PUBLIC REVIEW DRAFT

FEASIBILITY STUDY REPORT
NEWMAN'S CHEVRON
2021 6th Street
Bremerton, Washington

May 3, 2024

Prepared for:
Washington State Department of Ecology – NW Region Office
15700 Dayton Ave. N.
Shoreline, Washington 98133

Prepared by:
Leidos Inc.
11824 North Creek Parkway N, Suite 101
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On Behalf of:
Chevron Environmental Management Company
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P.O. Box 84
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and

Victory Business Park LLC
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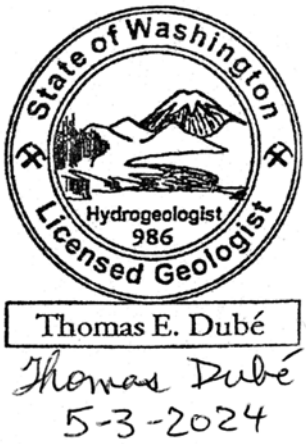

Thomas E. Dubé, LG/LHg

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LIST OF ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
bgs	below ground surface
CEMC	Chevron Environmental Management Company
COC	contaminant of concern
CSM	conceptual site model
DRO	diesel-range organics
FS	feasibility study
GRO	gasoline-range organics
HRO	heavy-range organics
mg/kg	milligrams per kilogram
MTCA	Model Toxics Control Act
ND	non-detect
NFA	No Further Action
PLP	Potentially Liable Person
RI	remedial investigation
RIWP	remedial investigation work plan
SB	soil boring
TPH	total petroleum hydrocarbons
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VI	vapor intrusion
WAC	Washington Administrative Code

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FEASIBILITY STUDY REPORT
NEWMAN'S CHEVRON

1 INTRODUCTION AND OBJECTIVE

Leidos, Inc. (Leidos), has prepared this Feasibility Study (FS) report, on behalf of Chevron Environmental Management Company (CEMC), Nordic Properties, Inc. (Nordic), and Victory Business Park, LLC (Victory), collectively referred to as "the Parties", for the Newman's Chevron site (the Site), located at 2021 6th Street in Bremerton, Washington. A Site vicinity map is included as Figure 1. Preparation of this FS was performed pursuant to the requirements of Agreed Order No. DE 14246 (the Agreed Order), which was entered into by the State of Washington, Department of Ecology (Ecology) and the Parties, in February 2018.

This FS was prepared in accordance with the regulatory requirements established by Chapter 173-340 of the Washington Administrative Code (Model Toxics Control Act Regulation and Statute [MTCA], Ecology Publication No. 94-06, revised 2013[1]). Per Section 173-340-350 of that document, "The purpose of the feasibility study is to develop and evaluate cleanup action alternatives to enable a cleanup action to be selected for the site."

[1] Per email communication from Mr. Dale Myers of Ecology, dated January 23, 2024, based on the original submittal date of the original Agency Review Draft FS report (November 13, 2023), Ecology has determined that this draft and all future versions of the FS Report for the Newman's Chevron Site do not require revisions to comply with new MTCA rule requirements that became effective on January 1, 2024.

2 SITE BACKGROUND

2.1 GENERAL SITE INFORMATION

- **Site Name:** Newman's Chevron
- **Alternate Names:** 6th Street Fuel
- **Address:** 2021 6th Street, Bremerton, WA 98337
- **Assessor Parcel Number:** Kitsap County 3717-002-015-0106
- **Ecology Cleanup Site ID:** 5252
- **Ecology Facility/Site ID:** 1436359
- **Ecology UST ID:** 7972
- **Ecology Agreed Order No.:** DE14246
- **Latitude/Longitude:** 47.56707/-122.64572
- **Township/Range/Section:** 24N 1E 14
- **Current Owner/Operator:** Victory Business Park, LLC
- **Potentially Liable Persons (PLPs):**
  - CEMC
  - Nordic (formerly known as Wilkins Distributing Company)
  - Victory
  - Karin Newman
- **Designated Project Coordinators:**
  - Washington Department of Ecology – Mr. Dale Myers
  - CEMC – Mr. James Kiernan
  - Nordic – Mr. Roger Jensen
  - Victory – Mr. Jim Reed
  - Primary Project Coordinator for the Parties – Mr. James Kiernan
- **Project Consultant:** Leidos – Mr. Russ Shropshire, PE

2.2 SITE DESCRIPTION AND SETTING

For the purposes of this document, the following terminology will apply:

- "Property" refers to the property located at 2021 6th Street, which was previously determined to be impacted by one or more releases of petroleum products resulting from past operations of a service station on the Property. The Property may also be referred to as "the former service station property".
- "Site" refers to the area where petroleum contamination, originating from the Property, has come to be located. A Site may include both on-Property and off-Property areas. The Site area is defined by the findings of the remedial investigation (RI) previously completed for the Site (Leidos, 2023).

The Property is located at the southeast corner of the intersection of Naval Avenue and 6th Street in Bremerton, Washington, as shown on Figure 2. The Property is identified by the Kitsap County Assessor as Parcel No. 3717-002-015-0106 and is approximately 0.39 acre in size. Title records for the Property indicate that the current parcel was formerly three separate parcels (Parcels I, II, and III). Legal descriptions of the Property still retain references to these former

parcel numbers. A map showing the current and former parcel boundaries is included as Figure 3.

The Property is currently occupied by a closed gasoline service station and convenience store. The retail building has an area of approximately 2,500 square feet and the canopy has an area of approximately 1,200 square feet. Three regulated underground storage tanks (USTs) are present in the northeastern portion of the Property (Figure 2). Ecology UST records indicate that these tanks were installed on October 30, 1990, and that their current status is "Temporarily Closed".

2.2.1 Adjacent Properties

The Property is bounded by 6th Street to the north followed by commercial businesses across 6th Street (a bank and store with parking lot); private residences to the east and southeast; a paved alley to the south followed by a tire shop and private residences; and Naval Avenue to the west. An ARCO service station is located to the west of the Property across Naval Avenue at 2101 6th Street. This ARCO station (former Budget Rent-a-Car) is identified as Ecology Facility/Site ID No. 53813326 and received a No Further Action (NFA) determination in September 2013 (Ecology, 2013a).

2.2.2 Topography

The Property lies at an elevation between approximately 106 and 110 feet above sea level (NAVD88). The property surface is generally level, but the western half slopes gently to the west. Concrete retaining walls border the Property on the east and south sides, and the walls are several feet in height. The alley and parcels south of the Property range in elevation from approximately 103 to 107 feet. The residential parcel to the east of the Property ranges from approximately 107 to 114 feet.

2.2.3 Surface Water

The Property is located approximately 4,900 feet south of Anderson Cove. Oyster Bay is located approximately 5,600 feet to the northwest, and Sinclair Inlet is approximately 3,700 feet to the south and 5,600 feet to the east of the Property. No surface water bodies are located in the nearby vicinity of the Site.

2.2.4 Climate

The Bremerton climate is characterized by mild temperatures and an extended rainy season, with an average annual rainfall of 56 inches. Average temperatures vary between 34°F and 45°F in the winter and 53°F to 75°F in the summer. The driest month of the year is typically July, with the rainy season extending from October to March.

2.3 SITE OPERATING HISTORY

As discussed in Section 2.2, the current tax parcel associated with the Property formerly consisted of three separate parcels (Parcels I, II and III; see Figure 3). The Agreed Order alleges that CEMC's affiliate, Texaco Inc. (Texaco), began leasing Parcel III (the westernmost parcel) in 1928, and that Texaco purchased Parcel III in 1943.

The Agreed Order alleges that Texaco began leasing Parcels I and II in 1961, and that a gasoline service station was reconfigured to occupy all three parcels. Kitsap County Assessor's records indicate that the current service station building and canopy were constructed at that time. The

Agreed Order alleges that in 1981, Texaco sold Parcel III and assigned its interest in the leases of Parcels I and II to Wilkins Distributing Company (Wilkins), known now as Nordic. Wilkins subsequently sublet Parcels I and II to Robert and Karin Newman in 1981. Wilkins then purchased Parcels I and II in 1985.

The Newmans operated the service station beginning in 1981. The Newmans purchased Parcels I, II, and III from Wilkins in 1990 and continued to operate the service station as Newman's Chevron until 2004, when the Property was sold to SJ-N-SJ Corporation (SJ-N-SJ). The deed from this sale, and all subsequent property transfers, reference the current tax parcel number (3717-002-015-0106).

SJ-N-SJ owned the Property and operated the service station from 2004 to 2006. In 2006, Chang S. Choe purchased the Property and continued to operate the service station until it was closed in 2008.

2.4 SITE USE

2.4.1 Current Site Use

The current owner, Victory, acquired the Property in December 2012. Service station infrastructure, including a convenience store building, three regulated USTs, and dispenser islands remain on the Property. However, they are believed to have been unused since the service station was closed in 2008. The convenience store building is currently vacant and Ecology UST records indicate that the status of the regulated USTs is "Temporarily Closed".

2.4.2 Land Use/Zoning

The Site is located in the incorporated Bremerton city limits within Kitsap County, Washington. The Property is zoned General Commercial (GC), which allows for high intensity commercial uses. The off-Property areas of the Site are zoned Low Density Residential (R-10), which are adjacent to the GC zone, located to the east and southeast of the Property (Figure 2).

2.4.3 Future Use Plans

Leidos is not aware of specific future use plans for the Property. However, based on its location and zoning, it is expected that the Property will either be reopened as a service station and convenience store location or redeveloped for other commercial use.

The three regulated USTs currently existing on the Property were installed in October 1990. Therefore, if the Property is to be operated as a service station again in the future, it is likely that these USTs would need to first be replaced, due to their age, as the life expectancy of current UST systems is on the order of 30 years.

3 SUMMARY OF REMEDIAL INVESTIGATION AND CONCEPTUAL SITE MODEL

This section provides a summary of the findings of the RI that was performed for the Agreed Order (Leidos, 2023). RI field activities were performed in a phased approach between August 2018 and October 2022. The findings of the RI were used to update and refine a conceptual site model (CSM) for the Site, which summarizes the collective information that is known or suspected about the presence of contamination at the Site, and the physical, chemical, or biological processes that may impact contaminant migration, transport to other media, or potential exposure by human and/or ecological receptors.

3.1 GEOLOGY AND HYDROGEOLOGY

3.1.1 Geology

Based on the results of soil boring and sampling activities during the RI, as well as available soil descriptions from pre-RI activities, the following four lithologic units have been identified at the Site:

- Unit A: Fill and recent deposits
- Unit B: Glacial lacustrine silt with clay
- Unit C: Glacial till and related material
- Unit D: Glacial advance outwash sand

Figure 4 shows the location of section line A-A', which is presented as a cross sectional view in Figure 5. Addition details regarding each lithologic unit are provided below.

Unit A

The uppermost lithologic unit throughout the Site consists of fill material, other disturbed or redistributed soils, and possibly some other recent (Holocene) post-glacial deposits. This unit consists of sand, silt, silty sand, and gravel in varying proportions. The thickness typically ranges from 2 to 8 feet; however, in areas of the eastern tank basin and excavation pits, the fill thickness extends up to 12 feet (Figure 5). The fill material at most of the Site is not always readily distinguishable from the native material beneath it, so its presence and thickness based on observations during drilling are inferred in many places.

Unit B

Below Unit A is a silt layer with variable amounts of clay, minor fine-grained sand, and up to several percent gravel. The clay-rich silt is commonly finely laminated and varies from low to high plasticity; its consistency is typically soft to firm. This unit everywhere is underlain by Unit C (glacial till), and in places this unit may grade coarser downward into the till. Unit B is up to 13 feet thick and is only present in the eastern two-thirds of the Site; it pinches out to the west of borings SB-7 and SB-8 (Figure 5). This unit also pinches out north of SB-7 and was not identified in borings SB-1 and SB-2. Unit B was found in all seven borings drilled in 2000 outside the periphery of the eastern tank basin (B-1 to B-7; GSM, 2001). Unit B contains widely scattered fine gravel suspended within the fine-grained laminated matrix, and it appears to be gradational with Unit C. Thus, Unit B is believed to be a glacial-lacustrine deposit.

Note that another silt-rich unit is also present under Naval Avenue and in the northwestern portion of the Site based on borings (SB-21 and SB-29), up to 10 feet thick. However, this is a coarser silt unit without clay, and with a greater amount of gravel, and is considered to be part of Unit A.

Unit C

Below Units A and B is a lithologic unit that includes a heterogeneous mix of silt, sand, gravel, and minor clay, often with a fine matrix of silty sand. This unit includes some layers of medium-grained sand and gravelly sand. Unit C includes glacial till and related till-like material, which is marked by a greater hardness and a wide range of grain sizes, including significant but variable amounts of gravel. This unit, known as the Vashon till, is present across the Site and varies in thickness from approximately 8 feet to at least 17 feet (Figure 5). Within the western UST basin, the top of Unit C appears to be present at a depth of approximately 8 to 9 feet bgs. In the area immediately south of the eastern UST basin, the top of the till is present at approximately 15 to 16 feet bgs. The consistency of the till material is generally described as dense to very dense or firm to hard. The upper few feet of this unit is locally less dense and grades upward into silty sand and then into the silt of Unit B. The till was rarely observed to perch small seams of water (a few inches thick) on top of it.

Unit D

Below the glacial till is a unit of fine sand that has been observed wherever drilling extended beyond the base of the till. The sand typically ranges from very fine to medium-grained and includes trace amounts of coarse silt ranging up to 10 percent, with up to several percent gravel. The top of this sand was identified in 15 RI borings at depths ranging from 17 to 25 feet. In RI borings that did not penetrate through Unit C, the top of Unit D would range to greater than 31.5 feet bgs. This Unit D sand was found to be greater than 28 feet thick in boring SB-1, to a drilled depth of 51.5 feet bgs. Drilling at the ARCO station to the west of the Site revealed that this unit extends to a depth of at least 80 feet bgs (Ecology 2013a). Based on the lithology of this unit and its thick presence below glacial till, Unit D likely represents Vashon glacial advance outwash material.

Lithology in Eastern UST Basin

The geology within the area of the former eastern UST basin is somewhat different than that shown on the cross section (Figure 5) located just south of the basin. Pre-RI reports indicated that native shallow soils surrounding the former UST basin consisted of medium dense sandy silt (Units A and B). Within the tank basin, the former backfill material (sandy gravel) extended from near the surface to approximately 10 feet bgs, with medium dense sand from 10 to 12 feet bgs, and sandy silt (Unit B) from 12 to at least 14 feet bgs (the maximum excavation depth). As noted above, the borings labeled B-1 to B-7 (Figure 4) also identified the silt-rich Unit B around the outside periphery of the tank basin. The 2-foot thick sand layer (10 to 12 feet bgs) was identified on the north, west, and south walls of the tank-pit excavation completed in 1990, but not in the two test pits excavated to 13 feet bgs near the southeast corner of the main tank basin (AGI, 1990). Based on the differing geology outside the tank basin, the sand layer at a depth of 10 to 12 feet bgs appears to be tank-bed material placed on top of excavated silt at the time of the UST installation (possibly 1961). Therefore, this tank-basin sand would laterally terminate against the silty soil of Unit B.

3.1.2 Hydrogeology

Groundwater was not encountered during RI field activities at the Site, except for a few thin seams of water perched in small pockets overlying glacial till. As stated in Section 3.4 of the RI Report (Leidos, 2023), the water table within the upper aquifer in this area is expected to be situated at approximately 70 feet bgs. This aquifer appears to be present within the lower portion of Unit D, the Vashon advance outwash sand. At the adjacent ARCO station, only one monitoring well was installed to the water table, and thus the direction of groundwater flow could not be determined (AGI, 1990; Ecology, 2013a).

3.2 CONTAMINANT RELEASE

Based on data from the RI and previous environmental investigations, as well as information that is known or suspected regarding service station operations at the Site between approximately 1928 and 2008, Leidos has identified the following as likely potential sources for the petroleum hydrocarbon impacts at the Site:

- Past releases to the subsurface associated with leaking petroleum USTs;
- Past releases to soil associated with leaking product conveyance piping associated with the former service station configurations;
- Past releases to the ground surface or near-surface soils from UST overfills in the current or former UST basin areas; and
- Past releases to the ground surface associated with vehicle refueling or pump maintenance operations at the current or former dispenser island locations.

3.3 CONTAMINANTS OF CONCERN

MTCA defines a contaminant as "any hazardous substance that does not occur naturally or occurs at greater than natural background levels." Based on the results of the RI, and previous environmental investigations performed at the Site, the following hazardous substances have been identified as contaminants of concern (COCs):

- Gasoline-range organics (GRO)
- Diesel-range and heavy-range organics (DRO/HRO)
- Benzene
- Ethylbenzene
- Xylenes
- Naphthalene

3.4 EXTENT OF PETROLEUM IMPACTS

Residual petroleum impacts, consisting of the COCs identified above, have been determined to be present in vadose zone soils at the Site. The approximate extent of these impacts, based on MTCA Method A cleanup level exceedances for Site soil sample results, is depicted on Figures 5 and 6. The use of MTCA Method A cleanup levels on these figures is for screening-level purposes only. Further discussion regarding the selection of cleanup standards for the Site is presented in Section 4.

As shown on Figure 6, soil sampling results from the RI indicate that two distinct areas of petroleum impacted soil are present at the Site:

(1) MTCA Method A cleanup level exceedances for GRO and related constituents are present in the large area that comprises the eastern UST basin, the station building, pump islands, and extending to the east and southeast of the station.

(2) MTCA Method A cleanup level exceedances for DRO, GRO and related constituents are present in the smaller area of the western UST basin near Naval Avenue and extending to the northeast and west/southwest of the basin.

The first of these two areas appears to have originated from multiple release locations on the eastern portion of the Property, including the former regulated UST basin removed in 1990 and the service station pump islands, and it extends a short distance off-Property to the east and a shorter distance to the southeast. This impacted zone does not appear to reach the residential structure at 2005 6th Street; however, it may reach the western portion of the structure at 2007 6th Street. Petroleum contamination (exceeding Method A cleanup levels) in this zone has been identified at depths as shallow as 10 feet bgs in RI soil boring SB-7, near the southern pump island. Shallow impacts to soil at the former station were also detected in pre-RI soil sampling locations B, C, N, and W (AGI, 1990) and pre-RI soil borings BM-4 through BM-8 and BM-12, with impacts as shallow as 7 feet bgs (PEI, 2009). The contamination generally is deeper to the east and reaches its deepest level in boring SB-27, at a maximum sample depth of 26.5 feet bgs (Figure 5). In SB-27, a deeper sample at 29 feet bgs, within Unit C, showed all results as non-detect.

The second of these two areas likely originated from the western former tank basin on the Property, and it extends a short distance off-Property to the west/southwest under Naval Avenue. For RI soil samples, the petroleum contamination in this zone was identified at depths as shallow as 8 feet bgs in borings UST-2, UST-4, SB-20, and SB-24. This widespread area of shallow petroleum impact implies that contamination was able to be transported in an approximately horizontal direction, likely migrating on top of the till layer (Figure 5). The base of contamination was identified as being deepest at SB-17 at a maximum depth of 24.5 feet bgs. Figure 6 shows the area between SB-17, SB-24, and borings around the northern UST, where petroleum impacts to soil include both GRO and DRO.

The vertical extent of contamination in Site soil is identified within the fine-grained material of Units B and C in the eastern area, and Units A and C in the western area. The sample at 24-24.5 feet bgs in SB-17 is the only contaminated soil identified within Unit D, situated 3 feet below the upper contact and with uncontaminated soil below (results for the sample at 29.5 feet bgs were all non-detect or at reporting limits). Aside from this single sample, the low-permeability lithologies of Unit C appear to significantly retard the downward transport of infiltrating water, and in all but this one location act to keep the petroleum hydrocarbons from reaching Unit D. The very fine to medium sand with minor silt of Unit D appears to further impede the downward transport of hydrocarbon contamination (maximum depth of 24.5 feet bgs) and protect the deep underlying aquifer situated at approximately 70 feet bgs.

