs, with a maximum depth of 8 ft bgs in some areas. The majority of the excavations terminated at the glacial till unit present at approximately 4 to 8 ft bgs. Due to the presence of active Site infrastructure, contaminated soil was left in place below the storm drain and water main lines, beneath the western fence line, within the fenced former Water District compound onsite at the time, and extending under Building 2. The residual contaminated soil left in place was documented in a restrictive covenant (Kitsap County 2000) that limits activities that could come in contact with residual contamination.

Following completion and backfilling of the remedial excavation in 1997, Golder conducted quarterly surface water monitoring at Dogfish Creek and storm drain outfalls adjacent to the north and east of the Site that receive stormwater from the Site and adjacent roadways (Ecology 2019). The monitoring was conducted to evaluate the potential for groundwater contamination, through contact with the impacted soil, to migrate into the creek. In July 2000, Ecology issued a letter to Mr. Ronald Yingling at the County indicating that, after 2 years of surface water monitoring with only a single detection below the Model Toxics Control Act (MTCA) Method A cleanup level of TPH-D over that time (potentially associated with roadway run-off), surface water monitoring at the Site could be discontinued (Ecology 2000). (Ecology 2019)

After the surface water sampling was terminated in 2000, Ecology oversight has consisted of periodic 5-year reviews. In the 2006 Periodic Review Letter, Ecology requested an additional round of surface water sampling to confirm conditions in Dogfish Creek. Benzene was detected in one sample collected during this event at a concentration exceeding the surface water criteria. Ecology indicated that this detection may be the result of roadway run-off or a combination of migrating groundwater and run-off (Welty 2018). Based on the additional sampling results, the Site passed Ecology's 2006 periodic review, and further surface water sampling was not deemed necessary and will, therefore, not be included in this investigation.

Ecology issued no requests for further information in their 2012 periodic review. However, as part of the most recent periodic review (Ecology 2018), Ecology indicated that groundwater contamination at the Site (if any) has not been delineated and the groundwater flow direction has not been established. Ecology requested that three monitoring wells be installed at the Site to evaluate groundwater flow direction and quality, which is the focus of this work plan.

1.2 Site Features and Uses

The Site has been utilized by Kitsap County as a shop and material storage location for their maintenance operations. However, portions of the Site have been used by the local Water District for water storage and for sewer easement purposes. While the former Water District space is no longer in use in the westernmost corner of the Site, the City of Poulsbo (City) still maintains a sewer line easement to the north of the Site. The County continues to use the Site for material, vehicle, and equipment storage, as well as a maintenance shop. The significant surface features and approximate locations of subsurface utilities are shown on Figure 2.

Stormwater runoff generated at the Site generally flows into stormwater catchment basins located throughout the Site, and into an adjacent bio swale located along the southwest edge of the Site fenceline. Stormwater collected into the bio swale either infiltrates or presumably flows northwest, under Bond Road/SR305, and into Dogfish Creek, as noted above (Figure 2).

2.0 SOIL AND GROUNDWATER CHARACTERIZATION

Landau Associates, Inc. (LAI) will provide an environmental professional to oversee the drilling activities, screen soil samples for contamination using field instruments, and collect soil and groundwater samples for laboratory analysis, as described in Table 1. Groundwater samples will be collected from temporary soil borings and from permanent groundwater wells. Drilling and utility locate services will be conducted by LAI subcontractors. Sample containers, preservatives, analytical methods, and holding times for both soil and groundwater are provided in Table 2.

2.1 Utilities

Prior to drilling activities, LAI will request both a public and private utility locate to identify locations of underground utilities at the Site. LAI will contact the public utility locate one-call service a minimum of 48 hours before the commencement of drilling activities to have public utilities marked. Prior to contacting this service, proposed drilling locations will be marked in white. Once the public utility locate is complete, a private utility locate will be conducted in conjunction with additional utility identification (i.e., air knife) activities using a private locate subcontractor. The private utility locate will identify the approximate locations of private conductible utilities at the Site.

Soil characterization activities will include sampling of soil that was left in place beneath existing utilities during previous cleanups, the private utility locate will also include visual confirmation of storm sewer and water lines. Air knife/vacuum truck equipment, provided and operated by an LAI subcontractor, will be utilized to expose and visually confirm the locations of these utilities at approximately every other proposed soil boring location, or what is deemed an adequate number of locations so that the LAI field staff can accurately identify the utility locations and alignment in the immediate vicinity of the proposed boring. Approximate utility locations, based on existing Site information, are shown on Figure 2, but may be adjusted based on the observed utility locations observed in the field.

2.2 Soil

Upon the request of the County, LAI will conduct a voluntary soil exploration to determine the extent of contamination remaining at the Site. This was not specified in Ecology's 2018 periodic review. Soil samples will be collected in areas of potential residual contamination, which includes areas along the existing site fencing, storm drains, within the former Water District area, and beneath Building 2; these areas are shown on Figure 2. Each soil boring will be advanced at the proposed boring locations illustrated on Figure 3. Borings may be adjusted if deemed unsuitable in the field. A total of 17 samples will be collected including 11 samples below existing utilities and along the western fenceline, 4 samples from the former Water District compound, and 2 samples from below Building 2. At locations adjacent to existing utilities, soil borings will be advanced at a slight angle so samples can be collected at depths below the utility. Soil borings advanced below Building 2 will either be at a slight angle, or from inside the building footprint.