Based on the vertical extent of petroleum impacts to soil at the Site that exceed MTCA Method A cleanup levels (which are intended to be protective of groundwater), there appears to be a

sufficient interval of non-impacted soil (40+ feet), such that residual soil impacts leaching to groundwater is not a contaminant transport pathway of concern.

3.5 ENVIRONMENTAL MEDIA OF CONCERN

The RI evaluated the following environmental media that were identified as potential media of concern by the RIWP:

Evaluation of Potential Media of Concern		
Potential Media of Concern Evaluated by the RI	**Retained as a Medium of Concern?**	**Justification**
Soil	Yes	One or more hazardous substances have been detected in soil above naturally occurring background conditions. Therefore, soil is considered a medium of concern for the Site.
Groundwater	No	Groundwater has not been encountered at the Site within the maximum depth explored (51.5 feet bgs). As discussed in Section 3.1.2, groundwater at the Site is expected to be first encountered at a depth of approximately 70 feet bgs. This deep groundwater is separated from any Site contamination by 40+ feet of intervening relatively low-permeability soil of Units C and/or D. Therefore, groundwater is not considered a medium of concern for the Site.
Soil Vapor	Yes	As discussed in Section 3.5 of the RI, results of recent Tier 2 VI assessment activities indicate that the presence of petroleum contamination at the Site is not resulting in VI to existing buildings on the former service station property or nearby properties. However, Tier 1 results indicate that naphthalene has been detected in shallow soil vapor at concentrations that exceed current MTCA Method B screening levels for soil gas. Therefore, soil vapor is considered a medium of concern for potential future land use scenarios.
Surface Water	No	The RIWP identified surface water as a medium of potential concern due to groundwater's ability to infiltrate subgrade stormwater conveyance piping that may drain to surface water. However, based on the results of the RI, this potential contaminant transport pathway has been determined to be incomplete because groundwater is not present at the shallow depths where stormwater piping is present near the Site (generally less than 10 feet bgs).

3.6 POTENTIAL RECEPTOR AND TRANSPORT/EXPOSURE PATHWAY EVALUATION

3.6.1 Potential Receptors

Receptors are individuals or populations that are at risk of being exposed to hazardous substances at or originating from a contaminated site. Based on the location and setting of the Site, the RI evaluated the following potential receptors:

Evaluation of Potential Receptors		
Potential Receptors Evaluated by the RI	**Retained as a Receptor of Concern?**	**Justification**
Humans	Yes	The Site is located in a commercial and residential area in the City of Bremerton, Washington. Based on current and future expected land use on and in the vicinity of the Site, humans are considered receptors of concern for the hazardous substances present at the Site.
Terrestrial Ecological Organisms	No	Based on the exclusion criteria established by WAC 173-340-7491(1), terrestrial ecological organisms are not considered as receptors of concern for the Site. See Section 3.6.1.1 for additional details.
Aquatic Ecological Organisms	No	Based on results of the RI, surface water is not considered an environmental medium of concern. Therefore, aquatic ecological organisms are not considered receptors of concern for the Site.

3.6.1.1 Terrestrial Ecological Evaluation

For sites impacted by releases of hazardous substances to soil, WAC chapters 173-340-7490 through 173-340-7494 establish the requirement, and define the procedures, for conducting a terrestrial ecological evaluation (TEE) to determine whether conditions at the site may pose a threat to the terrestrial environment.

Within the TEE procedure, WAC 173-340-7491(1) provides an exclusion from the requirement to complete a TEE, for sites where there is less than 1.5 acres of contiguous undeveloped land on the site or within 500 feet of any area of the site.[2]

Based on the urban setting, and land use in the area within 500 feet of any portion of the Site, this exclusion from the requirement to complete a TEE is applicable to the Site. Therefore, terrestrial ecological organisms are not considered receptors of concern for the Site.

3.6.2 Exposure Pathway Analysis

Exposure pathways are the paths that hazardous substances may take from a source to a receptor. Exposure pathways include transport pathways (how a hazardous substance moves through and across different environmental media) and an exposure route (the path by which receptors may be exposed to hazardous substances). Examples of exposure routes include:

- Direct contact – Ingestion and/or dermal contact with hazardous substances
- Inhalation – Breathing hazardous substances in air (dust, vapor, or gases)

This section presents an analysis of potential exposure pathways for the two media of concern that have been identified for the Site: soil and soil vapor.

[2] This exclusion applies only for sites contaminated with hazardous substances other than those specified in WAC 173-340-7491(1)(c)(ii).

3.6.2.1 Potential Transport Pathways and Exposure Routes for Soil

The following tables provide an evaluation of potential transport pathways and exposure routes that may be associated with the presence of petroleum impacted soil at the Site.

Evaluation of Potential Transport Pathways – Soil		
Potential Transport Pathways	**Retained as a Transport Pathway of Concern?**	**Justification**
Migration of Non-Aqueous Phase Liquid (NAPL)	No	Based on the Site operating history and results of pre-RI investigations, most petroleum impacts to soil are expected to have occurred prior to 1990. Based on the expected age of these releases, petroleum impacts to soil would be expected to have reached stable conditions with no significant further migration.
Leaching to groundwater	No	The bottom-most extents of petroleum impacts to soil that exceed cleanup levels based on protection of groundwater (MTCA Method A) have been delineated well above the level of groundwater (at least 40 feet) at the Site; the water table is situated at approximately 70 feet bgs. Surface water infiltration through soils at the Site is limited due to the urban nature of the Site, which is predominantly covered by impermeable surfaces, and due to fine-grained soils at depth.
Volatilization to soil vapor	Yes	Petroleum-range hydrocarbon impacts to soil vapor have been confirmed by soil vapor sampling. However, the results of this work indicate that petroleum constituents in soil vapor are readily attenuated in shallow soils, which is likely due to the presence of sufficient oxygen to facilitate aerobic degradation.

Evaluation of Potential Exposure Routes – Soil	
Potential Exposure Routes	**Applicability**
Ingestion of, or dermal contact with, contaminated soil	**Exposure route of concern for future subsurface work –** The areas of soil impacted by petroleum-range hydrocarbons at the Site are mostly covered by buildings and pavement and are generally present at depths that would not be encountered by routine construction activities. Therefore, the potential for ingestion or dermal contact by human receptors is considered limited. However, potential ingestion or dermal contact exposures may be possible for workers or the public if impacted soils are exposed during future subsurface construction activities.
Inhalation of hazardous vapors and/or airborne particulates (i.e., dust) in outdoor air	**Exposure route of concern for future subsurface work –** Similar to above, under typical conditions the potential for exposure by inhalation of hazard vapors or dust in outdoor air from contaminated soil is limited. However, potential for exposure by inhalation may exist for workers or the public if impacted soils are exposed during future subsurface construction activities.

3.6.2.2 Potential Transport Pathways and Exposure Routes for Soil Vapor

The following tables provide an evaluation of potential transport pathways and exposure routes that may be associated with the presence of petroleum impacted soil vapor at the Site.

Evaluation of Potential Transport Pathways – Soil Vapor		
Potential Transport Pathways	**Retained as a Transport Pathway of Concern?**	**Justification**
Migration to indoor air	Yes	VI assessment results for work performed to date indicate that petroleum impacted soil vapor is not impacting indoor air quality in existing buildings on or near the Site. However, Tier 1 VIA sampling results indicate that naphthalene has been detected in shallow soil vapor at concentrations exceeding current MTCA Method B screening levels for sub-slab soil gas. Therefore, migration of impacted soil vapor to indoor air has been retained as a pathway of concern for future buildings or changes in land use at, or near, the Site.

Evaluation of Potential Exposure Routes – Soil Vapor	
Potential Exposure Routes	**Applicability**
Inhalation	**Exposure route of potential future concern -** Not an exposure route of concern under current land use. However, may need re-evaluation under future building construction or other land use changes.

4 CLEANUP ACTION OBJECTIVES

Cleanup standards define the objectives that must be achieved by a cleanup action. As defined in WAC 173-340-700, cleanup standards consist of the following three components:

- Cleanup levels for the hazardous substances present;
- The location(s) where these cleanup levels must be met, i.e., the point(s) of compliance; and
- Other regulatory requirements that apply to the site because of the type of action and/or location of the site. These requirements are specified in applicable state and federal laws and are generally established in conjunction with the selection of a specific cleanup action.

4.1 CLEANUP LEVELS

A cleanup level defines the concentration of a hazardous substance above which a contaminated medium (e.g., soil or groundwater) must be remediated in some manner (Ecology, 2013b).

4.1.1 Proposed Cleanup Levels for Soil

As previously discussed in greater detail in Section 5 of the RI report (Leidos, 2023), Leidos utilized MTCA Method B to develop site-specific cleanup levels for total petroleum hydrocarbons (TPH) in soil that would be protective of a direct contact exposure pathway at the Site. Because the Site appears to have been impacted by two discrete petroleum sources: 1) the eastern UST basin and pump islands; and 2) the orphaned UST basin in the western portion of the Property, Leidos calculated site-specific Method B TPH cleanup values for each source area, in order to account for potential compositional differences in the petroleum products that were historically stored/used in these areas.

Cleanup Levels for TPH in Soil	
Method B TPH Cleanup Level for Soil (mg/kg)	**Applicable Site Area**
3,353	Soils impacted by petroleum releases from the dispenser islands and eastern UST basin.
2,477	Soils impacted by petroleum releases from the undocumented UST basin in the western portion of the Site.

4.1.2 Cleanup Levels for Soil Vapor

Although soil vapor has been identified as a medium of concern, due to the potential to impact indoor air under a future land-use change, petroleum impacts to soil vapor will not drive the development of cleanup standards for the Site. At this time, MTCA does not include development of cleanup levels for soil vapor.

In the event of a future land-use change that may increase the potential for VI to indoor air, Leidos expects that MTCA Method B screening levels for soil gas, or Method B indoor air cleanup levels, will be used to evaluate the need for future VI evaluation or mitigation measures.

4.2 POINTS OF COMPLIANCE

Points of Compliance (POCs) are the locations on a site where cleanup levels must be met. MTCA defines the standard POC for each environmental medium (soil, groundwater, air, and surface water).

4.2.1 POCs for Soil

The standard POCs for the exposure pathways of concern for petroleum impacted soil at the Site are limited to:

- Direct contact – Soils from the ground surface to a depth of 15 feet bgs.

4.3 OTHER REGULATORY REQUIREMENTS

WAC 173-340-710 requires that all cleanup actions conducted under MTCA comply with applicable state and federal laws. Applicable state and federal laws include those that are legally applicable requirements, as well as those requirements that Ecology determines are relevant and appropriate. Applicable, relevant, and appropriate requirements are collectively referred to as ARARs.

Potential ARARs that may be associated with specific cleanup actions to be evaluated for the Site are discussed in Section 6.

4.4 PROPOSED CLEANUP STANDARDS AND KNOWN POINTS OF EXCEEDENCES

The following table presents a summary of the proposed cleanup standards for the Site. As previously discussed in Section 4.3, additional components of these cleanup standards, in the form of ARARs, may be required to be included in the cleanup standards for the Site. Additional discussion regarding potential ARARs that may be required for each of the cleanup action alternatives evaluated by this FS is provided in Section 6.

Proposed Cleanup Standards			
Method B TPH Cleanup Level (mg/kg)	**Medium**	**Point of Compliance**	**Applicable Site Area**
3,353	Soil	Ground surface to a depth of 15 feet bgs	Soils impacted by petroleum releases from the dispenser islands and eastern UST basin.
2,477	Soil	Ground surface to a depth of 15 feet bgs	Soils impacted by petroleum releases from the undocumented UST basin in the western portion of the Site.

Based on review of the RI and pre-RI soil sampling results, petroleum impacts to soil have been detected above the proposed Method B cleanup standards at the following sampling locations (Figure 7):

Soil Sample Location ID	Sample Depth (feet bgs)	Investigation	Sample Date	Results
Eastern Portion of Site, TPH Cleanup Level = 3,353 mg/kg				
B	10.5	Pre-RI AGI (1990)	8/1990	TPH detected at 4,875 mg/kg
BM-5	11-12	Pre-RI PEI (2009)	7/20/2009	GRO detected at 4,100 mg/kg and 4,400 mg/kg in duplicate sample
Western Portion of Site, TPH Cleanup Level = 2,477 mg/kg				
UST-2	8	RI Leidos (2018)	8/28/2018	GRO detected at 670 mg/kg DRO detected at 2,800 mg/kg (combined TPH = 3,470 mg/kg)

4.5 SUMMARY OF CLEANUP ACTION OBJECTIVES

Based on the evaluation of potential receptors and transport/exposure pathways presented above in Section 3.6, and the development of cleanup standards for soil previously discussed in Sections 4.1 through 4.4, the following cleanup action objectives have been identified for use in evaluating cleanup action alternatives for the Site:

- Achieve compliance with the cleanup standards for soil at the Site, which are presented above in Section 4.4; and
- Address the potential for naphthalene in shallow soil vapor to create a VI exposure pathway of concern due to redevelopment or other land use changes to properties that are part of the Site.

5 DEVELOPMENT OF CLEANUP ACTION ALTERNATIVES

This section presents the development of the cleanup action alternatives that were evaluated for this FS.

5.1 PRELIMINARY SCREENING OF CLEANUP ACTION COMPONENTS

Cleanup action alternatives consist of one or more cleanup action components, which may consist of treatment technologies, containment or removal actions, engineered or institutional controls, or other types of remedial approaches that may be used individually or in combination with one another to achieve cleanup of a site. Therefore, the first step in developing cleanup action alternatives for the Site was to complete a preliminary screening of cleanup action components that may be appropriate for the cleanup action objectives that were previously identified in Section 4.5.

The following remedial approaches were considered for inclusion as cleanup action components for the FS. Additional details regarding the factors considered for the preliminary screening of cleanup action components are presented in Table 1.

Remedial Approach	Description	Retained as Cleanup Action Component?
Excavation	Physical removal and replacement of contaminated media by conventional excavation equipment, or other means such as large-diameter-auger drilling equipment	Yes
Containment	Use of engineered physical or hydraulic barriers (including surface caps) to prevent further migration of contaminant mass and/or protect sensitive receptors	Yes
Monitored Natural Attenuation (MNA)	Reliance on naturally occurring physical, chemical, and biological processes to reduce contaminant concentrations	Yes
Soil Vapor Extraction (SVE)	In-situ remediation technology that uses vacuum applied to one or more extraction wells to induce phase transfer and capture of volatile contaminants in unsaturated soils	Yes
Bioventing	In-situ remedial technology that enhances aerobic biodegradation of contaminants by supplying atmospheric air to the subsurface	No
Solidification/ Stabilization	In-situ or ex-situ process that fixes contamination in place, by the physio-chemical process of mixing the contaminated media with other materials such as binders and other additives, to reduce or eliminate leaching or migration potential	No
Enhanced Biodegradation	Includes a number or approaches, including bioaugmentation (application of contaminant degrading microbes) and biostimulation (introduction of limiting nutrients) that are intended to enhance naturally occurring biodegradation processes	No
In-Situ Chemical Oxidation	Introduction of chemical oxidants (typically by injection) to react with and destroy organic compounds by breaking down molecular bonds	No

Remedial Approach	Description	Retained as Cleanup Action Component?
Ex-Situ Onsite Treatment	Includes a number of approaches, including aeration, soil washing, or thermal treatment, to treat soils onsite for reuse as backfill, or to facilitate disposal at an alternative offsite disposal facility	No
Institutional Controls	Use of administrative controls such as deed restrictions, legal agreements, or soil management plans to eliminate or control contaminant to receptor exposure pathways	Yes

5.2 PROPOSED CLEANUP ACTION ALTERNATIVES

Based on the preliminary screening of cleanup action components presented in Section 5.1, the following cleanup action alternatives were developed to be further evaluated in the FS:

- Alternative 1: Containment, MNA, and Institutional Controls;
- Alternative 2: Abandoned UST Closure and Soil Excavation, Containment, MNA, and Institutional Controls;
- Alternative 3: Abandoned UST Closure and Soil Excavation, SVE, Containment, MNA, and Institutional Controls;
- Alternative 4: Abandoned and Regulated UST System Closure and Soil Excavation, and Institutional Controls; and
- Alternative 5: Abandoned and Regulated UST System Closure and Soil Excavation.

5.2.1 Alternative 1: Containment, MNA, and Institutional Controls

Under Alternative 1, compliance with soil cleanup standards for the Site would be achieved through natural attenuation, which is expected to require a restoration time frame of approximately 10 to 15 years[3]. During the restoration time frame, exposure pathways to soil containing TPH at concentrations above Site cleanup levels would be managed through a combination of containment (by capping) and institutional controls (Figure 8).

Capping would consist of repair and maintenance of asphalt and concrete surfaces and/or building covers on the Property in order to minimize potential exposure to shallow soils. Capping would also provide an added benefit by continuing to minimize surface water infiltration through petroleum impacted soils to reduce the potential for contaminant leaching and migration.

[3] Restoration time frame estimates presented in Section 5.2 of the FS are approximations based on professional experience and judgment, and are considered appropriate for feasibility-level comparisons of the cleanup action alternatives evaluated by the FS. Additional discussions regarding the estimated restoration time frame for each alternative are presented in Section 6.5.

Institutional controls would be utilized during the restoration time frame to require inspection, maintenance, and repair of the cap, and to provide notification regarding land-use restrictions and requirements for soil handling until the Site cleanup standards are met.

Under Alternative 1, cleanup of the Site would not be complete until results of a future soil sampling event indicate compliance with the site-specific Method B soil cleanup levels for soils shallower than 15 feet bgs. A soil monitoring program would be developed and implemented following the estimated 10- to 15-year restoration time frame period. Monitoring would involve subsurface soil sampling in areas of Method B exceedances (Section 4.4) and laboratory analysis for the Site COCs (Section 3.3). If soil concentrations were not in compliance, an additional round of soil compliance monitoring would be performed after some time period (e.g., every 5 years) until the cleanup standards for the Site were achieved.

However, even after compliance with soil cleanup levels for the Site is complete, any institutional controls requiring assessment or mitigation of a VI exposure pathway on the former service station property, 1932 5th Steet property, and 2005/2007 6th Street property would have to be maintained, unless the results of further assessment indicate that the potential for VI associated with naphthalene in shallow soil vapor is no longer an exposure pathway of concern. This assessment would involve future monitoring of pertinent shallow soil vapor locations for naphthalene, with comparison of concentrations to Ecology soil vapor screening levels.

Under Alternative 1, institutional controls would be required to address the following:

- Provide notification and communicate land-use restrictions and/or soil handling requirements until soil cleanup standards are achieved throughout the Site;
- Require regular inspection, maintenance, and repair of the cap until soil cleanup standards are achieved throughout the Site; and
- Require future assessment or mitigation of a potential VI exposure pathway on the former service station property, and the properties at 1936 5th Street and 2005/2007 6th Street, if a land-use change or new construction were to occur on any of these properties.

Additional discussion regarding the estimated restoration time frame for Alternative 1 is presented in Section 6.5.1.1.

5.2.2 Alternative 2: Abandoned UST Closure and Soil Excavation, Containment, MNA, and Institutional Controls

Alternative 2 is similar to Alternative 1 but includes additional components to address regulatory closure of the three abandoned USTs present along the western boundary of the former service station property, adjacent to Naval Avenue, and to achieve the soil cleanup standards in this area (Figure 9). In association with the closure and removal of these USTs, Alternative 2 would include excavation, to the extent practicable, of soils containing TPH concentrations greater than the Method B TPH cleanup level that was developed for this portion of the Site (2,477 mg/kg). Excavation of these soils is expected to achieve the cleanup standards for soils in the western portion of the Site, unless additional contaminated soil is encountered in the Naval Avenue right-of-way that cannot be accessed for removal due to utilities or other infrastructure.

In the eastern portion of the Site, compliance with soil cleanup standards would be achieved through MNA, as previously described for Alternative 1.

Institutional controls required under Alternative 2 would be the same as those previously discussed for Alternative 1.

The restoration time frame for Alternative 2 is expected to be approximately 5 to 10 years. Additional discussion regarding the estimated restoration time frame for Alternative 2 is presented in Section 6.5.2.1.

5.2.3 Alternative 3: Abandoned UST Closure and Soil Excavation, SVE, Containment, MNA, and Institutional Controls

Alternative 3 is similar to Alternative 2 but includes the addition of an SVE component to address shallow soil impacts (< 15 feet bgs) in the eastern portion of the Site (Figure 10). Within this area, a network of vapor extraction wells would be installed around the existing service station infrastructure to facilitate extraction of contaminated soil vapors and induce phase transfer and capture of volatile petroleum hydrocarbons present in soil in this area. SVE and vapor treatment equipment would be housed in an equipment compound, to be constructed on the Property, or in a trailer-mounted mobile treatment unit. It is expected that the SVE system would operate for a period of 6 to 12 months, after which contaminant concentrations in the extracted vapor would likely have decreased to de minimis levels, such that further operation of the system would provide limited or no additional benefit. At that time, if further reductions of TPH concentrations were necessary to achieve soil cleanup levels in the eastern portion of the Site, Alternative 3 would rely upon MNA.

Like Alternative 2, Alternative 3 includes regulatory closure of the three abandoned USTs adjacent to Naval Avenue, and excavation to achieve compliance with the soil cleanup standards in the western portion of the Site. This alternative would also utilize the same capping strategy and institutional controls required for both Alternatives 1 and 2.

The restoration time frame to achieve soil cleanup standards under Alternative 3 is expected to be less than 5 years. However, institutional controls to require future assessment or mitigation of a potential VI exposure pathway would have to be maintained beyond this time frame unless additional investigation was performed which determined that levels of naphthalene in shallow soil vapor were no longer an exposure pathway of concern for the Site, as discussed for Alternative 1. Additional discussion regarding the estimated restoration time frame for Alternative 3 is presented in Section 6.5.3.1.

5.2.4 Alternative 4: Abandoned and Regulated UST System Closure and Soil Excavation, and Institutional Controls

Under Alternative 4, compliance with soil cleanup standards would be achieved by excavation that would be performed in association with closure of both the abandoned and regulated UST systems at the Site (Figure 11). Similar to Alternatives 2 and 3, Alternative 4 would address soil impacts from the ground surface to point of compliance (15 feet bgs) in the western portion of the Site through excavation performed in conjunction with closure of the three abandoned USTs present in that area. In the eastern portion of the Site, shallow soil impacts would be addressed by excavation that would be performed in association with removal of the regulated UST system, including the three USTs, associated conveyance and vent piping, and the dispenser islands.

Following achievement of compliance with the soil cleanup standards for the Site, additional VI assessment would be performed to assess the potential for VI under future building construction

or other land use changes. If this exposure route of potential future concern was not eliminated by the remedial excavation activities, then Alternative 4 would require the use of institutional controls to require future assessment or mitigation of a potential VI exposure pathway, similar to Alternatives 1 through 3.

Meeting the soil cleanup standards for the Site by excavation under Alternative 4 is expected to be readily achievable. Therefore, the restoration time frame for Alternative 4 is expected to be approximately 1 year, following completion of a Cleanup Action Plan (CAP) for the Site. Additional discussion regarding the estimated restoration time frame for Alternative 4 is presented in Section 6.5.4.1.

5.2.5 Alternative 5: Abandoned and Regulated UST System Closure and Soil Excavation

Alternative 5 is similar to Alternative 4, in that it would rely on excavation to achieve cleanup standards for soil in both the western and eastern portions of the Site (Figure 12). However, Alternative 5 differs from Alternative 4 because the objective of Alternative 5 is to address all potential exposure pathways of concern without the use of institutional controls. Therefore, Alternative 5 may include removal of additional petroleum impacted soils, beyond what would be removed under Alternative 4 to meet soil cleanup standards for the Site, in order to eliminate the potential for naphthalene in soil vapor as an exposure pathway of future concern at the Site. As such, Alternative 5 may also require:

- Removal of the existing service station building to facilitate additional shallow soil excavation on the Property; and
- Excavation (including possible removal and replacement of existing structures) in off-Property areas, including the alley to the south and adjacent residential properties at 1936 5th Street and 2005/2007 6th Street.

Due to the technical challenges associated with implementing a remedial excavation based on a soil vapor cleanup objective, it is likely that Alternative 5 would be implemented in phases to facilitate the additional soil vapor assessment work that would be required to determine compliance with the cleanup objectives. The coordination of off-Property work, and potential removal/replacement of off-Property structures would also make Alternative 5 more technically and administratively challenging to implement. Therefore, the restoration time frame for Alternative 5 is expected to be on the order of approximately 5 years. Additional discussion regarding the estimated restoration time frame for Alternative 5 is presented in Section 6.5.5.1.

6 EVALUATION OF CLEANUP ACTION ALTERNATIVES

This section describes the procedures and results of the evaluation of cleanup action alternatives performed for the FS.

WAC 173-340-360 describes the minimum requirements and procedures for selecting cleanup actions.

6.1 MINIMUM REQUIREMENTS FOR CLEANUP ACTIONS

WAC 173-340-360(2) defines the minimum requirements that must be met for all cleanup actions. To select a cleanup action for a site, a cleanup action must meet each of the minimum requirements specified in this subsection. As specified in this section, "Because cleanup actions will often involve the use of several cleanup action components at a single site, the overall cleanup action shall meet the requirements of this section." The minimum requirements for cleanup actions include the following requirements.

6.1.1 Threshold Requirements

Threshold requirements specified by WAC 173-340-360(2)(a) require that all cleanup actions shall:

- Protect human health and the environment;
- Comply with cleanup standards (see WAC 173-340-700 through 173-340-760);
- Comply with applicable state and federal laws (see WAC 173-340-710); and
- Provide for compliance monitoring (see WAC 173-340-410 and 173-340-720 through 173-340-760).

6.1.2 Other Requirements

When selecting from cleanup action alternatives that fulfill the threshold requirements, the selected action shall meet other requirements specified by WAC 173-340-360(2)(b):

- Provide for a reasonable restoration time frame;
- Consider public concerns; and
- Use permanent solutions to the maximum extent practicable.

Additional details regarding the evaluation of these requirements are provided in Sections 6.2 through 6.4.

6.1.3 Additional Minimum Requirements

Under WAC 173-340-360(2), the following additional minimum requirements may also be applicable for this Site:

- WAC 173-340-360(2)(d) – Requires soils with hazardous substance concentrations that exceed soil cleanup levels to be treated, removed, or contained, at current or potential future residential areas and at schools and child care centers.
- WAC 173-340-360(2)(e) – Specifies requirements for use of institutional controls as a cleanup action component.
- WAC 173-340-360(2)(f) – Requires that cleanup actions prevent or minimize present and future releases and migration of hazardous substances in the environment.

- WAC 173-340-360(2)(g) – Specifies that cleanup actions shall not rely primarily on dilution and dispersion unless the incremental costs of any active remedial measures over the costs of dilution and dispersion grossly exceed the incremental degree of benefits of active remedial measures over the benefits of dilution and dispersion.

6.2 RESTORATION TIME FRAME

WAC 173-340-360(4) describes the requirements and procedures for determining whether a cleanup action provides for a reasonable restoration time frame. To satisfy this requirement, the following factors must be considered:

- Potential risks posed by the site to human health and the environment;
- Practicability of achieving a shorter restoration time frame;
- Current use of the site, surrounding areas, and associated resources that are, or may be, affected by releases from the site;
- Potential future use of the site, surrounding areas, and associated resources that are, or may be, affected by releases from the site;
- Availability of alternative water supplies;
- Likely effectiveness and reliability of institutional controls;
- Ability to control and monitor migration of hazardous substances from the site;
- Toxicity of the hazardous substances at the site; and
- Natural processes that reduce concentrations of hazardous substances and have been documented to occur at the site or under similar site conditions.

Additional details regarding the estimated restoration time frame for each alternative are provided in Section 6.5.

6.3 CONSIDERATION OF PUBLIC CONCERNS

WAC 173-340-360(2)(b)(iii) requires the consideration of public concerns in selection of a cleanup action. This process may include concerns from individuals, community groups, local governments, tribes, federal and state agencies, or any other organization that may have an interest in or knowledge of the Site.

In association with this requirement, WAC 173-340-600(14), "Selection of cleanup actions", also requires that whenever a cleanup action proposes a restrictive covenant as part of a draft cleanup action plan, that notice be provided and comments sought from the city or county department with land use planning authority for real property subject to the restrictive covenant.

Consideration of public concerns is also included as a component of the disproportionate cost analysis (DCA) process, which is presented in Section 6.4, and further discussion regarding the consideration of public concerns for each of the alternatives is provided in Section 6.5.

6.4 DISPROPORTIONATE COST ANALYSIS

Per WAC 173-340-360(3), when selecting a cleanup action, preference shall be given to permanent solutions to the maximum extent practicable. To determine whether a cleanup action uses permanent solutions to the maximum extent practicable, a DCA must be performed, unless

Ecology and the PLPs agree to a permanent cleanup action (WAC 173-340-360(3)(d)). Costs are disproportionate to the benefits if the incremental costs of the alternative over that of a lower cost alternative exceed the incremental degree of benefits achieved by the alternative over that of the other lower cost alternative (WAC 173-340-360(3)(e)(i)).

To perform the DCA, each of the alternatives were scored based on the relative degree of benefit they would provide for the following evaluation criteria established by WAC 173-340-360(3)(f):

- Protectiveness (30 percent);
- Permanence (20 percent);
- Effectiveness over the long term (20 percent);
- Management of short-term risks (10 percent);
- Technical and administrative implementability (10 percent); and
- Consideration of public concerns (10 percent).

A Total Relative Benefit Score was calculated for each alternative by summing the scores for these evaluation criteria, using a weighted approach that utilized the above-referenced percentages that were recommended by Ecology.

Due to the nature of the DCA evaluation criteria, scores are based primarily on qualitative comparison, using best professional judgment. Therefore, the scores assigned are not intended to quantify the degree of potential benefit provided by one alternative relative to another, but only to indicate the standing, relative to the other alternatives, on a scale of least to most beneficial.

For this DCA, the alternative considered to provide the least benefit was assigned a score of "1" and the other alternatives were assigned successively higher scores based on their relative degree of increased benefit, with a maximum potential score of "5". In cases where two or more alternatives were considered to have equal benefit, the highest score assigned was equal to the number of degrees of relative benefit for that criterion. For example, if two of the alternatives were considered equal in benefit, then the highest possible score assigned to the most beneficial alternative was "4". If all alternatives were considered equal in benefit, then the highest score assigned to any of the alternatives was "1".

To complete the DCA, project lifecycle costs were estimated for each of the alternatives. Cost estimates are presented in Appendix A.

Table 2 presents a summary of the evaluation, comparison, benefit scoring, and cost of each alternative for the DCA. The results of the DCA are also presented graphically on Figure 13.

6.5 SUMMARY OF CLEANUP ALTERNATIVES EVALUATION RESULTS

This section presents a summary of the evaluation findings for each cleanup alternative.

6.5.1 Alternative 1: Containment, MNA, and Institutional Controls

6.5.1.1 Alternative 1 – Restoration Time Frame

Restoration time frame means the period of time needed to achieve the required cleanup levels at the points of compliance established for a site. As previously discussed in Section 4.4, the cleanup standards proposed by the RI consist of the following site-specific Method B cleanup levels for soil:

- 3,353 mg/kg, to be attained from the ground surface to 15 feet bgs in soils impacted by petroleum releases from the dispenser islands and regulated UST basin in the eastern portion of the Site; and
- 2,477 mg/kg, to be attained from the ground surface to 15 feet bgs in soils impacted by petroleum releases from the undocumented UST basin in the western portion of the Site.

As discussed in Section 4.4, and shown on Figure 7, based on the results of the pre-RI and RI assessment efforts, only four soil samples have been identified that are not in compliance with these cleanup standards (of the approximately 140 soils samples collected for the RI, only two samples [UST-2 and its duplicate] are not in compliance).

Near the dispenser islands and regulated UST basin, three samples collected from soil borings B and BM-5 contained TPH levels ranging from 4,100 to 4,875 mg/kg. The soil sample with the highest TPH concentration (4,875 mg/kg) was collected from soil boring B by AGI in 1990. The other two samples were collected at soil boring BM-5 by PEI in 2009.

Although the analytical results for these samples exceed the 3,353 mg/kg cleanup level established for this portion of the Site, their levels are on the order of the cleanup level, and one must also consider that these results are for samples that were collected in 1990 and 2009. Therefore, it is possible that a present-day effort to resample these areas may confirm that soils near the dispenser islands and eastern UST basin are already in compliance with the soil cleanup level for this area.

In the western portion of the Site, one soil sample collected from soil boring UST-2 contained a combined TPH concentration of 3,470 mg/kg. Again, the TPH concentration of this sample exceeds but is on the order of the soil cleanup level for this portion of the Site (2,477 mg/kg).

It is difficult to predict the restoration time frame for a natural attenuation cleanup strategy. Chapter IX of the United States Environmental Protection Agency (USEPA) guidance document "How to Evaluate Alternative Cleanup Technologies for Underground Storage Tank Sites" includes a discussion regarding how to estimate the lifetime of residual contamination for hydrocarbon releases that will remain trapped within the vadose zone (USEPA, 2004). Under ideal conditions, this document suggests that the rate of aerobic biodegradation of hydrocarbons for sandy silt at a depth of approximately 13 feet bgs (4 meters) would be approximately 3 mg/kg/day. At this rate, the time necessary to achieve a 1,500 mg/kg reduction in TPH concentrations across the Site would be 500 days or slightly less than 1.5 years. However, the document also compares cleanup timeframes for aerobic biodegradation under ideal conditions (i.e., where oxygen diffusion through soil is the limiting criteria) to those estimated using a lower maximum rate of biodegradation (0.41 mg/kg/day) that was published by Ostendorf and Kampbell in 1991. At this rate, the time necessary to achieve a 1,500 mg/kg reduction in TPH concentration across the Site would be approximately 3,700 days or 10 years.

Based on experience and professional judgment, Leidos believes that an MNA cleanup strategy would be unlikely to achieve cleanup standards for the Site in a period of 1 to 2 years. However, given the limited extent of soils with TPH concentrations in excess of the cleanup levels, and considering the relatively minor degree by which these concentrations exceed those cleanup levels, it is reasonable to expect that cleanup standards for the Site could be achieved in a period of approximately 10 to 15 years under an MNA cleanup strategy.

Based on many of the restoration time frame assessment criteria previously discussed in Section 6.2, Alternative 1 might appear to provide a reasonable restoration time frame, based on the following:

- Potential risks posed by the Site to human health and the environment are considered low, as they are limited to direct contact with soil and inhalation of hazardous vapors and/or airborne particulates (i.e., dust) in outdoor air if construction or other subsurface activities are performed, and the potential for VI under a future land-use change scenario.
- The Site is likely to be used as the location of another gasoline service station or for other commercial use in the future. In addition, a gasoline service station is located immediately west of the Site, across Naval Avenue and an automotive service facility is located to the south of the Site, along Naval Avenue.
- Groundwater is not a medium of concern for the Site. Drinking water supply in the Site area is provided by the City of Bremerton.
- Institutional controls are likely to be effective and reliable to address the potential for future exposures to contaminated soil.
- Results of the RI indicate that petroleum impacts to soil are no longer migrating. Separate phase hydrocarbons have not been detected at the Site and groundwater has not been encountered at depths where petroleum impacts to soil are present.
- Results of the RI indicate that TPH in soil at the Site consists primarily of GRO and DRO hydrocarbons, with a limited number of low-level detections of BTEX or naphthalene.
- Natural processes to reduce concentrations of petroleum hydrocarbons are known to occur under similar site conditions.

However, Alternative 1 does not provide a reasonable restoration time frame when considering the practicability of achieving a shorter restoration time frame under a more aggressive cleanup alternative.

6.5.1.2 Alternative 1 – Consideration of Public Concerns

As previously discussed in Section 6.3 and again in Table 2, there are currently no known public concerns regarding the selection of a cleanup action for the Site. However, it is expected that public concerns, if any exist, will be identified during the comment period for the Public Review Draft FS Report.

Alternative 1 proposes use of restrictive covenants to address potential exposure pathways from hazardous substances before and during a cleanup of TPH impacted soil, and after cleanup standards for soil have been achieved at the Site to address future potential for VI. Therefore, per the requirements of WAC 173-340-600(14), notice would have to be provided to, and comments sought from, the city or county department with land use planning authority for real property in the Site vicinity.

If any public concerns are identified, they will be integrated into the cleanup alternative selection process in the Final FS Report.

6.5.1.3 Alternative 1 – DCA Results

Results of the DCA (Table 2) indicate that Alternative 1 received a cumulative benefit score of 14 and had estimated total lifecycle costs of approximately $399,000, resulting in a cost-benefit ratio score of 29. As shown in Figure 13, Alternative 1 scored the lowest of all alternatives for

the relative degree of benefit that it would provide. Although Alternative 1 has the lowest estimated total lifecycle costs, its cost-benefit ratio score suggests that it would not be cost effective relative to Alternatives 2 and 4.

6.5.1.4 Alternative 1 – Compliance with Other Minimum Requirements

Alternative 1 would not comply with the minimum requirements established by WAC 173-340-360(2). Specifically, Alternative 1 would not comply with all applicable state laws if Ecology directed closure of the abandoned USTs under the authority of WAC 173-360A. Additionally, Alternative 1 would not comply with WAC 173-340-360(2)(e)(iii), which requires that cleanup actions shall not rely primarily on institutional controls and monitoring where it is technically possible to implement a more permanent cleanup action for all or a portion of a site.

6.5.1.5 Alternative 1 – Evaluation Summary

Based on the evaluation of cleanup alternatives, Alternative 1 is not recommended for further evaluation as the preferred cleanup alternative. Due to the lack of evidence suggesting that the abandoned USTs were properly decommissioned, and due to the presence of petroleum impacted water within the southernmost of these USTs, it is likely that Ecology would request their regulatory closure under the authority of WAC 173-360A. Therefore, Alternative 1 would not comply with threshold requirements that require compliance with applicable state and federal laws. In addition, Alternative 1 would not comply with WAC 173-340-360(2)(e)(iii), which requires that cleanup actions shall not rely primarily on institutional controls and monitoring where it is technically possible to implement a more permanent cleanup action for all or a portion of a site. Alternative 1 was determined to provide the lowest level of benefit by the DCA, and is not considered to provide a reasonable restoration time frame, because of the practicability of achieving a shorter restoration time frame using a more aggressive cleanup alternative, like Alternative 2 or 4.

6.5.2 Alternative 2: Abandoned UST Closure and Soil Excavation, Containment, MNA, and Institutional Controls

6.5.2.1 Alternative 2 – Restoration Time Frame

Similar to Alternative 1, Alternative 2 would rely on MNA to achieve the TPH cleanup level in soils near the dispenser islands and the regulated UST basin in the eastern portion of the Site. However, Alternative 2 would use excavation to meet the TPH cleanup level for soil near the abandoned UST basin in the western portion of the Site. Therefore, based on the higher TPH cleanup level for the eastern portion of the Site, and considering the dates when samples were collected from soil borings B and BM-5 that exceed this cleanup level (1990 and 2009, respectively), it is expected the restoration time frame for Alternative 2 would be less than for Alternative 1 (see evaluation in Section 6.5.1.1). For the purpose of the FS, the restoration time frame for Alternative 2 is estimated to be 5 to 10 years.

As previously discussed in Section 6.5.1.1, Alternative 1 would be considered to provide a reasonable restoration time frame based on the risk-based evaluation criteria for this requirement. Therefore, because Alternative 2 is a more aggressive cleanup alternative that is expected to provide a restoration time frame that is less than Alternative 1, Alternative 2 is considered to provide a reasonable restoration time frame.

6.5.2.2 Alternative 2 – Consideration of Public Concerns

Same as for Alternative 1. There are currently no known public concerns regarding the selection of a cleanup action for the Site. However, it is expected that public concerns, if any exist, will be identified during the comment period for the Public Review Draft FS Report.