Soil borings will be advanced using direct-push drilling methods completed by a driller licensed in the State of Washington, and drilling will be monitored by an LAI Environmental Professional. Borings will be advanced to approximately 8 ft bgs, 1 to 2 ft below the groundwater table, or until refusal is met in dense soil, whichever is encountered first. One soil sample will be collected for laboratory analysis at each boring location (using procedures described in Section 2.2.2); the interval collected for laboratory analysis will be the interval with the greatest potential for contamination, based on fielding-screening observations (described Section 2.2.1). In order to prevent volatilization of contaminants during the drilling and screening process, potentially contaminated depth intervals will be immediately containerized in a 4-ounce jar with no headspace. Once the boring has been drilled to total depth, a sample will be collected from the jar yielding the greatest potential for contamination, using the U.S. Environmental Protection Agency (EPA) 5035A soil sample collection method (described in Section 2.2.2). The remaining pre-filled jars will be emptied into the waste storage drums, along with all other soil cuttings, and disposed of as described in Section 2.4 below. If no evidence of contamination is observed, a sample will be collected from the interval just above the groundwater table.

A record of the soil and groundwater conditions observed during drilling will be recorded on a soil boring log. The boring log will also show soil types, evidence of contamination based on field screening, and other pertinent information such as drilling action and/or poor recovery. Following completion, all soil boring locations will be geo-located with a hand-held Global Positional System (GPS).

2.2.1 Field Screening

Soil field-screening techniques include visual observation for the presence of sheen, observations of noticeable petroleum hydrocarbon odors, and volatile organic compound (VOC) screening using a photoionization detector (PID).

- Visible observations will be made of the entire soil core sample, noting soil discoloration and/or the presence of sheen; field personnel will indicate, at a minimum, one of the following results for each 2 ft of sample core length:
    - No staining / staining
    - No sheen / slight sheen / heavy sheen.
- Soil core samples will be screened for the presence of VOCs by analyzing headspace above the soil with a PID; results will be recorded in parts per million (ppm) for, at a minimum, each 2 ft of sample core length. A note will be made on the chain of custody (COC) form noting PID concentrations for samples yielding PID readings over 5 ppm.
- Olfactory indications of contamination will be noted, if observed.

2.2.2 Soil Boring Sample Collection

Soil samples collected for analysis for volatile parameters (e.g., gasoline-range TPH and any VOCs including benzene, toluene, ethylbenzene, and xylenes [BTEX]) must be collected before non-volatile samples and in accordance with EPA Method 5035A. The EPA Method 5035A soil sampling method is

intended to reduce volatilization and biodegradation of samples. The EPA Method 5035A procedure for soil sample collection is as follows:

- Collect soil cores from the drilling sample core using coring devices (i.e., EnCore® sampler, EasyDraw Syringe®, or a Terra Core™ sampling device). Each core will consist of approximately 5 grams of soil. Collect three discrete cores from each sampling location. One EasyDraw Syringe® or one Terra Core™ sampling device can be used to collect the three discrete cores at each sample location; however, if the EnCore samplers are used, then three sampling devices are required.
- Remove excess soil from the coring device. If an EasyDraw Syringe or Terra Core sampling device is used for sample collection, place the "cored" soil directly into three preserved 40 milliliter (mL) vials with a stirbar. Vials will be preserved as indicated in Table 2. If the EnCore sampler is used, then close the sampler for transport to the laboratory.
- Collect an additional 2 ounces of soil from drilling sample core and place it in a laboratory-supplied jar for moisture content analysis and laboratory screening purposes. Fill the jar to minimize headspace.

Soil samples to be tested for non-volatile parameters (i.e., TPH-D and TPH-O) will be collected from the identified soil sampling intervals using the following methods:

- Scrape the outside of the soil core to expose a fresh sampling surface using a clean, decontaminated stainless-steel spoon.
- Homogenize the soil in a decontaminated stainless-steel bowl using a newly decontaminated stainless-steel spoon.
- Transfer the homogenized soil into the appropriate laboratory-supplied sample container.

Soil samples collected for laboratory analysis will be labeled using the following format:

Soil Borings: "SB-location-(depth interval ')"

For example, a soil sample collected between 4 and 5 ft bgs at SB-6 would be SB-6-(4-5').

2.2.3 Soil Analyses

To confirm the field-screening results and to provide recommendation on potential remediation strategies, soil samples will be collected in laboratory-provided sample containers, and delivered in a chilled cooler under standard COC protocols to ALS Laboratories (ALS) in Everett, Washington for analysis. Soil samples will be analyzed for TPH-G using Method NWTPH-Gx, and TPH-D and TPH-O using Method NWTPH-Dx.

One composite soil sample will also be collected from the drill cuttings and analyzed for Resource Conservation and Recovery Act (RCRA) 8 metals for waste characterization purposes in accordance with standard disposal facility requirements.

Following initial analysis, up to four soil samples with concentrations of TPH-D or TPH-O above the MTCA Method A cleanup level (if any) will also be analyzed for extractable petroleum hydrocarbons (EPH) to support alternative potential site-specific cleanup levels.

Analytical results will be requested on 5-day turnaround times so that EPH analysis can be requested (if necessary) before the hold time for analysis is exceeded.

2.3 Groundwater

Ecology's periodic review requested that data be gathered to determine the groundwater flow direction and identify any contamination onsite. A groundwater elevation survey will be conducted, along with sampling from soil borings and three new monitoring wells, in order to identify groundwater flow direction and to assess groundwater quality conditions. Proposed monitoring well locations are shown on Figure 4, but locations may be adjusted based on observations made during the utility locate.

2.3.1 Temporary Groundwater Sampling

Groundwater samples will be collected from up to three soil boring locations to better identify and evaluate potential contamination at the Site using low-flow sampling techniques and procedures, as follows:

- During soil boring activities with a direct-push drill rig, groundwater grab samples will be collected using a groundwater sampler consisting of a 4-ft-long, wire-wrapped, stainless-steel screen (0.010-inch slot size) with a retractable protective steel sheath. The groundwater sampler will be advanced to the sample depth and the protective sheath will be retracted to expose the stainless-steel screen to the formation.
- Prior to sampling, each well will be purged using a peristaltic pump. Purging will begin with a low pumping rate, and the groundwater elevation will be monitored to minimize drawdown. If groundwater drawdown is observed and it does not stabilize, the pumping rate will be decreased until the groundwater elevation remains stable.
- Field parameters including pH, temperature, specific conductance, dissolved oxygen, and oxidation reduction potential (ORP) will be monitored and recorded every 3 minutes during purging using an in-line flow-through cell. Purging of the well will be considered complete when all field parameters become stable for three successive readings or if purging activities have reached a maximum of 20 minutes. The successive readings should be within +/– 0.1 standard units for pH, +/– 3 percent for conductivity, and +/– 10 percent for dissolved oxygen.
- Sample data will be recorded on a groundwater sample collection form including sample number and time collected; the observed physical characteristics of the sample (e.g., color, turbidity, odor, and sheen); field parameters; sampling equipment; and analyses requested.
- Any problems or significant observations will be noted in the "comments" section of the groundwater sample collection form.
- Groundwater samples will be collected directly into the appropriate sample containers using the same pump used for purging. To prevent degassing during sampling for VOCs, a low pumping rate will be maintained, and the VOC containers will be filled completely so that no head space remains. Samples will be chilled to 6 degrees Celsius (°C), or less, immediately after collection. Clean gloves will be worn when collecting each sample.

Groundwater samples collected from soil boring locations for laboratory analysis will be labeled using the following format:

Groundwater Wells: "GW-SB-location-YYMMDD"

For example, a groundwater sample collected from soil boring 5 on December 5, 2019 would be GW-SB-5-191205.

2.3.2 Monitoring Well Groundwater Sampling

Since there are no existing monitoring wells on the Site, and per Ecology's request, three monitoring wells will be installed, developed, and surveyed for top of polyvinyl chloride (PVC) casing (TOPVC) elevations in order to develop groundwater contours for the Site.

2.3.2.1 Installation

Based on our understanding of the hydrology and groundwater conditions at the Site, we anticipate that the wells will be installed to a maximum depth of 10 ft bgs. Monitoring wells will be installed using hollow-stem auger techniques completed by a driller licensed in the State of Washington, and drilling will be monitored by an LAI Environmental Professional. The monitoring wells will be constructed with 2-inch-diameter, flush-threaded, Schedule 40 PVC solid pipe with a 5-ft long, 0.010-inch machine-slotted, PVC casing. The wells will be installed such that the top of the well screen is above the water table observed at the time of drilling; based on previous investigations, the water table is anticipated to be 2 to 5 ft bgs. A filter pack material consisting of pre-washed, pre-sized number 12/20 silica sand or 2/12 Monterey Beach sand (or equivalent) will be placed from the bottom of the well to approximately 1 ft above the top of the screen. Filter pack material will be placed slowly and monitored by the driller to avoid bridging of material. A 100 percent, bentonite chip seal will be placed above the filter sand pack material to within approximately 1 ft of ground surface and hydrated during placement. Concrete will be used to backfill the boring from the top of the bentonite seal to the surface for placement of the protective cover. The wells will be completed at the ground surface with flush-mounted protective casings.

A record of the soil and groundwater conditions observed during drilling and monitoring well installation details will be recorded on field forms. The boring log will also record soil types, evidence of contamination based on field screening, blow counts, and other pertinent information such as drilling action and/or poor recovery. Following completion, all soil boring locations will be geo-located with a hand-held, mapping grade, GPS. The well log will also include the well names and the identification numbers (Well Tag) assigned by Ecology, which will be attached to each well casing (inside the well monument) following well installation. The well identification number will be recorded on the boring log.