Alternative 2 proposes use of restrictive covenants to address potential exposure pathways from hazardous substances before and during a cleanup of TPH impacted soil, and after cleanup standards for soil have been achieved at the Site to address future potential for VI. Therefore, per the requirements of WAC 173-340-600(14), notice would have to be provided to, and comments sought from, the city or county department with land use planning authority for real property in the Site vicinity.

If any public concerns are identified, they will be integrated into the cleanup alternative selection process in the Final FS Report.

6.5.2.3 Alternative 2 – DCA Results

Results of the DCA presented in Table 2 indicate that Alternative 2 received a cumulative benefit score of 21 and had estimated total lifecycle costs of approximately $466,000, resulting in a cost-benefit ratio score of 22. As shown in Table 2 and graphically on Figure 13, Alternative 2's benefit score was lower than all other alternatives, except for Alternative 1.

6.5.2.4 Alternative 2 – Compliance with Other Minimum Requirements

Alternative 2 is expected to comply with all other minimum requirements established by WAC 173-340-360(2).

6.5.2.5 Alternative 2 – Evaluation Summary

Based on the evaluation of cleanup alternatives, Alternative 2 is not recommended for further consideration as the preferred cleanup alternative for the Site. Alternative 2 could be implemented in a manner that complies with the minimum requirements that must be met for all cleanup actions, but is expected to provide significantly less benefit than Alternative 4, at a similar level of cost.

6.5.3 Alternative 3: Abandoned UST Closure and Soil Excavation, SVE, Containment, MNA, and Institutional Controls

6.5.3.1 Alternative 3 – Restoration Time Frame

Alternative 3 is similar to Alternative 2 because it uses excavation to meet the TPH cleanup level for soil near the abandoned UST basin in the western portion of the Site. However, Alternative 3 would rely on an active in-situ remediation strategy, SVE, to address a portion of the TPH cleanup in soil near the regulated UST basin and dispenser islands. SVE operation in this portion of the Site would be expected to operate for a period of 6 to 12 months (based on past experience with SVE systems), after which contaminant concentrations in the extracted soil vapor would likely decrease to de minimis levels, such that further operation of the system would provide limited or no additional benefit. At that time, if further reductions of TPH concentrations were necessary to achieve soil cleanup levels in the eastern portion of the Site, Alternative 3 would rely upon MNA. For the purpose of the FS, the restoration time frame for Alternative 3 is estimated to be less than 5 years.

As previously discussed in Section 6.5.2.1, Alternative 2 is considered to provide a reasonable restoration time frame. Therefore, because Alternative 3 is expected to provide a restoration time frame that is less than Alternative 2, Alternative 3 is also considered to provide a reasonable restoration time frame.

6.5.3.2 Alternative 3 – Consideration of Public Concerns

Same as for Alternative 1. There are currently no known public concerns regarding the selection of a cleanup action for the Site. However, it is expected that public concerns, if any exist, will be identified during the comment period for the Public Review Draft FS Report.

Alternative 3 proposes use of restrictive covenants to address potential exposure pathways from hazardous substances before and during a cleanup of TPH impacted soil, and after cleanup standards for soil have been achieved at the Site to address future potential for VI. Therefore, per the requirements of WAC 173-340-600(14), notice would have to be provided to, and comments sought from, the city or county department with land use planning authority for real property in the Site vicinity.

If any public concerns are identified, they will be integrated into the cleanup alternative selection process in the Final FS Report.

6.5.3.3 Alternative 3 – DCA Results

Results of the DCA presented in Table 2 indicate that Alternative 3 received a cumulative benefit score of 27 and had estimated total lifecycle costs of approximately $930,000, resulting in a cost-benefit ratio score of 34. As shown in Table 2 and graphically on Figure 13, Alternative 3's benefit score was higher than Alternatives 1 and 2 and less than Alternatives 4 and 5. Alternative 3's cost-benefit ratio of 34 suggests that it would not be cost effective relative to Alternatives 1, 2 and 4.

6.5.3.4 Alternative 3 – Compliance with Other Minimum Requirements

Alternative 3 could be implemented in a manner that complies with all other minimum requirements established by WAC 173-340-360(2).

6.5.3.5 Alternative 3 – Evaluation Summary

Based on the evaluation of cleanup alternatives, Alternative 3 is not recommended for consideration as the preferred cleanup alternative for the Site. Alternative 3 could be implemented in a manner that complies with the minimum requirements that must be met for all cleanup actions, and is expected to provide a level of benefit equivalent to Alternatives 2 and 5.

However, there are many unknowns regarding the potential effectiveness of an SVE remedy at the Site. Soil heterogeneities associated with the various fill materials used at the Site, including highly permeable gravel fills, would likely make it difficult to focus SVE air flow from the impacted soil areas of concern. Use of SVE at this Site would also require a significant financial investment for pilot testing, design, installation, and operation for a system that would likely provide remedial benefit for a period of only a few months.

6.5.4 Alternative 4: Abandoned and Regulated UST System Closure and Soil Excavation, and Institutional Controls

6.5.4.1 Alternative 4 – Restoration Time Frame

Similar to Alternatives 2 and 3, Alternative 4 would rely on closure of the abandoned USTs and excavation of soils above 15 feet bgs to meet the TPH cleanup level for the western portion of the Site. However, Alternative 4 would also rely on excavation to address TPH cleanup in soil near the regulated UST basin and dispenser islands.

Following a period for planning and permitting, achieving the site-specific Method B soil cleanup levels through excavation could be completed rapidly. Therefore, the restoration time frame for Alternative 4 is estimated to be less than 1 year.

As previously discussed in Section 6.5.2.1, Alternative 2 is considered to provide a reasonable restoration time frame. Therefore, because Alternative 4 is expected to provide a restoration time frame that is less than Alternative 2, Alternative 4 is also considered to provide a reasonable restoration time frame.

6.5.4.2 Alternative 4 – Consideration of Public Concerns

Same as for Alternative 1. There are currently no known public concerns regarding the selection of a cleanup action for the Site. However, it is expected that public concerns, if any exist, will be identified during the comment period for the Public Review Draft FS Report.

Alternative 4 proposes use of restrictive covenants to address potential exposure pathways from hazardous substances before and during a cleanup of TPH impacted soil, and after cleanup standards for soil have been achieved at the Site to address future potential for VI. Therefore, per the requirements of WAC 173-340-600(14), notice would have to be provided to, and comments sought from, the city or county department with land use planning authority for real property in the Site vicinity.

If any public concerns are identified, they will be integrated into the cleanup alternative selection process in the Final FS Report.

6.5.4.3 Alternative 4 – DCA Results

Results of the DCA presented in Table 2 indicate that Alternative 4 received a cumulative benefit score of 32 and had estimated total lifecycle costs of approximately $550,000. As shown in Table 2 and graphically on Figure 13, Alternative 4's benefit score was the second highest of all the alternatives evaluated. However, Alternative 4 would provide the lowest cost-benefit ratio. Costs for Alternative 4 were higher than Alternatives 1 and 2, but less than Alternatives 3 and 5.

6.5.4.4 Alternative 4 – Compliance with Other Minimum Requirements

Alternative 4 could be implemented in a manner that complies with all other minimum requirements established by WAC 173-340-360(2).

6.5.4.5 Alternative 4 – Evaluation Summary

Based on the evaluation of cleanup alternatives, Alternative 4 is recommended for selection as the preferred cleanup alternative for the Site. Alternative 4 could be implemented in a manner that complies with the minimum requirements that must be met for all cleanup actions, and is expected to provide the second highest level of benefit for any of the alternatives evaluated and

the lowest cost-benefit ratio. Although Alternative 5 is expected to provide the greatest degree of benefit, its costs are expected to be disproportionate to the minimal degree of additional benefit that would be provided over Alternative 4. Alternative 4 would also provide the shortest restoration time frame of any of the cleanup alternatives evaluated by the FS.

6.5.5 Alternative 5: Abandoned and Regulated UST System Closure and Soil Excavation

6.5.5.1 Alternative 5 – Restoration Time Frame

As previously discussed in Section 5.2.5, Alternative 5 is similar to Alternative 4, in that it relies on excavation to achieve cleanup standards for soil in both the western and eastern portions of the Site. However, Alternative 5 differs from Alternative 4 in that Alternative 5 includes additional excavation, beyond what would be necessary to achieve the site-specific Method B soil cleanup levels, in order to eliminate all potential contaminant exposure pathways for the Site without the need for on-going institutional controls. Therefore, Alternative 5 may include additional on-Property and/or off-Property excavation and removal/replacement of existing on-Property/off-Property structures in order to address the presence of naphthalene in shallow soil vapor at concentrations exceeding the current MTCA Method B screening level for sub-slab soil gas.

Due to the technical challenges associated with implementing a remedial excavation based on a soil vapor cleanup objective, it is likely that Alternative 5 would be implemented in phases to facilitate additional, and potentially multiple, phases of soil vapor assessment. The coordination of off-Property work, and potential removal/replacement of off-Property structures would also make Alternative 5 more technically and administratively challenging to implement. Therefore, the restoration time frame for Alternative 5 is expected to be approximately 5 years[4].

As previously discussed in Section 6.5.2.1, Alternative 2 is considered to provide a reasonable restoration time frame. Therefore, because Alternative 5 is expected to provide a restoration time frame that is less than Alternative 2, Alternative 5 is also considered to provide a reasonable restoration time frame.

6.5.5.2 Alternative 5 – Consideration of Public Concerns

Same as for Alternative 1. There are currently no known public concerns regarding the selection of a cleanup action for the Site. However, it is expected that public concerns, if any exist, will be identified during the comment period for the Public Review Draft FS Report.

The objective of Alternative 5 is to address all potential exposure pathways of concern without the use of institutional controls. Therefore, if Alternative 5 were successful in achieving this objective, its implementation would not require acceptance by city or county departments with land use planning authority for real property.

[4] Restoration time frame estimates presented in Section 5.2 of the FS are approximations based on professional experience and judgment, and are considered appropriate for feasibility-level comparisons of the cleanup action alternatives evaluated by the FS. Additional discussions regarding the estimated restoration time frame for each alternative are presented in Section 6.5.

If any public concerns are identified, they will be integrated into the cleanup alternative selection process in the Final FS Report.

6.5.5.3 Alternative 5 – DCA Results

Results of the DCA presented in Table 2 indicate that Alternative 5 received a cumulative benefit score of 34 and had estimated total lifecycle costs of approximately $1,700,000. As shown in Table 2 and graphically on Figure 13, Alternative 5's benefit score was the highest of any of the alternatives evaluated for the FS. However, its costs were also significantly higher than any other alternative, resulting in a cost-benefit ratio score of 50. This result suggests that the costs to implement Alternative 5 would be disproportionate to the degree of benefit that would be provided.

6.5.5.4 Alternative 5 – Compliance with Other Minimum Requirements

Alternative 5 could be implemented in a manner that complies with all other minimum requirements established by WAC 173-340-360(2).

6.5.5.5 Alternative 5 – Evaluation Summary

Based on the evaluation of cleanup alternatives, Alternative 5 is not recommended for consideration as the preferred cleanup alternative for the Site. Alternative 5 could be implemented in a manner that complies with the minimum requirements that must be met for all cleanup actions and is expected to provide the highest level of benefit for any of the alternatives evaluated. However, Alternative 5 is expected to provide only slightly more benefit than Alternative 4, while having much higher costs and a lower degree of certainty for success. In addition, implementation of Alternative 5 is expected to be challenging because the endpoints for an excavation intended to satisfy a soil vapor screening level cannot be readily defined.

7 FEASIBILITY STUDY SUMMARY

This FS was prepared in accordance with the MTCA Cleanup Regulation (WAC 173-340) for the purpose of developing and evaluating cleanup alternatives to enable a cleanup action to be selected for this Site. Five cleanup alternatives were developed and compared to identify the most appropriate cleanup action to satisfy the cleanup action objectives identified in Section 4.5.

Based on the evaluation performed, Alternative 4 (Abandoned and Regulated UST System Closure and Soil Excavation, and Institutional Controls) is recommended for selection as the preferred cleanup alternative for the Site.

Although the results of the DCA indicate that Alternative 5 (Abandoned and Regulated UST System Closure and Soil Excavation) would provide the greatest benefit (Total Relative Benefit Score = 34), Alternative 5 is expected to be significantly more expensive than the next most beneficial alternative, Alternative 4. This cost differential is due to Alternative 5's objective of achieving closure for the Site without use of institutional controls, and the potential complexity to design and implement a remedial excavation based on compliance with screening levels for soil gas. Based on this complexity, it is likely that excavation activities for Alternative 5 would have to be performed in several phases, may require work in the alley or at neighboring residential properties, and may require the demolition and replacement of one or more existing structures.

Alternative 4 is expected to provide a similar level of benefit to Alternative 5, with a Total Relative Benefit Score of 32, but at a much lower cost. Alternative 4 would provide the lowest cost to benefit ratio of any of the alternatives and has the lowest estimated restoration time frame (less than one year).

Based on the results of the DCA, the minimal incremental benefit that would be provided by Alternative 5 over Alternative 4 is disproportionate to the difference in estimated costs between these alternatives.

8 REFERENCES

AGI, 1990. "Work Plan. Vapor Extraction System. Newman Texaco, 2021 6th Street, Bremerton, Washington." October 17.

Ecology, 2013a. "No Further Action at the following Site: Budget Rent A Car ARCO (ARCO 5810), 2101 West 6th Street, Bremerton, Washington 98132." September 27.

Ecology, 2013b. "Model Toxics Control Act Regulation and Statute." Washington State Department of Ecology Publication No. 94-06. Revised 2013.

GSM, 2001. "Additional Subsurface Assessment, Interim TPH Evaluation, and Soil Excavation Report, Newman's Chevron, 2021 6th Street, Port Orchard, WA." March 26.

Leidos, 2023. "Public Review Draft, Remedial Investigation Report, Newman's Chevron, 2021 6th Street, Bremerton, Washington." May 26.

PEI, 2009. "Limited Phase II Environmental Site Assessment of the Chevron Gas Station Property. 2021 6th Street, Bremerton, Washington 98337." August 20, 2009.

USEPA, 2004. "How to Evaluate Alternative Cleanup Technologies for Underground Storage Tank Sites: A Guide for Corrective Action Plan Reviewers." Chapter IX, Monitored Natural Attenuation; incorporated into document EPA 510-B-17-003 (October 2017). May 2004.

LIMITATIONS

This technical document was prepared on behalf of the Parties and is intended for their sole use and for use by the local, state, or federal regulatory agency that the technical document was submitted to by Leidos. Any other person or entity obtaining, using, or relying on this technical document hereby acknowledges that they do so at their own risk, and Leidos shall have no responsibility or liability for the consequences thereof.

Site history and background information provided in this technical document are based on sources that may include interviews with environmental regulatory agencies and property management personnel and a review of acquired environmental regulatory agency documents and property information obtained from the Parties and others. Leidos has not made, nor has it been asked to make, any independent investigation concerning the accuracy, reliability, or completeness of such information beyond that described in this technical document.

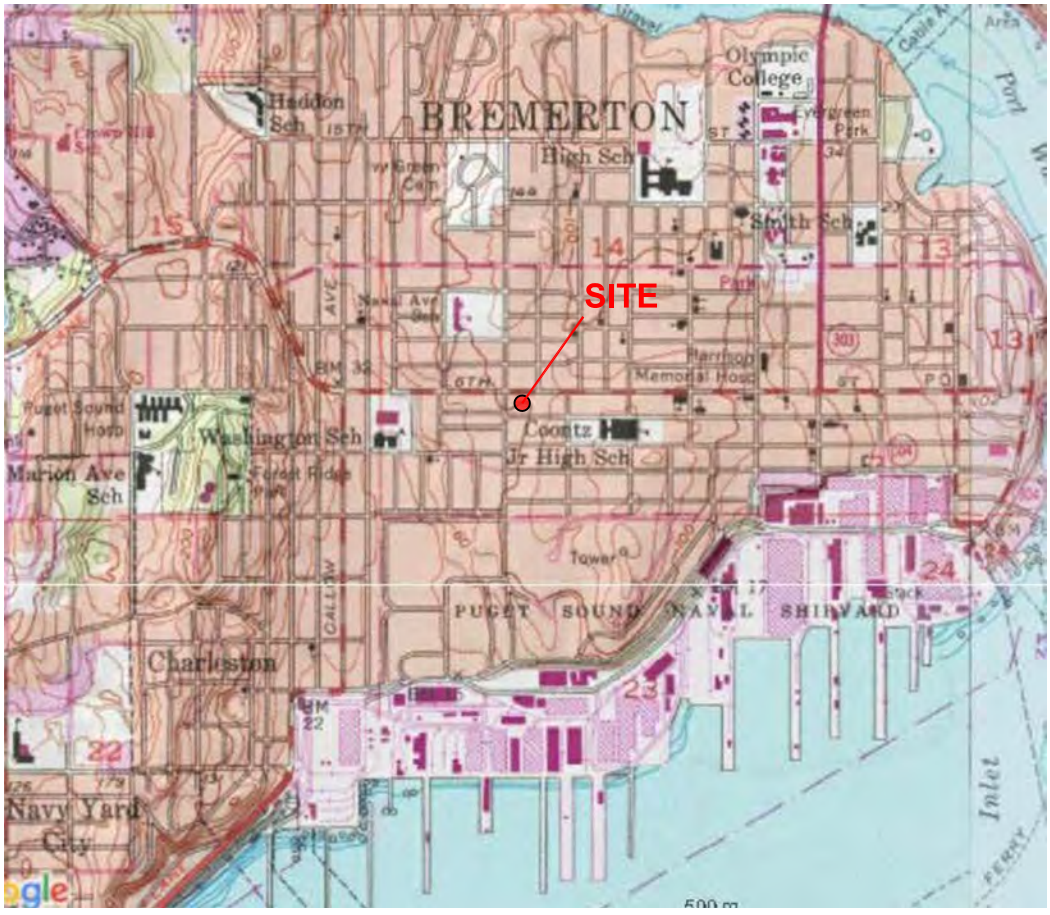
Recognizing reasonable limits of time and cost, this technical document cannot wholly eliminate uncertainty regarding the vertical and lateral extent of impacted environmental media.

Opinions and recommendations presented in this technical document apply only to site conditions and features as they existed at the time of Leidos site visits or site work and cannot be applied to conditions and features of which Leidos is unaware and has not had the opportunity to evaluate.

All sources of information on which Leidos has relied in making its conclusions (including direct field observations) are identified by reference in this technical document or in appendices attached to this technical document. Any information not listed by reference or in appendices has not been evaluated or relied on by Leidos in the context of this technical document. The conclusions, therefore, represent our professional opinion based on the identified sources of information.

Figures

N



leidos

Newman's Chevron 2021 6th Street Bremerton, Washington	Site Vicinity Map	FIGURE 1
	DATE: 9/29/2023 — DRAWING: 204177_Bremerton_FS Vicinity_Map.dwg	

IMAGE SOURCE: GOOGLE EARTH, 2017.

leidos

SCALE

0 25 50 75ft

N

Newman's Chevron
2021 6th Street
Bremerton, Washington

Site Map

DATE: 9/29/2023

DRAWING: 204177 FS Report Figures.dwg

FIGURE
2

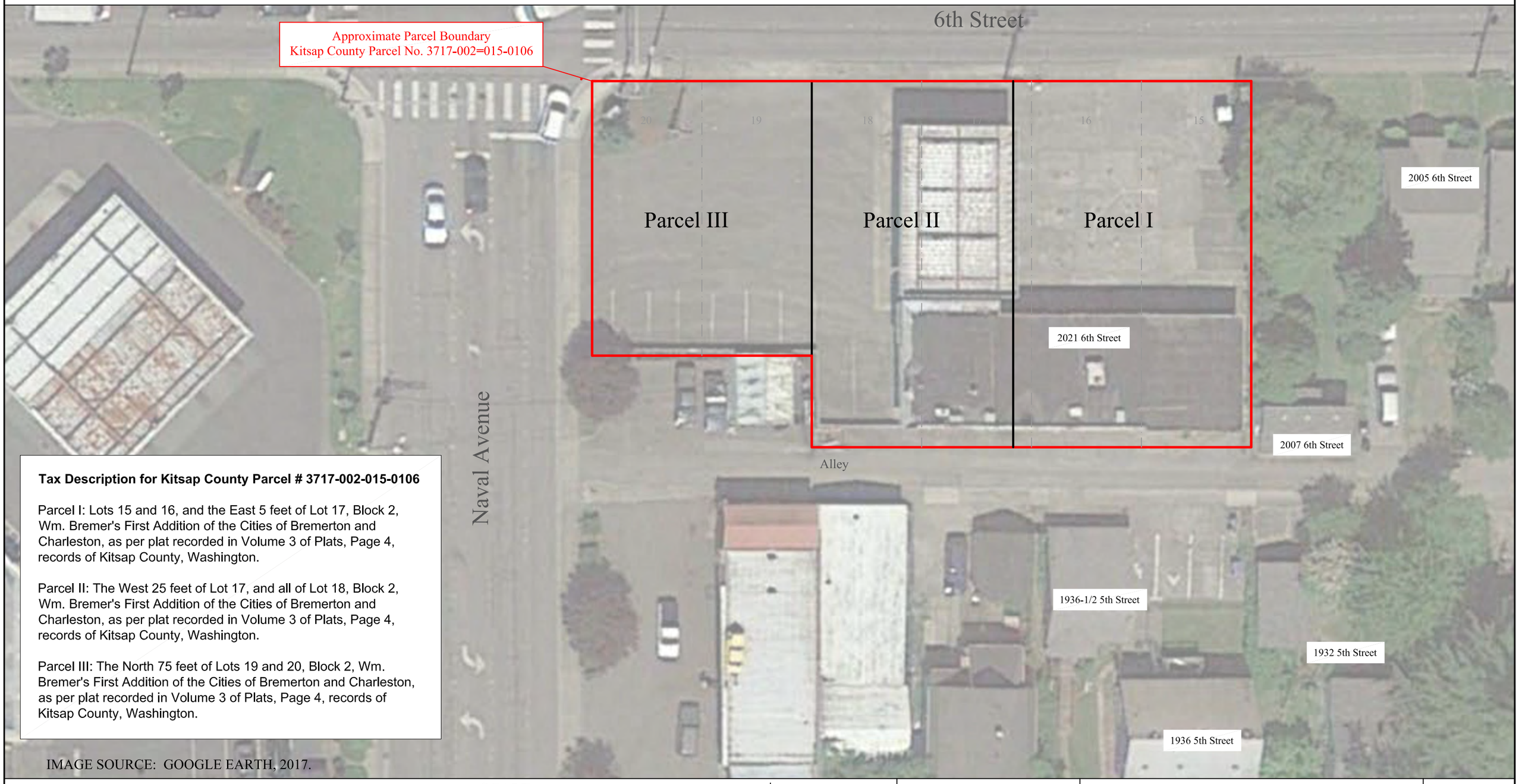
LEGEND:

Approximate Current Parcel Boundary

Approximate Former Parcel Boundaries

Approximate Lot Boundaries

15 Kitsap County Assessor's Tax Lot Identification Number



Tax Description for Kitsap County Parcel # 3717-002-015-0106

Parcel I: Lots 15 and 16, and the East 5 feet of Lot 17, Block 2, Wm. Bremer's First Addition of the Cities of Bremerton and Charleston, as per plat recorded in Volume 3 of Plats, Page 4, records of Kitsap County, Washington.

Parcel II: The West 25 feet of Lot 17, and all of Lot 18, Block 2, Wm. Bremer's First Addition of the Cities of Bremerton and Charleston, as per plat recorded in Volume 3 of Plats, Page 4, records of Kitsap County, Washington.

Parcel III: The North 75 feet of Lots 19 and 20, Block 2, Wm. Bremer's First Addition of the Cities of Bremerton and Charleston, as per plat recorded in Volume 3 of Plats, Page 4, records of Kitsap County, Washington.

IMAGE SOURCE: GOOGLE EARTH, 2017.

leidos

SCALE

0 25 50 75ft

N

Newman's Chevron
2021 6th Street
Bremerton, Washington

Current and Former Property Boundaries

DATE: 9/29/2023

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FIGURE
3

LEGEND:

- SB-9 — RI Soil Boring Location (August 2018)
- SB-20 — RI Soil Boring Location (July 2019)
- SB-30 — RI Soil Boring Location (February 2020)
- SVP-1 — RI Soil Vapor Sampling Probe Location
- Approximate Location of Undocumented UST
- BM-1 — Pre-RI Soil Boring Location (PEI, 2009)
- B-2 — Pre- RI Soil Boring Location (Geoscience Management, 2000)
- Pre-RI Test Excavation and Confirmation Samples (Geoscience Management, 2000)
- (N) Pre-RI Confirmation Soil Sample (AGI, 1990)
- Pre-RI Test Pit (AGI, 1990)
- Approximate Location of Former Service Bay Hoist
- A — A' Geologic Cross-Section Location Line

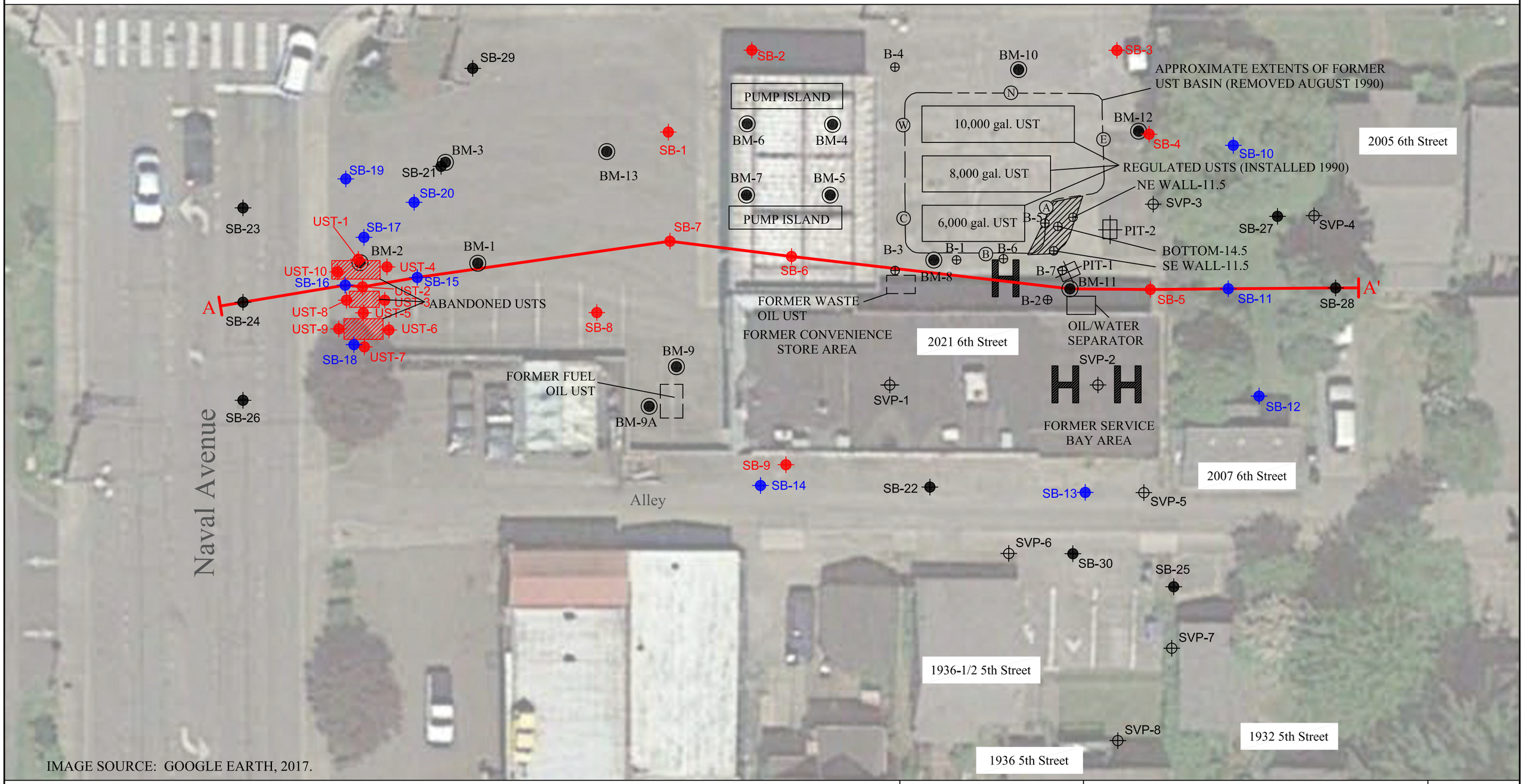

IMAGE SOURCE: GOOGLE EARTH, 2017.

leidos

SCALE 0 20 40 60ft

N

Newman's Chevron
2021 6th Street
Bremerton, Washington

Location of Cross-Section Line A-A'

DATE: 9/29/2023

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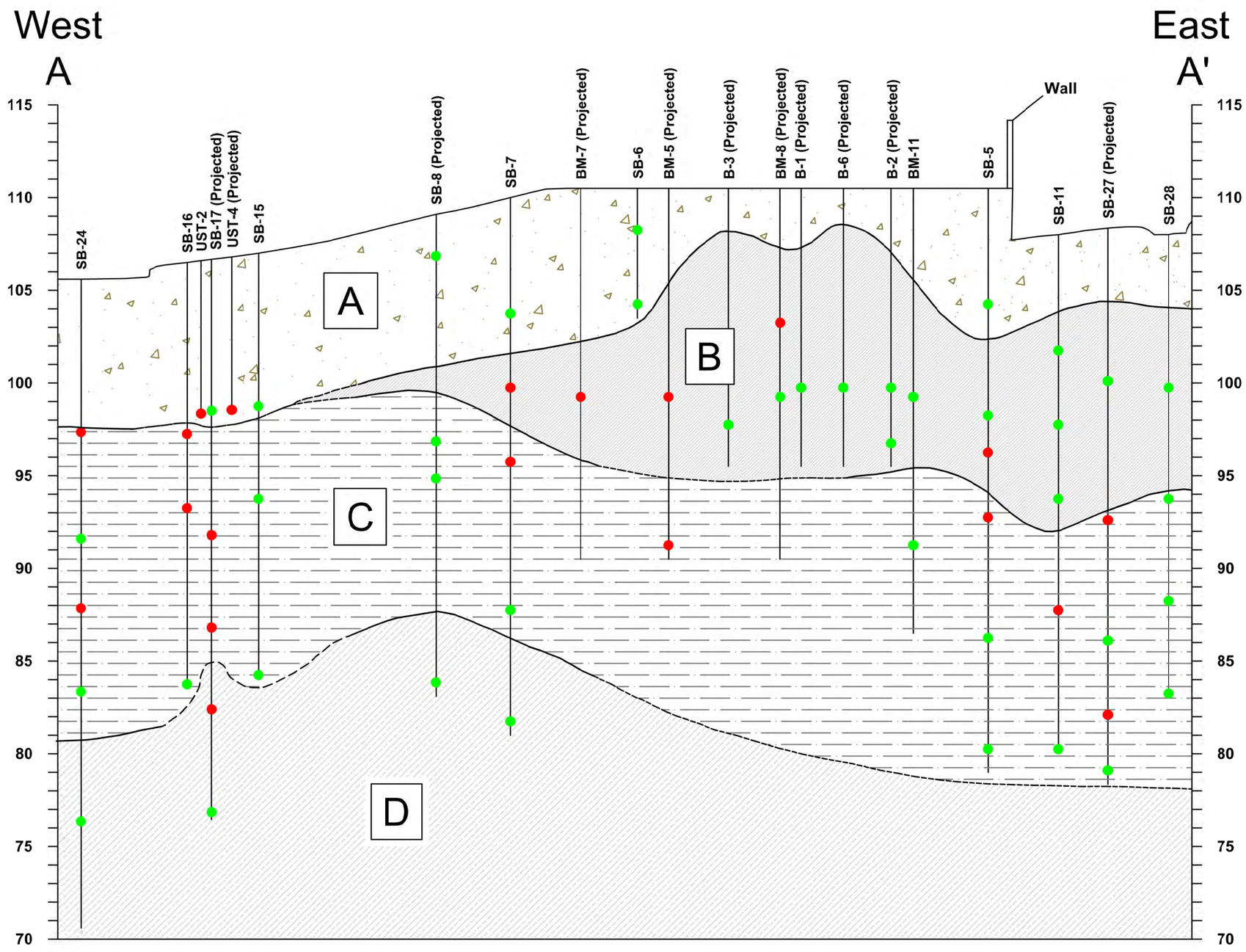
FIGURE 4

LEGEND:

- Soil Boring
- Contact line between soil types
- Contact line between soil types (inferred)
- Location of soil sample with laboratory results exceeding MTCA Method A cleanup levels for one or more analytes
- Location of soil sample with laboratory results less than MTCA Method A cleanup levels for all analytes

SOIL LITHOLOGY LEGEND:

- Unit A: Fill and recent deposits
- Unit B: Glacial lacustrine silt with clay
- Unit C: Glacial till and related material
- Unit D: Glacial advance outwash sand



0 12 24 48

HORIZONTAL SCALE: 1" = 24'
VERTICAL SCALE: 1" = 6'

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Newman's Chevron
2021 6th Street
Bremerton, Washington

Geologic Cross-Section A-A'

DATE: 9/29/2023

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FIGURE
5

LEGEND:

- SB-9 — RI Soil Boring Location (August 2018)
- SB-20 — RI Soil Boring Location (July 2019)
- SB-30 — RI Soil Boring Location (February 2020)
- SVP-1 — RI Soil Vapor Sampling Probe Location
- Approximate Location of Undocumented UST
- BM-1 — Pre-RI Soil Boring Location (PEI, 2009)
- B-2 — Pre- RI Soil Boring Location (Geoscience Management, 2000)
- Pre-RI Test Excavation and Confirmation Samples (Geoscience Management, 2000)
- Pre-RI Confirmation Soil Sample (AGI, 1990)
- Pre-RI Test Pit (AGI, 1990)
- Approximate Location of Former Service Bay Hoist
- Approximate Extent of Soil Containing Gasoline-Range Petroleum Impacts (GRO and/or BTEX) at Concentrations Greater than MTCA Method A Cleanup Levels
- Approximate Extent of Soil Containing GRO and DRO at Concentrations Greater than MTCA Method A Cleanup Levels

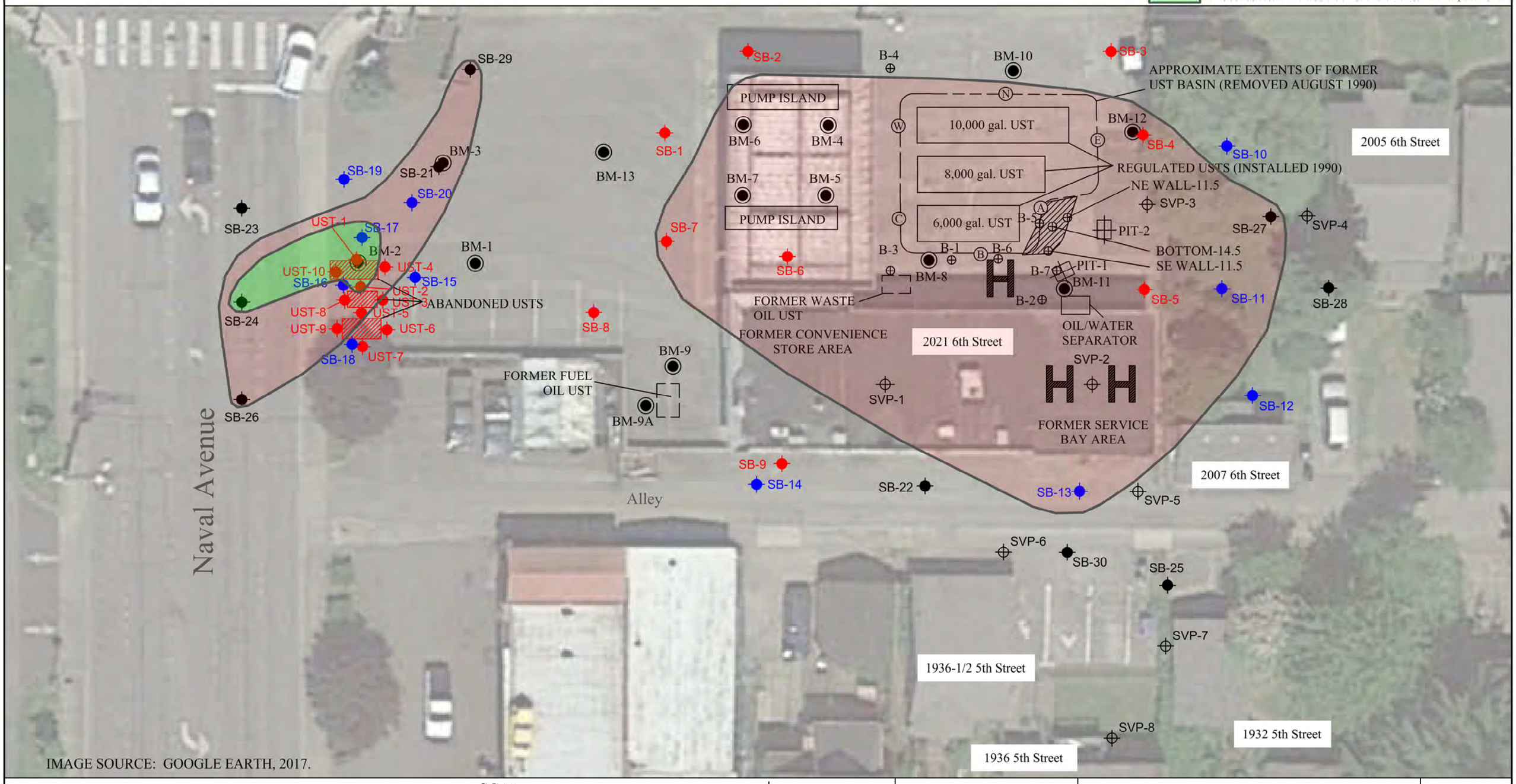

IMAGE SOURCE: GOOGLE EARTH, 2017.