2.3.2.2 Development and Survey

The wells will be developed after at least 48 hours following installation to allow the well seals to set. Well development is performed to remove formation material from the well bore and the filter pack. The wells will be developed by surging and overpumping. Surging will be accomplished by repeatedly and rapidly raising and lowering a stainless-steel bailer or surge block across the screened interval. Groundwater will be pumped rapidly from each well using a 12-volt submersible (i.e., whaler) pump or peristaltic pump. The pump type and pumping rates will depend on the recharge rate of the well. A minimum of 5 casing volumes will be removed.

Following well development, LAI will perform a level loop survey of the top of well casing elevations to facilitate development of relative groundwater elevation contour maps. The survey will be conducted using a level loop transit and surveying rod. The casing elevations will be based on an arbitrary local datum determined in the field.

2.3.2.3 Groundwater Monitoring

Groundwater monitoring will include collection of groundwater elevations and analytical samples during one groundwater monitoring event. Groundwater monitoring will be conducted at least 24 hours after well development.

2.3.2.4 Groundwater Monitoring Well Sample Collection Procedures

Water levels will be measured at each well prior to collecting samples from any of the proposed monitoring wells. Groundwater samples will be collected at each monitoring well using low-flow sampling techniques and procedures, as follows:

- Immediately following removal of each well monument cover, the wellhead will be observed for damage, leakage, and staining. Additionally, immediately following removal of the well head cap, any odors will be documented and the condition of the well opening will be observed. Any damage, leakage, or staining to the well head or well opening will be documented.
- The depth to groundwater will be measured from the top of the well casing prior to extraction of water from the well using a water level indicator.
- Prior to sampling, each well will be purged using a peristaltic pump that is attached to dedicated purge and sample collection tubing. Purging will begin with a low pumping rate, and the groundwater elevation will be monitored to minimize drawdown. If groundwater drawdown is observed and it does not stabilize, the pumping rate will be decreased until the groundwater elevation remains stable.
- Field parameters, including pH, temperature, specific conductance, dissolved oxygen, and oxidation reduction potential (ORP), will be monitored and recorded every 3 minutes during purging using an in-line flow-through cell. Purging of the well will be considered complete when all field parameters become stable for three successive readings or if purging activities have reached a maximum of 20 minutes. The successive readings should be within +/– 0.1 pH units for pH, +/– 3 percent for conductivity, and +/– 10 percent for dissolved oxygen.
- Sample data will be recorded on a groundwater sample collection form including sample number and time collected; the observed physical characteristics of the sample (e.g., color, turbidity, odor, and sheen); field parameters; sampling equipment; and analyses requested.
- Any problems or significant observations will be noted in the “comments” section of the groundwater sample collection form.
- Groundwater samples will be collected directly into the appropriate sample containers using the same pump used for purging. To prevent degassing during sampling for VOCs, a low pumping rate will be maintained, and VOC containers will be filled completely so that no head space remains. Samples will be chilled to 6 °C, or less, immediately after collection. Clean gloves will be worn when collecting each sample.

Groundwater samples collected from monitoring wells for laboratory analysis will be labeled using the following format:

Groundwater Wells: "MW-location-YYMMDD"

For example, a groundwater sample collected at MW-1 on December 5, 2019 would be MW-1-191205.

2.3.3 Groundwater Analyses

Groundwater samples from temporary and permanent wells will be collected in laboratory-provided sample containers, and delivered in a chilled cooler under standard COC protocols to ALS for analysis. The samples will be analyzed for:

- TPH-G using Method NWTPH-Gx; TPH-D and TPH-O using Method NWTPH-Dx.
- BTEX using EPA Method 8020.
- Volatile petroleum hydrocarbons (VPH) analysis of one sample with test results above the cleanup levels for TPH-G (if any).
- EPH analysis of one sample with test results above cleanup levels for TPH-D and/or TPH-O, if any, to support potential risk-based closure.

Analytical results will be requested with a 5-day turnaround time to avoid hold time issues for the VPH/EPH analysis.

2.4 Waste Management

Soil and water investigation-derived waste (IDW) generated during soil sampling, well installation, well development, well sampling (purging), and equipment cleaning/decontamination will be segregated according to media type, and placed in 55-gallon drums and stored onsite pending the results of the disposal characterization analysis. Upon receipt of the sampling results, LAI will coordinate with a local disposal company to transport the drums to an appropriate disposal facility. It is assumed that the soil and groundwater will not be Dangerous Wastes, as defined in Chapter 173-303 Washington Administrative Code (WAC), and can be disposed of at a RCRA Subtitle D (solid waste) disposal facility.

3.0 CHARACTERIZATION ACTIVITIES AND REPORTING SCHEDULE

The soil and groundwater characterization activities will be implemented immediately upon Ecology's approval of this work plan.

Upon receipt of all sample results, LAI will conduct a review of the analytical data for quality control/quality assurance purposes, tabulate the data, and compare the results to applicable regulatory criteria. We will then prepare a report documenting the results of the soil and groundwater characterization. The report will document our findings and present our recommendations for next steps. Laboratory analytical reports will be provided with the report.

4.0 USE OF THIS WORK PLAN

This Soil and Groundwater Characterization work plan has been prepared for the exclusive use of Kitsap County for specific application to the North Road Shop site. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of LAI. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by LAI, shall be at the user's sole risk. LAI warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. We make no other warranty, either express or implied.