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SCALE 0 20 40 60ft

N

Newman's Chevron
2021 6th Street
Bremerton, Washington

Approximate Extents of Petroleum Impacted Soil

DATE: 9/29/2023

DRAWING: 204177 FS Report Figures.dwg

FIGURE 6

LEGEND:

- SB-9 — RI Soil Boring Location (August 2018)
- SB-20 — RI Soil Boring Location (July 2019)
- SB-30 — RI Soil Boring Location (February 2020)
- SVP-1 — RI Soil Vapor Sampling Probe Location
- Approximate Location of Undocumented UST
- BM-1 — Pre-RI Soil Boring Location (PEI, 2009)
- B-2 — Pre- RI Soil Boring Location (Geoscience Management, 2000)
- Pre-RI Test Excavation and Confirmation Samples (Geoscience Management, 2000)
- N — Pre-RI Confirmation Soil Sample (AGI, 1990)
- Pre-RI Test Pit (AGI, 1990)
- Approximate Location of Former Service Bay Hoist
- Soil Sampling Data for Soil Samples Exceeding Site-Specific Method B Cleanup Levels Above the Standard Point of Compliance for Direct-Contact (15 feet bgs)

Soil Sample ID: UST-2		
Depth (feet)	Date	Results
6	8/28/2018	GRO @ 670 mg/kg DRO @ 2,800 mg/kg

Soil Sample ID: BM-5		
Depth (feet)	Date	Results
11-12	7/20/2009	GRO @ 4,100 to 4,400 mg/kg

Soil Sample ID: B		
Depth (feet)	Date	Results
10.5	8/1990	TPH @ 4,875 mg/kg

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, SB-18, SB-19, SB-20, SB-21, SB-22, SB-23, SB-24, SB-25, SB-26, SB-27, SB-28, SB-30

BM-1, BM-2, BM-3, BM-4, BM-5, BM-6, BM-7, BM-8, BM-9, BM-9A, BM-10, BM-11, BM-12, BM-13

B-1, B-2, B-3, B-4, B-5, B-6, B-7

SVP-1, SVP-2, SVP-3, SVP-4, SVP-5, SVP-6, SVP-7, SVP-8

PIT-1, PIT-2

UST-1, UST-2, UST-3, UST-4, UST-5, UST-6, UST-7, UST-8, UST-9, UST-10

ABANDONED USTS

PUMP ISLAND

PUMP ISLAND

APPROXIMATE EXTENTS OF FORMER UST BASIN (REMOVED AUGUST 1990)

10,000 gal. UST

8,000 gal. UST

6,000 gal. UST

REGULATED USTS (INSTALLED 1990)

NE WALL-11.5

BOTTOM-14.5

SE WALL-11.5

FORMER WASTE OIL UST

FORMER CONVENIENCE STORE AREA

FORMER FUEL OIL UST

OIL/WATER SEPARATOR

FORMER SERVICE BAY AREA

2005 6th Street

2021 6th Street

2007 6th Street

1936-1/2 5th Street

1936 5th Street

1932 5th Street

Naval Avenue

Alley

IMAGE SOURCE: GOOGLE EARTH, 2017.

leidos

SCALE 0 20 40 60ft

N

Newman's Chevron
2021 6th Street
Bremerton, Washington

Exceedences of Method B Soil Cleanup Levels

DATE: 9/29/2023

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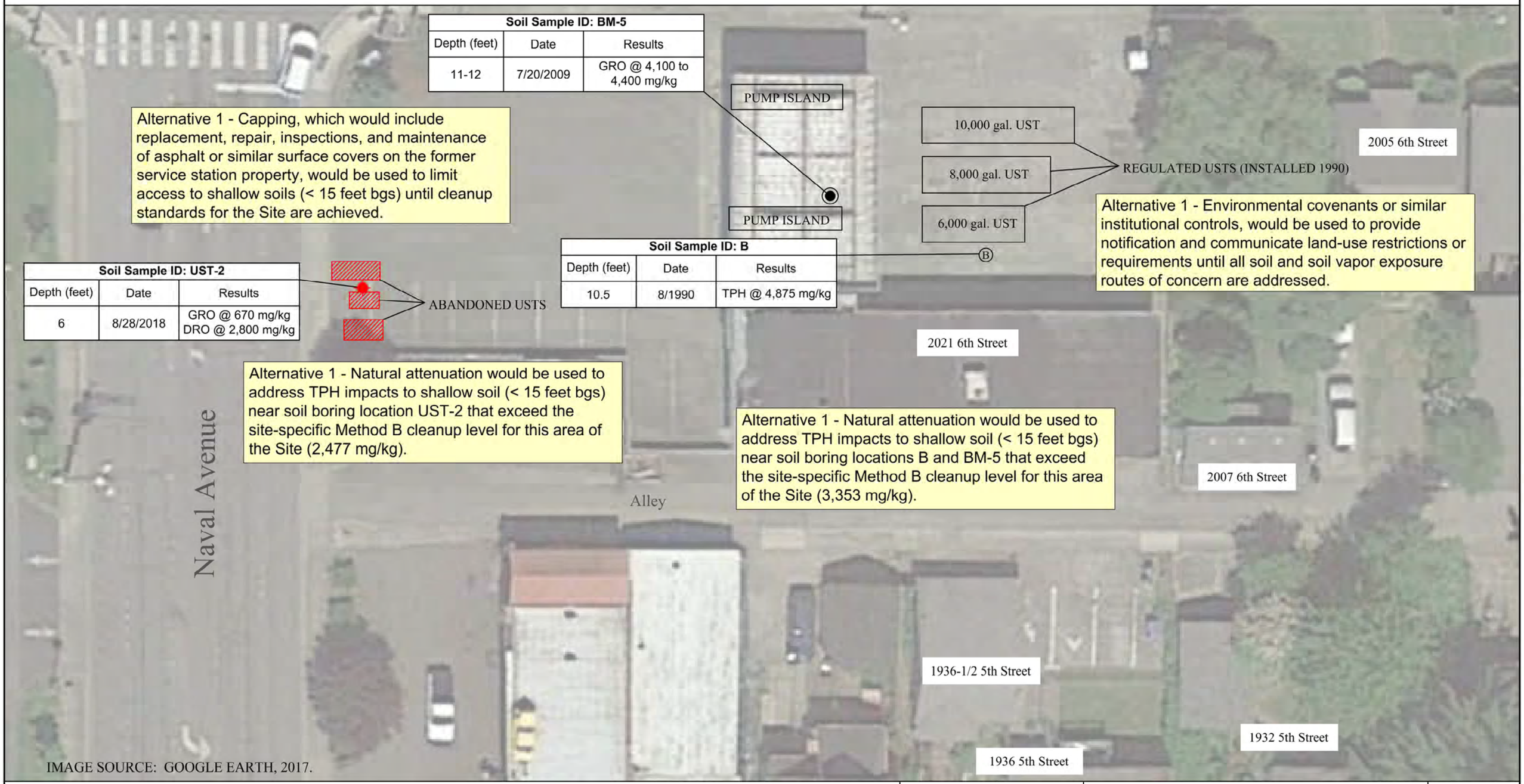
FIGURE 7



leidos

SCALE

0 20 40 60ft

N

Newman's Chevron
2021 6th Street
Bremerton, Washington

Alternative 1: Containment, MNA, and Institutional Controls

DATE: 4/1/2024

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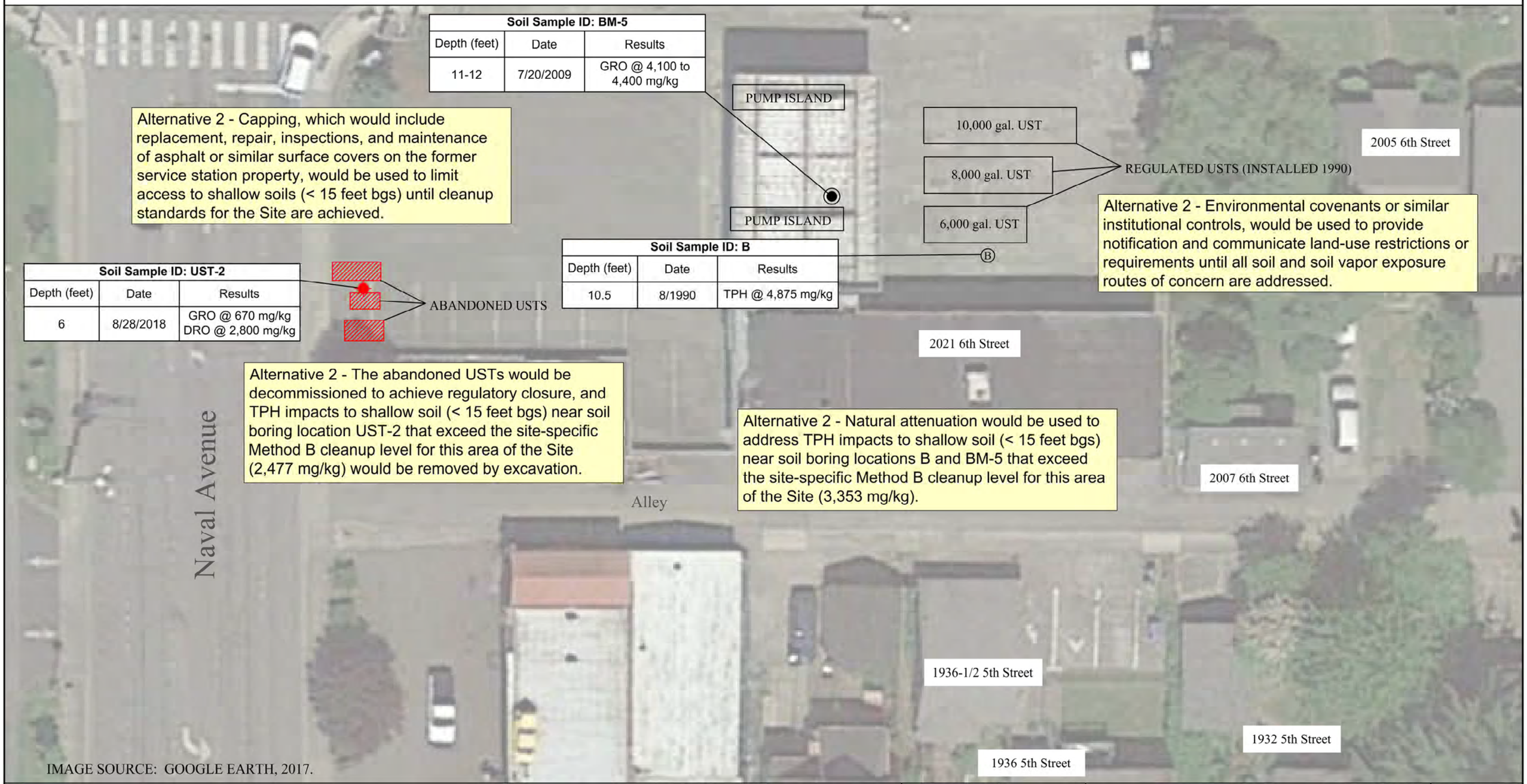
FIGURE 8



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SCALE

0 20 40 60ft

N

Newman's Chevron
2021 6th Street
Bremerton, Washington

Alternative 2: Abandoned UST Closure and Soil Excavation, Containment, MNA, and Institutional Controls

DATE: 4/1/2024

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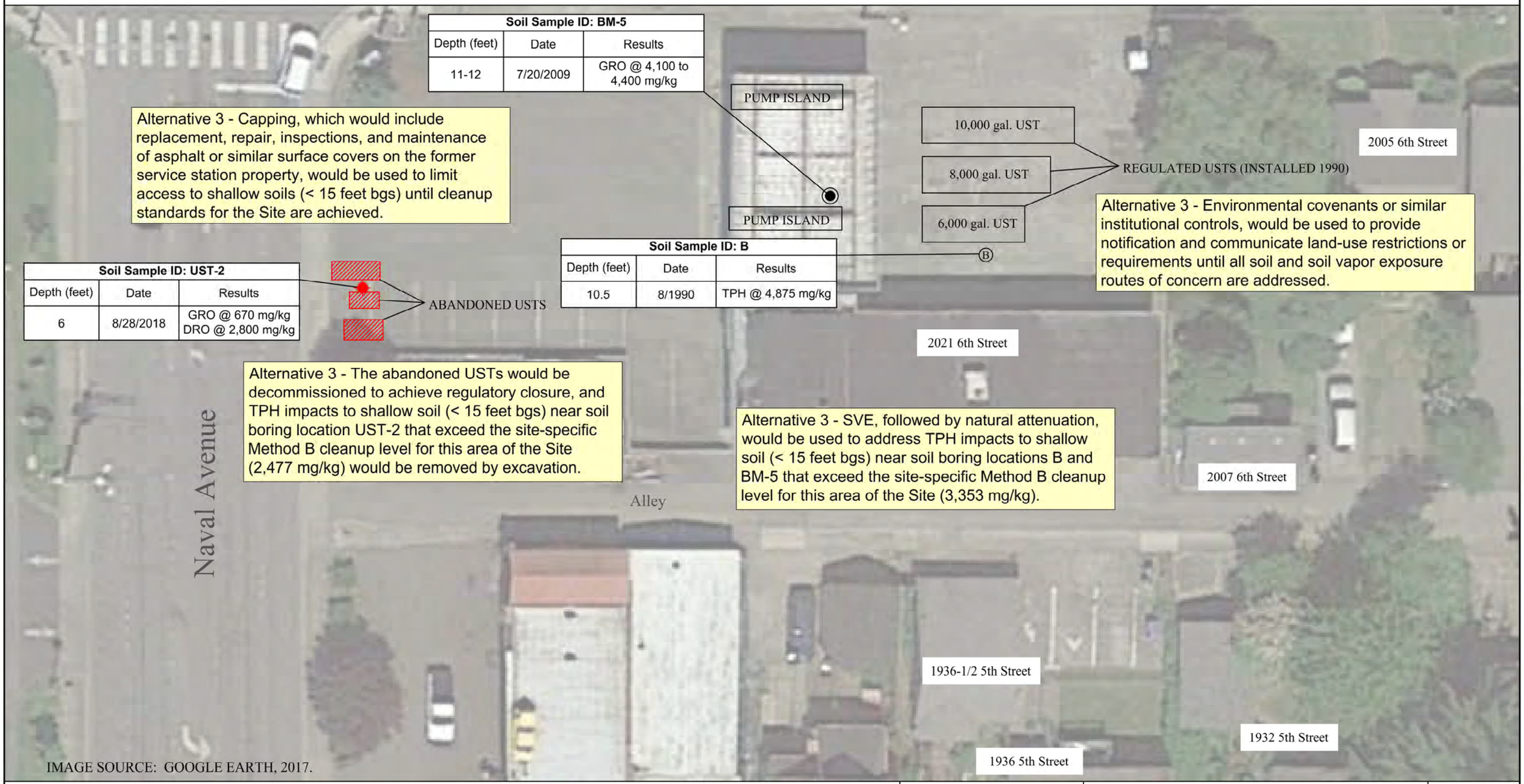
FIGURE 9



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SCALE

0 20 40 60ft

N

Newman's Chevron
2021 6th Street
Bremerton, Washington

Alternative 3: Abandoned UST Closure and Soil Excavation, SVE, Containment, MNA, and Institutional Controls

DATE: 4/1/2024

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FIGURE
10

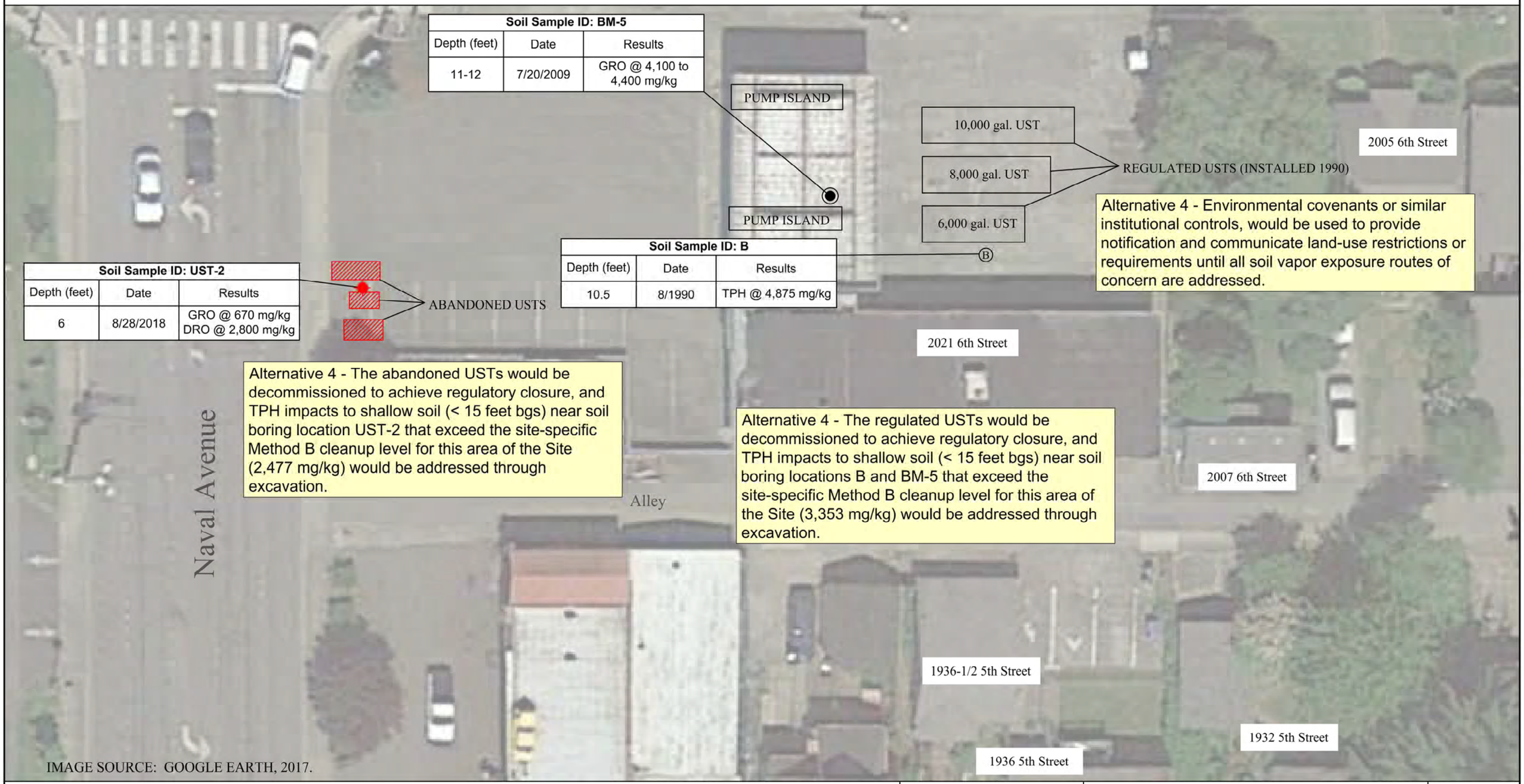

IMAGE SOURCE: GOOGLE EARTH, 2017.