5.0 REFERENCES

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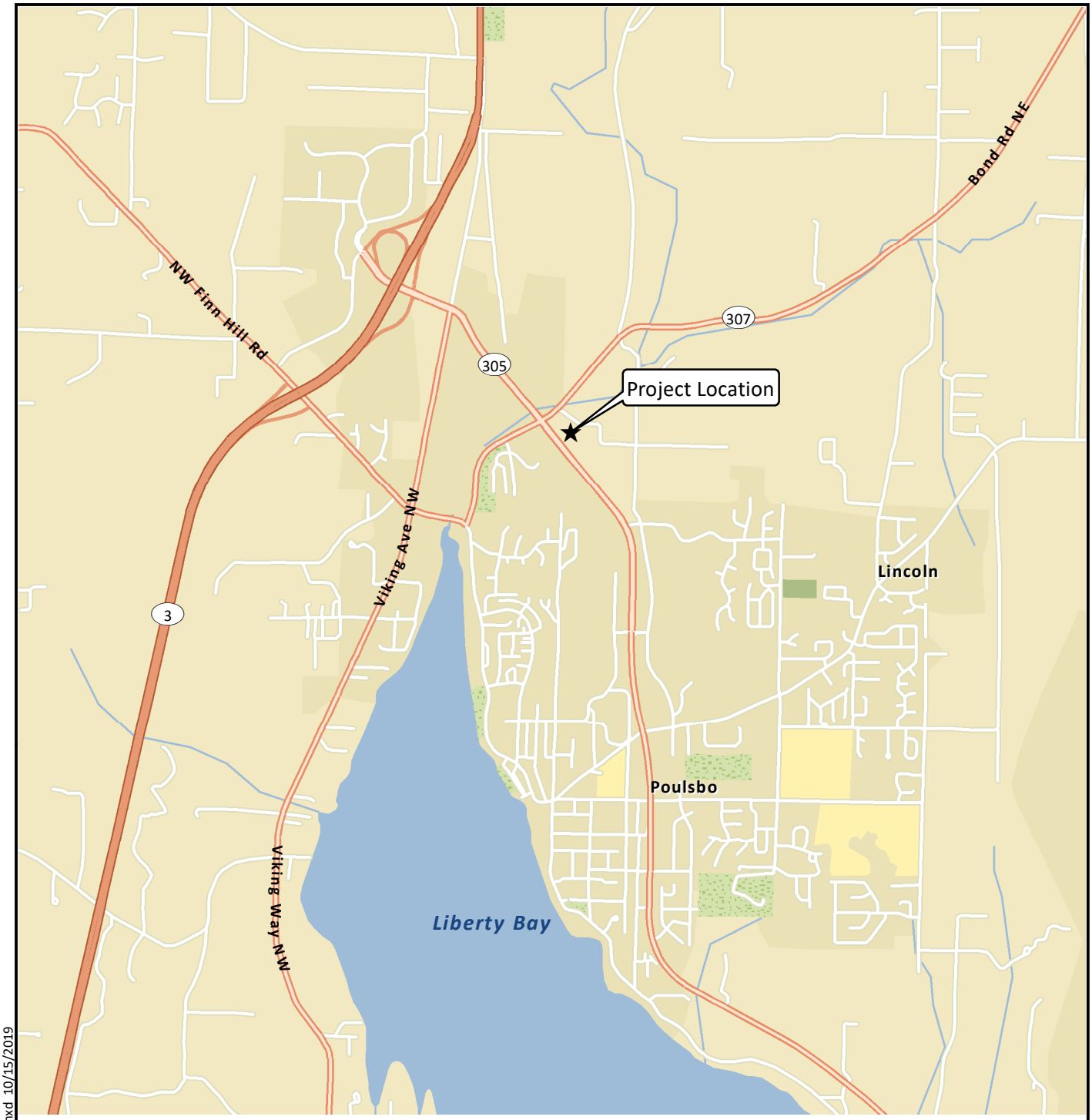

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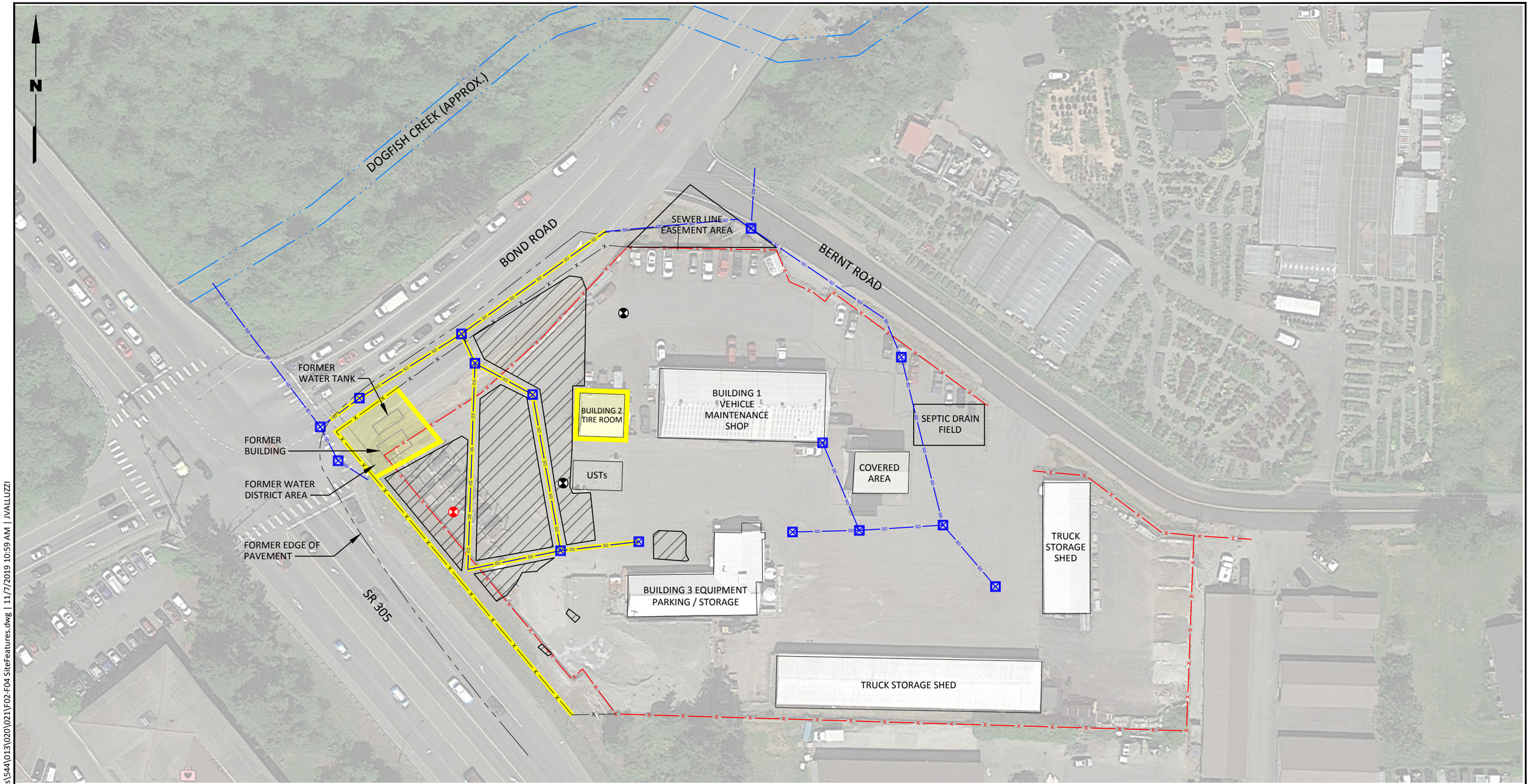
North Road Shop Soil and Groundwater Investigation Poulsbo, Washington	**Vicinity Map**	Figure 1



Legend

- Catch Basin
- Existing Storm Drain
- Existing Fence
- Former Fence
- Former Edge of Pavement
- Former Building / Structure
- Remedial Excavation (1997) Floor Soil Sample with Petroleum Hydrocarbon Detection (Red Indicates Cleanup Level Exceedance)
- Residual and/or Characterization Focus Areas
- Remedial Excavation Areas (1997)

0 70 140

Scale in Feet

Notes

1. UST = Underground Storage Tank
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Source: Kitsap County Topo, 2002; Bing Aerial Imagery, 2019

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North Road Shop
Soil and Groundwater Characterization
Poulsbo, Washington

Site Features and Residual Contamination Areas

Figure 2

Landau Associates | G:\Projects\544\013\020\021\F02-F04 SiteFeatures.dwg | 11/7/2019 10:59 AM | JVALLUZZI

N

DOGFISH CREEK (APPROX.)

BOND ROAD

BERNT ROAD

SEWER LINE EASEMENT AREA

FORMER WATER TANK

FORMER BUILDING

FORMER WATER DISTRICT AREA

FORMER EDGE OF PAVEMENT

SR 305

SB-1 SB-2 SB-3 SB-4 SB-5 SB-6 SB-7 SB-8 SB-9 SB-10 SB-11 SB-12 SB-13 SB-14 SB-15 SB-16 SB-17

DP-1 DP-2 DP-3 DP-4 DP-5 DP-6 DP-7 DP-8 DP-9 DP-10 DP-11 DP-12

BUILDING 1 VEHICLE MAINTENANCE SHOP

BUILDING 2 TIRE ROOM

USTs

COVERED AREA

SEPTIC DRAIN FIELD

TRUCK STORAGE SHED

BUILDING 3 EQUIPMENT PARKING / STORAGE

TRUCK STORAGE SHED

Legend

- Catch Basin
- Existing Storm Drain
- Existing Fence
- Former Fence
- Former Edge of Pavement
- Former Building / Structure
- SB-1 Proposed Offsite Soil Boring Location
- SB-3 Proposed Soil Boring Location
- DP-1 Previous Soil Boring Location (Post-1997 Remedial Excavation)
- Residual and/or Characterization Focus Areas

0 70 140

Scale in Feet

Notes

1. UST = Underground Storage Tank
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Source: Kitsap County Topo, 2002; Bing Aerial Imagery, 2019