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SCALE

0 20 40 60ft

N

Newman's Chevron
2021 6th Street
Bremerton, Washington

Alternative 4: Abandoned and Regulated UST System Closure and Soil Excavation, and Institutional Controls

DATE: 4/1/2024

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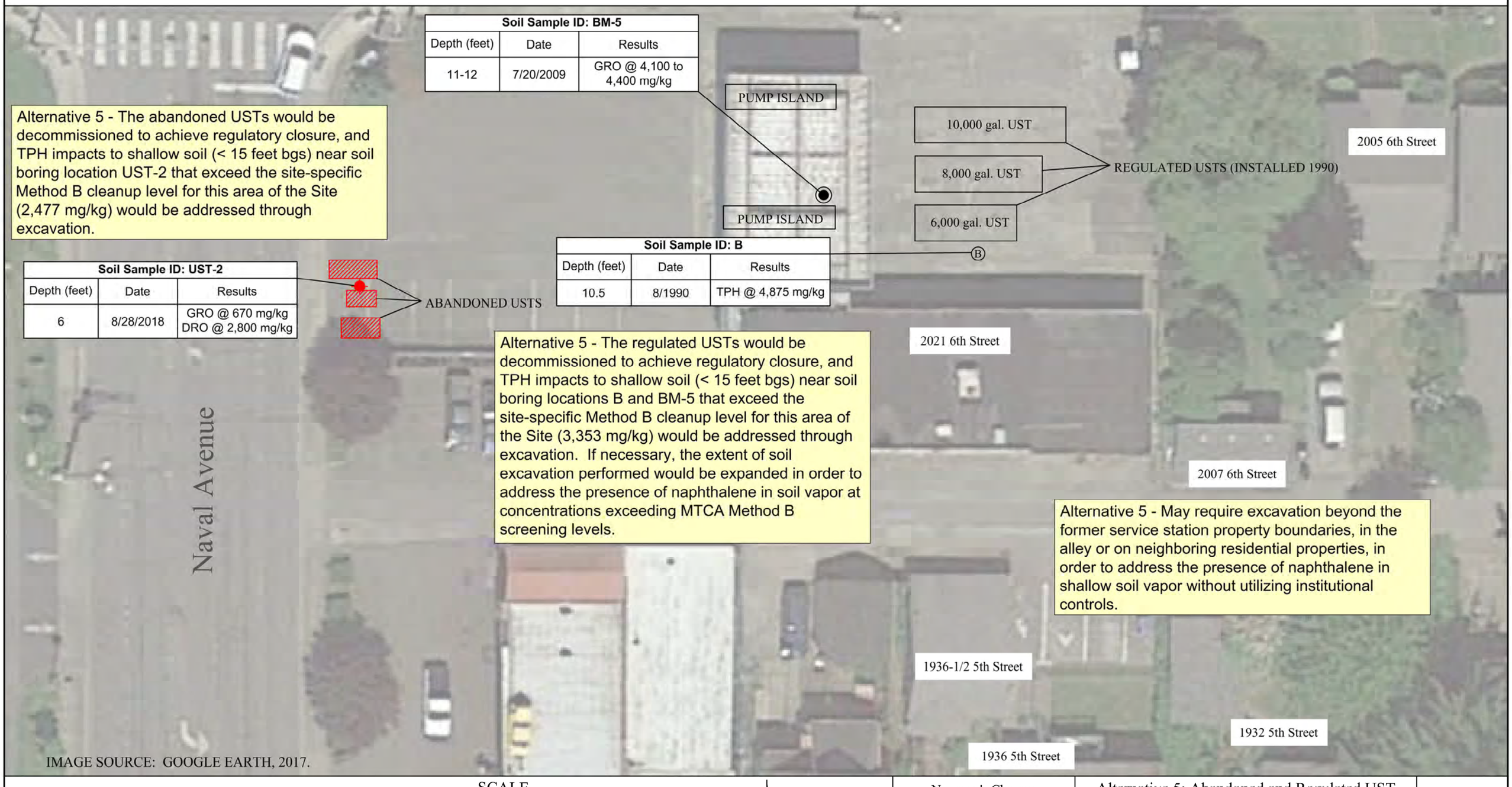
FIGURE 11



leidos

SCALE

0 20 40 60ft

N

Newman's Chevron
2021 6th Street
Bremerton, Washington

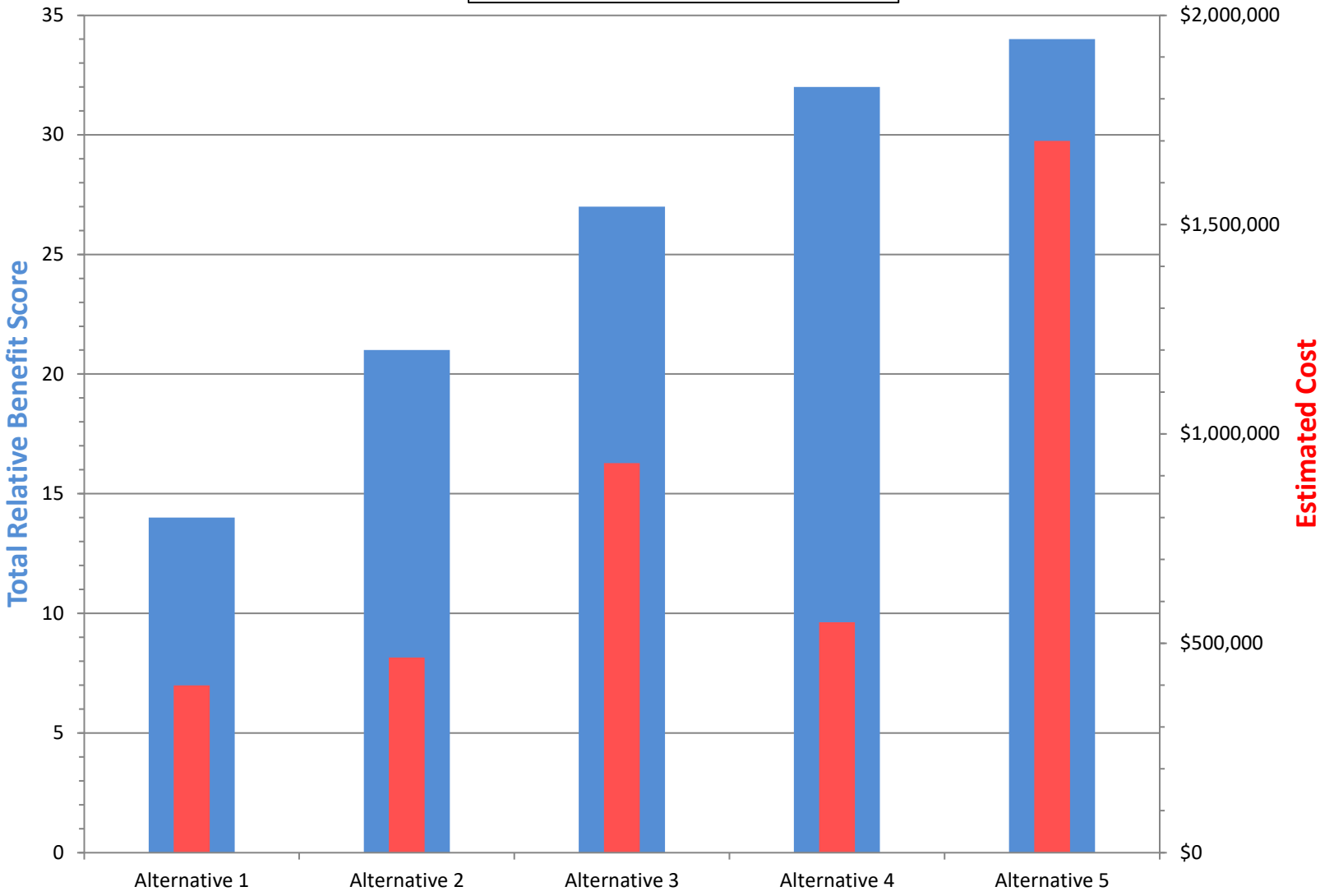
Alternative 5: Abandoned and Regulated UST System Closure and Soil Excavation

DATE: 4/1/2024

DRAWING: 204177 FS Report Figures.dwg

FIGURE 12

Figure 13: Graphical Summary of Disproportionate Cost Analysis



Tables

TABLE 1
PRELIMINARY SCREENING OF CLEANUP ACTION COMPONENTS
NEWMAN'S CHEVRON SITE
Bremerton, Washington

Remedial Technology	Description/Objective	Advantages	Disadvantages/Limitations	Implementability	Applicability for the Site
Excavation	• Physical removal and replacement of contaminated media by conventional excavation equipment, or other means such as large-diameter-auger drilling equipment	• Potential for complete contaminant removal in accessible areas • Short restoration time frame (when implemented under ideal conditions) • Allows monitoring for compliance with soil cleanup levels in real time, while the cleanup action is being implemented	• High cost • Generation of residual wastes requiring on-site treatment and reuse or off-site transportation and disposal • Effectiveness can be reduced by access limitations such as existing buildings and infrastructure, utilities, and deep contamination • Worker and public safety concerns • Disruption to nearby residents and local businesses	• At this Site, excavation could be difficult to implement, or limited, in areas near existing structures, utilities, and City of Bremerton rights-of-way	• Retained as a component of one or more cleanup action alternatives evaluated for the FS
Containment	• Use of engineered physical or hydraulic barriers (including surface caps) to prevent further migration of contaminant mass and/or to protect sensitive receptors	• Reduces the mobility of hazardous substances at a site when implemented effectively • Some containment options, such as surface capping, can be implemented and maintained for relatively low costs	• Does not reduce the toxicity or volume of hazardous substances present at a site • Other containment options such as barrier walls are more costly, would be difficult to implement at this Site, and would provide limited to no benefit in protecting human health and the environment	• Installation and maintenance of a surface cap would be readily implementable at the Site	• Retained as a component of one or more cleanup action alternatives evaluated for the FS
Monitored Natural Attenuation (MNA)	• Reliance on naturally occurring physical, chemical, and biological processes to reduce contaminant concentrations	• Low initial capital costs • Would reduce the toxicity, mobility, and volume of hazardous substances at the Site	• Long restoration time frame • Per MTCA, may only be applied at sites where source control (including removal and/or treatment of hazardous substances) has been conducted to the maximum extent practicable • Requires evidence that natural biodegradation or chemical degradation is occurring and will continue to occur at a reasonable rate at the site • Requires appropriate monitoring to ensure that the natural attenuation process is taking place and that human health and the environment are protected • Per MTCA, may not result in an unacceptable threat to human health and the environment during the restoration time frame • Would require future sampling to demonstrate compliance with site cleanup standards	• MNA would be readily implementable at the Site • Implementation may be challenging due to monitoring requirements (natural attenuation monitoring is typically based on routine monitoring of impacted groundwater, which has not been encountered at the Site)	• Retained as a component of one or more cleanup action alternatives evaluated for the FS

TABLE 1
PRELIMINARY SCREENING OF CLEANUP ACTION COMPONENTS
NEWMAN'S CHEVRON SITE
Bremerton, Washington

Remedial Technology	Description/Objective	Advantages	Disadvantages/Limitations	Implementability	Applicability for the Site
Soil Vapor Extraction (SVE)	• In-situ remediation technology that uses vacuum applied to one or more extraction wells to induce phase transfer and capture of volatile contaminants in unsaturated soils	• Proven technology to reduce the toxicity and volume of volatile petroleum hydrocarbons when implemented effectively • In addition to treating a portion of the volatile fraction of petroleum constituents present in soil, SVE induced air flow through the subsurface should enhance naturally occurring aerobic degradation of contaminants • While operational, may further reduce VI potential through capture of petroleum impacted soil vapor	• Pilot testing would be required to evaluate potential effectiveness • High cost for design and installation of a system that would likely be operated for a relatively short period of time • SVE effectiveness is more challenging for heterogeneous soils because air will selectively flow through more permeable channels where contamination may not be present • Equipment compound for an SVE system may impact property owner's or tenant's use of the Site • Potential noise issue for nearby residents and businesses during the operating period for the SVE system • Not as effective for less volatile petroleum hydrocarbons such as DRO and naphthalene • Vapor phase treatment options such as granular activated carbon would result in generation of residual waste requiring off-site transportation and reactivation or disposal • Would require future sampling to demonstrate compliance with site cleanup standards for soil • Effectiveness is dependent upon proper design, installation, and operational run time	• Installation and operation of an SVE system is believed to be implementable at the Site, but would be dependent on access to utility connections and an air discharge permit to operate the system	• Retained as a component of one or more cleanup action alternatives evaluated for the FS
Bioventing	• In-situ remediation technology that enhances aerobic biodegradation of contaminants by supplying atmospheric air to the subsurface	• Reduced restoration time frame versus an MNA strategy by facilitating a greater degree of biodegradation by more efficient aerobic processes • Applicable to any biodegradable petroleum hydrocarbon • Lower operation, maintenance, and monitoring costs than SVE • A vacuum-based bioventing system may provide some reduction of VI potential through capture of petroleum impacted soil vapor	• Effectiveness of system operation is difficult to determine, except by results from future compliance soil sampling • Would require future sampling to demonstrate compliance with site cleanup standards for soil	• Likely to be implementable at the Site	• Not retained as a cleanup action component because its implementation is expected to provide minimal benefit at this Site

TABLE 1
PRELIMINARY SCREENING OF CLEANUP ACTION COMPONENTS
NEWMAN'S CHEVRON SITE
Bremerton, Washington

Remedial Technology	Description/Objective	Advantages	Disadvantages/Limitations	Implementability	Applicability for the Site
Solidification/Stabilization	• An in-situ or ex-situ process that fixes contamination in place, by the physio-chemical process of mixing contaminated media with other materials such as binders and other additives, to reduce or eliminate leaching or migration potential	• None identified for the conditions at this Site because of minimal potential for leaching or further contaminant migration	• High cost • Technically and logistically challenging to implement, especially on smaller sites • Only effective in areas that are accessible for soil removal and replacement, or where in-situ mixing can be implemented • Would not reduce the toxicity or volume of hazardous substances at the Site	• Potentially implementable; however, significant technical and logistical challenges would be expected to implement this strategy at the Site, given its location, size, and the infrastructure currently present	• Not retained as a cleanup action component because its use would be expected to provide minimal benefit in achieving the cleanup objectives for the Site
Enhanced Biodegradation	• Includes a number of approaches, such as bioaugmentation (application of contaminant degrading microbes) and biostimulation (introduction of limiting nutrients) that are intended to enhance naturally occurring biodegradation processes	• Would reduce the toxicity, mobility, and volume of hazardous substances at the Site • Can often be implemented for relatively low costs	• Expected to require additional sampling and treatability testing to determine appropriate approach • Not considered a proven and widely used approach • Would require future sampling to demonstrate compliance with site cleanup standards for soil	• Likely to be implementable at the Site	• Not retained as a cleanup action component, primarily because of unknowns regarding its effectiveness to attain the cleanup objectives for the Site
In-Situ Chemical Oxidation (ISCO)	• Introduction of chemical oxidants (typically by injection) to react with and destroy organic compounds by breaking down molecular bonds	• Potentially short restoration time frame (when implemented under ideal conditions)	• Limited effectiveness in vadose zone • Low permeability and heterogeneous soils are challenging for amendment delivery and reduce efficiency and effectiveness • High cost • Potential production of chemical by-products • Safety concerns for workers and the public – oxidant reactions can be very rapid and exothermic	• Application of chemical oxidants could be readily implemented on the former service station property through the use of new injection points • Implementation may require restriction of public access during and immediately after injection events to ensure public safety	• Not retained as a cleanup action component, primarily because of limited effectiveness in the vadose zone and associated unknowns regarding its effectiveness to attain the cleanup objectives for the Site
Ex-Situ Onsite Treatment	• Includes a number of approaches, such as aeration, soil washing, or thermal treatment, to treat contaminated soils onsite for reuse as backfill, or to facilitate disposal at an alternative offsite disposal facility	• Under certain site conditions, ex-situ onsite treatment approaches may provide a cost-effective alternative to offsite transportation and disposal of contaminated soil and import of new backfill material	• Additional logistical challenges for implementation associated with space requirements for treatment, permitting, and compliance sampling • Excavated areas may have to remain open during the treatment process, creating a potential worker and public safety concern • Contingent upon excavated soils being suitable for reuse as backfill • Not likely to be cost effective at this Site in comparison to off-site treatment or disposal options	• Potentially implementable; however, significant technical and logistical challenges would be expected to implement this strategy at the Site, given its size and location	• Not retained as a cleanup action component because of technical and logistical challenges associated with its implementation and because it is unlikely to be cost effective given the conditions at this Site

TABLE 1
PRELIMINARY SCREENING OF CLEANUP ACTION COMPONENTS
NEWMAN'S CHEVRON SITE
Bremerton, Washington

Remedial Technology	Description/Objective	Advantages	Disadvantages/Limitations	Implementability	Applicability for the Site
Institutional Controls	• Use of administrative controls such as deed restrictions, legal agreements, or soil management plans to eliminate or control contaminant to receptor exposure pathways	• Provide a cost-effective means to eliminate or minimize potential exposure to hazardous substances	• Would not reduce the toxicity, mobility, or volume of hazardous substances at the Site	• Implementability of some institutional controls may be based on approval from property owners • Per WAC 173-340-360(2)(e)(iii), cleanup actions shall not rely primarily on institutional controls and monitoring where it is technically possible to implement a more permanent cleanup action for all or a portion of the site	• Retained as a component of one or more cleanup action alternatives evaluated for the FS

TABLE 2
COMPARISON AND SCORING OF ALTERNATIVES FOR THE DCA
NEWMAN'S CHEVRON SITE
Bremerton, Washington

Evaluation Criteria	Alternative 1 Containment, MNA, and Institutional Controls	Alternative 2 Abandoned UST Closure and Soil Excavation, Containment, MNA, and Institutional Controls	Alternative 3 Abandoned UST Closure and Soil Excavation, SVE, Containment, MNA, and Institutional Controls	Alternative 4 Abandoned and Regulated UST System Closure and Soil Excavation, and Institutional Controls	Alternative 5 Abandoned and Regulated UST System Closure and Soil Excavation
Protectiveness: Overall protectiveness of human health and the environment, including the degree to which existing risks are reduced, time required to reduce risk at the facility and attain cleanup standards, on-site and off-site risks resulting from implementing the alternative, and improvement of the overall environmental quality.	This alternative is considered to provide the lowest degree of protectiveness because it relies on MNA only to attain cleanup standards and would likely result in the longest restoration time frame. The estimated restoration time frame to attain cleanup standards for the Site is 10 to 15 years.	This alternative is considered to have a higher degree of protectiveness than Alternative 1 because it would actively address the potential for a future release of petroleum-impacted water from the southernmost abandoned UST and would attain soil cleanup standards in the western portion of the Site by soil excavation. These activities would reduce petroleum impacts at the Site over the short-term, and may reduce the restoration time frame. The estimated restoration time frame to attain cleanup standards for the Site is approximately 5 to 10 years.	This alternative is considered to have a higher degree of protectiveness than Alternative 2 because it would more actively address petroleum impacts to soil in the central and eastern portions of the Site by SVE. The combination of soil excavation in the western portion of the Site and SVE in the central and eastern portions would reduce petroleum impacts at the Site over the short-term, and should reduce the restoration time frame. The estimated restoration time frame to attain cleanup standards for the Site is less than 5 years.	This alternative is considered to have a higher degree of protectiveness than Alternative 3 because excavation, instead of SVE, in the central and eastern portions of the Site would likely attain cleanup standards more quickly than SVE and MNA. The estimated restoration time frame to attain cleanup standards for the Site is less than 1 year.	This alternative is considered to have the highest degree of protectiveness for all of the alternatives because it would attain cleanup standards and eliminate all potential contaminant exposure pathways without the need for on-going institutional controls. The estimated restoration time frame to attain cleanup standards for the Site is approximately 5 years.
Total Relative Benefit Score Weight = 30 Percent	Protectiveness Score = 1	Protectiveness Score = 2	Protectiveness Score = 3	Protectiveness Score = 4	Protectiveness Score = 5
Permanence: The degree to which the alternative permanently reduces the toxicity, mobility, or volume of hazardous substances, including the adequacy of the alternative in destroying the hazardous substances, the reduction or elimination of hazardous substance releases and sources of releases, the degree of irreversibility of waste treatment process, and the characteristics and quantity of treatment residuals generated.	This alternative is considered to provide the lowest degree of permanence because it relies solely on MNA to reduce the toxicity and volume of hazardous substances at the Site.	This alternative is considered to provide a higher degree of permanence than Alternative 1 because a portion of the petroleum impacts to soil at the Site would be addressed by excavation, which would provide for a permanent reduction in the toxicity and volume of hazardous substances present.	This alternative is considered to provide a higher degree of permanence than Alternative 2 because a larger portion of the petroleum impacts to soil at the Site would be addressed by active remediation.	This alternative is considered to provide an equivalent degree of permanence to Alternative 3 because a similar portion of the petroleum impacts to soil at the Site would be addressed by active remediation (i.e., excavation).	This alternative is considered to provide a higher degree of permanence than Alternatives 3 and 4 because a larger portion of the petroleum impacts to soil at the Site would be addressed by active remediation (i.e., excavation).
Total Relative Benefit Score Weight = 20 Percent	Permanence Score = 1	Permanence Score = 2	Permanence Score = 3	Permanence Score = 3	Permanence Score = 4

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Effectiveness Over the Long Term: Long-term effectiveness includes the degree of certainty that the alternative will be successful, the reliability of the alternative during the period of time hazardous substances are expected to remain on-site at concentrations that exceed cleanup levels, the magnitude of residual risk with the alternative in place, and the effectiveness of controls required to manage treatment residues or remaining wastes. The following types of cleanup actions components may be used as a guide, in descending order, when assessing the relative degree of long-term effectiveness: Reuse or recycling; destruction or detoxification; immobilization or solidification; on-site or off-site disposal in an engineered, lined and monitored facility; on-site isolation or containment with attendant engineering controls; and institutional controls and monitoring. **Total Relative Benefit Score Weight = 20 Percent**	Alternative 1 is the least active cleanup alternative and is expected to have the lease degree of certainty that it will be effective. Long-Term Effectiveness Score = 1	Alternative 2 would utilize excavation to achieve soil cleanup standards in the western portion of the Site. Therefore, it is expected to have a greater degree of certainty of success than Alternative 1. Long-Term Effectiveness Score = 2	Alternative 3 is similar to Alternative 2 but would use SVE to more actively achieve soil cleanup standards in the eastern portion of the Site. Therefore, Alternative 3 is expected to have a greater degree of certainty of success than Alternatives 1 or 2. Long-Term Effectiveness Score = 3	Alternative 4 is similar to Alternative 3 but would use excavation to achieve soil cleanup standards in the eastern portion of the Site. Due to questions regarding the potential effectiveness of SVE, excavation is considered to have a higher degree of certainty of success in meeting the soil cleanup standards in the eastern portion of the Site. Long-Term Effectiveness Score = 4	Alternative 5 is similar to Alternative 4; however, it seeks to achieve the added objective of addressing future concerns regarding VI potential. Due to the technically complexity associated with defining excavation endpoints based on soil vapor screening levels, there is some question regarding the degree of certainty that this alternative would be successful. Long-Term Effectiveness Score = 4