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North Road Shop
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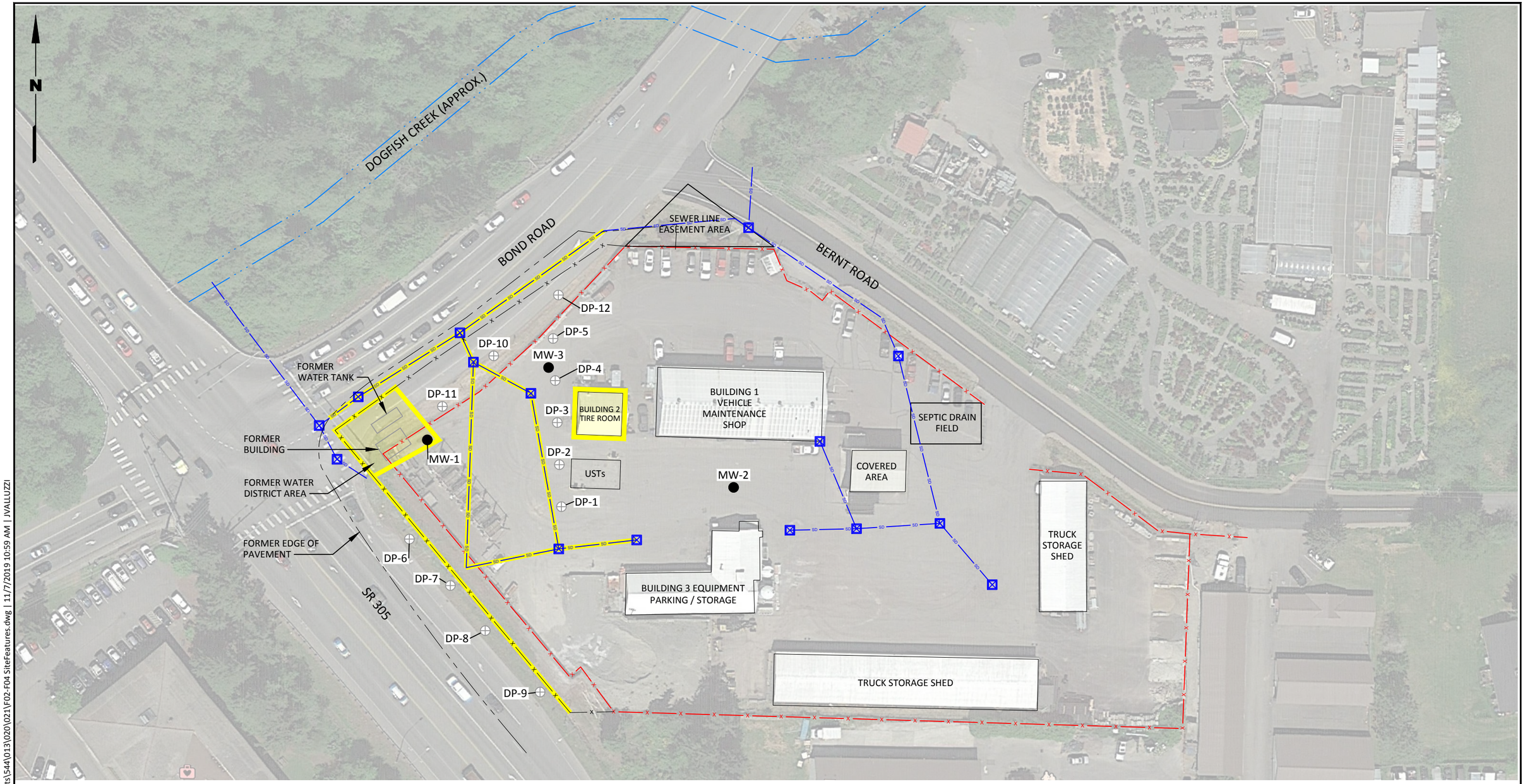
Soil Characterization Locations

Figure 3

Landau Associates | G:\Projects\544\013\020\021\F02-F04 SiteFeatures.dwg | 11/7/2019 10:59 AM | JVALLUZZI



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Legend

- Catch Basin
- Existing Storm Drain
- Existing Fence
- Former Fence
- Former Edge of Pavement
- Former Building / Structure
- MW-1 — Proposed Groundwater Monitoring Well Location
- DP-1 — Previous Groundwater Sample Location (Post-1997 Remedial Excavation)
- Residual and/or Characterization Focus Areas

0 70 140

Scale in Feet

Source: Kitsap County Topo, 2002; Bing Aerial Imagery, 2019

Notes

1. UST = Underground Storage Tank
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

LANDAU ASSOCIATES

North Road Shop
Soil and Groundwater Characterization
Poulsbo, Washington

Groundwater Characterization Locations

Figure 4

Table 1
Sampling and Analysis Summary
North Road Shop Soil and Groundwater Characterization
Poulsbo, Washington

Sample locations	Soil Sample Depth Interval	Soil Analysis	Groundwater Analysis	Selection Rationale
SB-1*	Sample affected area. If no evidence of contamination - sample across water table.	Total Petroleum Hydrocarbons Gasoline, Diesel, and Oil ranges (by NWTPH-Gx, NWTPH -Dx). **See notes below for potential follow-up analyses.**		Characterize soil within westernmost area of the Site (including two offsite locations) near the Former Water District Lease Area.
SB-2*				
SB-3				
SB-4				
SB-5	Sample affected area. If no evidence of contamination - sample across water table.	Total Petroleum Hydrocarbons Gasoline, Diesel, and Oil ranges (by NWTPH-Gx, NWTPH -Dx). **See notes below for potential follow-up analyses.**		Characterize soil along west/northwest fenceline.
SB-6				
SB-7				
SB-8				
SB-13				
SB-9	Sample affected area. If no evidence of contamination - sample across water table.	Total Petroleum Hydrocarbons Gasoline, Diesel, and Oil ranges (by NWTPH-Gx, NWTPH -Dx). **See notes below for potential follow-up analyses.**		Characterize soil below utilities using angled drilling techniques.
SB-10				
SB-11				
SB-12				
SB-14				
SB-15				
SB-16	Sample affected area. If no evidence of contamination - sample across water table.	Total Petroleum Hydrocarbons Gasoline, Diesel, and Oil ranges (by NWTPH-Gx, NWTPH -Dx). **See notes below for potential follow-up analyses.**		Characterize soil below Building 2.
SB-17				
GW-SB-#	No soil samples will be collected during monitoring well installation.		Total Petroleum Hydrocarbons Gasoline, Diesel, and Oil ranges (by NWTPH-Gx, NWTPH -Dx); benzene, toluene, ethylbenzene, and xylenes (BTEX; by EPA 8020). **See notes below for potential follow-up analyses.**	Further extrapolate potential groundwater contamination with regards to offsite migration.
GW-SB-#				
GW-SB-#				
MW-1	No soil samples will be collected during monitoring well installation.		Total Petroleum Hydrocarbons Gasoline, Diesel, and Oil ranges (by NWTPH-Gx, NWTPH -Dx); benzene, toluene, ethylbenzene, and xylenes (BTEX; by EPA 8020). **See notes below for potential follow-up analyses.**	Install new monitoring wells to characterize groundwater quality and flow direction.
MW-2				
MW-3				

* Proposed locations outside of existing parcel boundary.

Notes:
Soil borings will be advanced using direct-push drilling methods up to about 2 feet below the groundwater table or until refusal at the till layer.

For soil borings, sample intervals should be approximately 1 foot in length and:
- If field screening indicates no contamination, collect one soil sample from the vadose zone-groundwater table interface.
- If field screening indicates contamination is present, collect one sample from the most contaminated zone.

For groundwater monitoring well installations using hollow-stem auger methods:
- Wells will be installed with 5-foot screens. The top of the screen will be placed approximately 1 foot above the water table.
- One sample testing above cleanup levels for TPH-G will be analyzed for VPH.
- One sample testing above cleanup levels for TPH-D and/or TPH-O will be analyzed for EPH.

Abbreviations and Acronyms:
EPH = extractable petroleum hydrocarbons
EPA = U.S. Environmental Protection Agency
TPH-D = total petroleum hydrocarbons diesel range
TPH-G = total petroleum hydrocarbons gasoline range
TPH-O = total petroleum hydrocarbon soil range
VPH = volatile petroleum hydrocarbons

Table 2
Sample Containers, Preservatives, Analytical Methods, and Holding Times
North Road Shop Site Soil and Groundwater Characterization
Poulsbo, Washington

Matrix	Method	Container	Preservative	Holding Time (a)	Laboratory Performing Analyses
Soil	Gasoline-range Petroleum Hydrocarbons by NWTPH-Gx	4 oz + 5035 methanol 40-ml vial	<6°C	14 days freeze vial within 48 hours	ALS Global Everett
Groundwater	Gasoline-range Petroleum Hydrocarbons by NWTPH-Gx	2 x 40-mL glass	Add HCl to pH<2; <6°C	14 days	ALS Global Everett
Soil	Diesel- and Oil-range Petroleum Hydrocarbons by NWTPH-Dx	4 oz	<6°C	14 days/40 days	ALS Global Everett
Groundwater	Diesel- and Oil-range Petroleum Hydrocarbons by NWTPH-Dx	500-mL amber glass	<6°C	7 days/40 days	ALS Global Everett
Soil	BTEX by EPA Method 8020	4 oz + 40-ml vial and two stirbar vials	methanol; <6°C	14 days freeze vials within 48 hours	ALS Global Everett
Groundwater	BTEX by EPA Method 8020	3 x 40-mL glass	HCl to pH<2; <6°C	14 days (7 days pH >2)	ALS Global Everett
Soil	RCRA 8 metals by EPA 6010 (7471 for mercury)	4 oz	<6°C	180 (mercury 28 days)	ALS Global Everett

Acronyms/Abbreviations:

°C = degrees Celsius
BTEX = benzene, toluene, ethylbenzene, and xylenes
EPA = US Environmental Protection Agency
HCL = Hydrochloric acid
mL = milliliter
oz = ounces
RCRA = Resource Conservation and Recovery Act

Notes:

(a) Time from sample collection to extraction/Time from sample extraction to analysis.