TABLE 2
COMPARISON AND SCORING OF ALTERNATIVES FOR THE DCA
NEWMAN'S CHEVRON SITE
Bremerton, Washington

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Management of short-term Risks: The risk to human health and the environment associated with the alternative during construction and implementation, and the effectiveness of measures that will be taken to manage such risks.	This alternative is considered to have the lowest degree of short-term risk because its implementation includes the least amount of construction or intrusive subsurface activities. Short-term risks associated with implementation of Alternative 1 include: • Risks to workers and the public from physical hazards or exposure to hazardous substances during future compliance monitoring events.	This alternative is considered to have a higher degree of short-term risk than Alternative 1 because its implementation includes additional intrusive subsurface activities to close the abandoned USTs and excavate shallow petroleum contaminated soil in their vicinity. Short-term risks associated with implementation of Alternative 2 include: • Risks to workers and the public from physical hazards or exposure to hazardous substances during abandoned UST removal and soil excavation activities. • Risks to workers and the public from physical hazards or exposure to hazardous substances during future compliance monitoring events.	This alternative is considered to have a higher degree of short-term risk than Alternative 2 because its implementation includes additional construction and intrusive subsurface activities to install and operate a SVE system. Short-term risks associated with implementation of Alternative 3 include: • Risks to workers and the public from physical hazards or exposure to hazardous substances during abandoned UST removal and soil excavation activities, and installation/operation of the SVE system. • Risks to workers and the public from physical hazards or exposure to hazardous substances during future compliance monitoring events.	This alternative is considered to have a higher degree of short-term risk than Alternative 3 because its implementation includes more extensive intrusive subsurface activities to close the regulated UST system and excavate shallow petroleum contaminated soil in the central and eastern portion of the Site. Short-term risks associated with implementation of Alternative 4 include: • Risks to workers and the public from physical hazards or exposure to hazardous substances during abandoned and regulated UST systems removal and soil excavation. • Risks to workers and the public from physical hazards or exposure to hazardous substances during future compliance monitoring events.	This alternative is considered to have a higher degree of short-term risk than Alternative 4 because its implementation is likely to require more extensive excavation and infrastructure removal to achieve the cleanup objectives for the Site without use of an environmental covenant or similar institutional control. Short-term risks associated with implementation of Alternative 5 include: • Risks to workers and the public from physical hazards or exposure to hazardous substances during abandoned and regulated UST systems removal and soil excavation. • Risks to workers and the public from physical hazards or exposure to hazardous substances during compliance monitoring events.
Total Relative Benefit Score Weight = 10 Percent	Management of Short-Term Risks Score = 5	Management of Short-Term Risks Score = 4	Management of Short-Term Risks Score = 3	Management of Short-Term Risks Score = 2	Management of Short-Term Risks Score = 1

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Technical and Administrative Implementability: Ability to be implemented, including consideration of whether the alternative is technically possible, availability of necessary off-site facilities, services and materials, administrative and regulatory requirements, scheduling, size, complexity, monitoring requirements, access for construction operations and monitoring, and integration with existing facility operations and other current or potential remedial actions.	Alternative 1 is technically implementable. Implementation of Alternative 1 would be dependent securing environmental covenants or similar institutional controls on multiple properties to address potential exposure pathways from hazardous substances before and during a cleanup of TPH impacted soil, and after cleanup standards for soil have been achieved at the Site. The administrative implementability of Alternative 1 would also be dependent on satisfaction of Ecology requirements for financial assurance for institutional controls during the restoration time frame for the project. Alternative 1 may not be administratively implementable if Ecology directs closure of the abandoned USTs under the authority of WAC 173-360A-0830.	Alternative 2 is technically implementable. Implementation of Alternative 2 would be dependent securing environmental covenants or similar institutional controls on multiple properties to address potential exposure pathways from hazardous substances before and during a cleanup of TPH impacted soil, and after cleanup standards for soil have been achieved at the Site. The administrative implementability of Alternative 2 would also be dependent on satisfaction of Ecology requirements for financial assurance for institutional controls during the restoration time frame for the project.	Alternative 3 may be technically implementable; however, pilot testing would be recommended to assess whether SVE can be utilized to effectively remediate petroleum contaminated soils at the Site. The ability to implement Alternative 3 would also be dependent on obtaining operating permits and utility connections for the SVE system. Implementation of Alternative 3 would be dependent securing environmental covenants or similar institutional controls on multiple properties to address potential exposure pathways from hazardous substances before and during a cleanup of TPH impacted soil, and after cleanup standards for soil have been achieved at the Site. The administrative implementability of Alternative 3 would also be dependent on satisfaction of Ecology requirements for financial assurance for institutional controls during the restoration time frame for the project.	Alternative 4 is technically implementable. Implementation of Alternative 4 would be dependent securing environmental covenants or similar institutional controls on multiple properties to address potential exposure pathways from hazardous substances before and during a cleanup of TPH impacted soil, and after cleanup standards for soil have been achieved at the Site. The administrative implementability of Alternative 4 would also be dependent on satisfaction of Ecology requirements for financial assurance for institutional controls during the restoration time frame for the project.	Alternative 5 would be technically challenging to implement because the endpoints for an excavation intended to satisfy a soil vapor screening level cannot be readily defined. Administratively, Alternative 5 could be less challenging to implement because it would not require use of institutional controls. However, implementation of Alternative 5 may also require off-Property excavation, removal/replacement of existing structures, and/or excavations deeper than 15 feet bgs to achieve the objective of closing the Site without use of institutional controls.
Total Relative Benefit Score Weight = 10 Percent	Technical and Administrative Implementability Score = 1	Technical and Administrative Implementability Score = 2	Technical and Administrative Implementability Score = 2	Technical and Administrative Implementability Score = 3	Technical and Administrative Implementability Score = 1

TABLE 2
COMPARISON AND SCORING OF ALTERNATIVES FOR THE DCA
NEWMAN'S CHEVRON SITE
Bremerton, Washington

Evaluation Criteria	Alternative 1 Containment, MNA, and Institutional Controls	Alternative 2 Abandoned UST Closure and Soil Excavation, Containment, MNA, and Institutional Controls	Alternative 3 Abandoned UST Closure and Soil Excavation, SVE, Containment, MNA, and Institutional Controls	Alternative 4 Abandoned and Regulated UST System Closure and Soil Excavation, and Institutional Controls	Alternative 5 Abandoned and Regulated UST System Closure and Soil Excavation
Consideration of Public Concerns: Whether the community has concerns regarding the alternative and, if so, the extent to which the alternative addresses those concerns. This process includes concerns from individuals, community groups, local governments, tribes, federal and state agencies, or any other organization that may have an interest in or knowledge of the site. **Total Relative Benefit Score Weight = 10 Percent**	Currently, there are no known public concerns regarding the selection of a cleanup action for the Site. Therefore, all alternatives are considered equal with regard to consideration of public concerns at this time. However, these scores will be revised, if necessary, based on comments received during the public comment period for the Public Review Draft Feasibility Study Consideration of Public Concerns Score =1	Currently, there are no known public concerns regarding the selection of a cleanup action for the Site. Therefore, all alternatives are considered equal with regard to consideration of public concerns at this time. However, these scores will be revised, if necessary, based on comments received during the public comment period for the Public Review Draft Feasibility Study Consideration of Public Concerns Score =1	Currently, there are no known public concerns regarding the selection of a cleanup action for the Site. Therefore, all alternatives are considered equal with regard to consideration of public concerns at this time. However, these scores will be revised, if necessary, based on comments received during the public comment period for the Public Review Draft Feasibility Study Consideration of Public Concerns Score =1	Currently, there are no known public concerns regarding the selection of a cleanup action for the Site. Therefore, all alternatives are considered equal with regard to consideration of public concerns at this time. However, these scores will be revised, if necessary, based on comments received during the public comment period for the Public Review Draft Feasibility Study Consideration of Public Concerns Score =1	Currently, there are no known public concerns regarding the selection of a cleanup action for the Site. Therefore, all alternatives are considered equal with regard to consideration of public concerns at this time. However, these scores will be revised, if necessary, based on comments received during the public comment period for the Public Review Draft Feasibility Study Consideration of Public Concerns Score =1
Total Relative Benefit Score[1]	**14**	**21**	**27**	**32**	**34**
Estimated Cost	**$399,000**	**$466,000**	**$930,000**	**$550,000**	**$1,700,000**
Cost-Benefit Ratio[2]	**29**	**22**	**34**	**17**	**50**

Notes:
1. The alternative with the highest Total Relative Benefit Score is considered to provide the greatest degree of benefit, relative to the other alternatives.
2. (Estimated Cost/Total Relative Benefit Score)/1,000

Appendix A:
Cleanup Alternatives Cost Estimates

Cost Estimate for Alternative 1
Containment, MNA, and Institutional Controls
Newman's Chevron Site
2021 6th Street, Bremerton, Washington

Cleanup Action Components	Unit	Cost/Unit	Quantity	Notes/Assumptions	Cost
Containment					
Surface Capping	Square Feet	$10	6,500	Repair or replace existing asphalt and concrete surfaces on the former service station property to provide a low permeability surface cap	$65,000
Cap Inspections	Per Year	$1,500	3	Inspection every 5 years	$4,500
Cap Maintenance and Repairs	Lump Sum	$6,500	3	10% of surface capping costs, every 5 years	$19,500
Natural Attenuation					
Develop Compliance Sampling Plan	Lump Sum	$10,000	1	Compliance sampling includes collection of soil samples to evaluate compliance with soil cleanup standards for the Site and two rounds of shallow soil vapor sampling to assess future VI potential based on shallow soil vapor conditions.	$10,000
Implement Compliance Sampling Plan	Lump Sum	$100,000	1	Coordinate, conduct, and report on compliance sampling investigation	$100,000
Institutional Controls					
Coordination and Management of Institutional Controls	Lump Sum	$50,000	1	Consultant and legal fees to develop, negotiate, record, and manage environmental covenants, soil management plans, or similar administrative controls with property owners and/or land use planning authorities	$50,000
Contingency Costs					
Added Contingency Costs	Lump Sum	$150,000	1	Contingengy costs for future VI assessment evaluation and/or VI mitigation measures if the results of the compliance sampling investigation indicate that petroleum hydrocarbon concentrations in shallow soil vapor are still a potential pathway of concern for future buildings or changes in land use at, or near, the Site.	$150,000
Total					$399,000

Cost Estimate for Alternative 2
Abandoned UST Closure and Soil Excavation, Containment, MNA, and Institutional Controls
Newman's Chevron Site
2021 6th Street, Bremerton, Washington

Cleanup Action Components	Unit	Cost/Unit	Quantity	Notes/Assumptions	Cost
Abandoned UST Closure and Soil Excavation					
Abandoned UST Closure	Lump Sum	$75,000	1	Includes planning, field implementation, and reporting to satisfy regulatory closure requirements for three abandoned USTs, including all subcontractor and laboratory analytical costs	$75,000
Containment					
Surface Capping	Square Feet	$10	6,500	Repair or replace existing asphalt and concrete surfaces on the former service station property to provide a low permeability surface cap	$65,000
Cap Inspections	Per Year	$1,500	2	Inspection every 5 years	$3,000
Cap Maintenance and Repairs	Lump Sum	$6,500	2	10% of surface capping costs, every 5 years	$13,000
Natural Attenuation					
Develop Compliance Sampling Plan	Lump Sum	$10,000	1	Compliance sampling includes collection of soil samples to evaluate compliance with soil cleanup standards for the Site and two rounds of shallow soil vapor sampling to assess future VI potential based on shallow soil vapor conditions.	$10,000
Implement Compliance Sampling Plan	Lump Sum	$100,000	1	Coordinate, conduct, and report on compliance sampling investigation	$100,000
Institutional Controls					
Coordination and Management of Institutional Controls	Lump Sum	$50,000	1	Consultant and legal fees to develop, negotiate, record, and manage environmental covenants, soil management plans, or similar administrative controls with property owners and/or land use planning authorities	$50,000
Contingency Costs					
Added Contingency Costs	Lump Sum	$150,000	1	Contingengy costs for future VI assessment evaluation and/or VI mitigation measures if the results of the compliance sampling investigation indicate that petroleum hydrocarbon concentrations in shallow soil vapor are still a potential pathway of concern for future buildings or changes in land use at, or near, the Site.	$150,000
Total					$466,000

Cost Estimate for Alternative 3
Abandoned UST Closure and Soil Excavation, SVE, Containment, MNA, and Institutional Controls
Newman's Chevron Site
2021 6th Street, Bremerton, Washington

Cleanup Action Components	Unit	Cost/Unit	Quantity	Notes/Assumptions	Cost
Abandoned UST Closure and Soil Excavation					
Abandoned UST Closure and Soil Excavation	Lump Sum	$75,000	1	Includes planning, field implementation, and reporting to satisfy regulatory closure requirements for three abandoned USTs, including all subcontractor and laboratory analytical costs	$75,000
SVE					
SVE Pilot Testing, Design, and Permitting	Lump Sum	$150,000	1	Costs for SVE pilot testing, system design, and permitting	$150,000
SVE System Construction, Installation, and Startup	Lump Sum	$200,000	1	Remediation system purchase, well and piping installation, and system startup	$200,000
SVE System Operation, Maintenance, and Monitoring	Per Year	$80,000	1	SVE system operation, maintenance, and monitoring, including utilities and laboratory analytical costs for permit compliance	$80,000
SVE System Decommissioning	Lump Sum	$50,000	1	SVE equipment removal, well decommissioning, and asphalt restoration	$50,000
Containment					
Surface Capping	Square Feet	$10	6,500	Repair or replace existing asphalt and concrete surfaces on the former service station property to provide a low permeability surface cap	$65,000
Cap Inspections	Per Year			Not included for Alternative 3 because the restoration time frame is expected to be less than 5 years	$0
Cap Maintenance and Repairs	Lump Sum			Not included for Alternative 3 because the restoration time frame is expected to be less than 5 years	$0
Natural Attenuation					
Develop Compliance Sampling Plan	Lump Sum	$10,000	1	Compliance sampling includes collection of soil samples to evaluate compliance with soil cleanup standards for the Site and two rounds of shallow soil vapor sampling to assess future VI potential based on shallow soil vapor conditions.	$10,000
Implement Compliance Sampling Plan	Lump Sum	$100,000	1	Coordinate, conduct, and report on compliance sampling investigation	$100,000
Institutional Controls					
Coordination and Management of Institutional Controls	Lump Sum	$50,000	1	Consultant and legal fees to develop, negotiate, record, and manage environmental covenants, soil management plans, or similar administrative controls with property owners and/or land use planning authorities	$50,000
Contingency Costs					
Additional Contingency Costs	Lump Sum	$150,000	1	Contingengy costs for future VI assessment evaluation and/or VI mitigation measures if the results of the compliance sampling investigation indicate that petroleum hydrocarbon concentrations in shallow soil vapor are still a potential pathway of concern for future buildings or changes in land use at, or near, the Site.	$150,000
Total					$930,000

Cost Estimate for Alternative 4
Abandoned and Regulated UST System Closure and Soil Excavation, and Institutional Controls
Newman's Chevron Site
2021 6th Street, Bremerton, Washington

Cleanup Action Components	Unit	Cost/Unit	Quantity	Notes/Assumptions	Cost
Abandoned UST Closure and Soil Excavation					
Abandoned UST Closure and Soil Excavation	Lump Sum	$75,000	1	Includes planning, field implementation, and reporting to satisfy regulatory closure requirements for three abandoned USTs, including all subcontractor and laboratory analytical costs	$75,000
Regulated UST System Closure and Soil Excavation					
Regulated UST System Closure and Infrastructure Removal	Lump Sum	$100,000	1	Includes planning, field implementation, and reporting to remove, and satisfy regulatory closure requirements for, the three regulated USTs, associated conveyance and vent piping, including all subcontractor and laboratory analytical costs	$100,000
Regulated UST System Soil Excavation	Lump Sum	$100,000	1	Includes costs for planning, excavation, shoring, backfill, oversight, soil compliance sampling, and reporting associated with overexcavation to achieve soil cleanup standards near the regulated UST basin and dispenser islands (to be performed in conjunction with removal of the regulated UST system)	$100,000
Develop and Implement VI Compliance Sampling Plan	Lump Sum	$75,000	1	Plan, coordinate, conduct, and report on a VI compliance sampling investigation to evaluate whether VI is still an exposure pathway of concern for future buildings or changes in land use at, or near, the Site	$75,000
Contingency Costs					
Contingency Costs for Coordination and Management of Institutional Controls	Lump Sum	$50,000	1	Contingency costs for consultant and legal fees to develop, negotiate, record, and manage environmental covenants, soil management plans, or similar administrative controls with property owners and/or land use planning authorities, if all potential exposure routes of concern are not addressed by the soil removal cleanup actions	$50,000
Additional Contingency Costs	Lump Sum	$150,000	1	Contingengy costs for future VI assessment evaluation and/or VI mitigation measures if the results of the compliance sampling investigation indicate that petroleum hydrocarbon concentrations in shallow soil vapor are still a potential pathway of concern for future buildings or changes in land use at, or near, the Site.	$150,000
Total					$550,000

Cost Estimate for Alternative 5
Abandoned and Regulated UST System Closure and Soil Excavation
Newman's Chevron Site
2021 6th Street, Bremerton, Washington

Cleanup Action Components	Unit	Cost/Unit	Quantity	Notes/Assumptions	Cost
Abandoned UST Closure and Soil Excavation					
Abandoned UST Closure and Soil Excavation	Lump Sum	$75,000	1	Includes planning, field implementation, and reporting to satisfy regulatory closure requirements for three abandoned USTs, including all subcontractor and laboratory analytical costs	$75,000
Regulated UST System Closure and Soil Excavation					
Regulated UST System Closure and Infrastructure Removal	Lump Sum	$100,000	1	Includes planning, field implementation, and reporting to remove, and satisfy regulatory closure requirements for, the three regulated USTs, associated conveyance and vent piping, including all subcontractor and laboratory analytical costs	$100,000
Service Station Building Demolition	Lump Sum	$100,000	1	Includes planning, permitting, demolition, and disposal costs to remove the existing service station building	$100,000
Petroleum Impacted Soil Excavation	Lump Sum	$100,000	1	Includes planning, permitting, implementation, laboratory analysis, and reporting to conduct on-Property soil excavation necessary to achieve the MTCA Method B soil cleanup levels for the Site and to address the presence of naphthalene in shallow soil vapor at concentrations exceeding Method B screening levels for sub-slab soil gas	$100,000
Service Station Building Replacement Costs	Lump Sum	$250,000	1	Costs to replace the existing service station building with an equivalent structure	$250,000
Develop and Implement VI Compliance Sampling Plan	Lump Sum	$75,000	1	Plan, coordinate, conduct, and report on a VI compliance sampling investigation to evaluate whether VI is still an exposure pathway of concern for future buildings or changes in land use at, or near, the Site	$75,000
Contingency Costs					
Contingency Costs	Lump Sum	$1,000,000	1	Contingengy costs for additional on-Property or off-Property excavation, VI assessment, or VI mitigation measures necessary to address the presence of naphthalene in shallow soil vapor without the use of institutional controls at the Site. May require demolition and replacement of existing residential structures on neighboring properties.	$1,000,000
Total					$1,700,000