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Remedial Investigation Report
Boeing Field Chevron
10805 East Marginal Way South
Tukwila, WA 98168
Ecology Facility/Site No.: 2551
Agreed Order No.: DE-10947

Prepared on behalf of:

Boeing Field Chevron
c/o Mr. Andrew Zabel
Houlihan Law
100 N. 35th Street
Seattle, WA 98103

Chevron Environmental Management Co.
Mr. James Kiernan
6001 Bollinger Canyon Road
San Ramon, CA 94583

Prepared by: G-Logics, Inc.
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October 7, 2020

G-Logics Project 01-0410-M

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Washington State Department of Ecology, NW Region
Mr. Dale Myers
3190 160th Avenue SE
Bellevue, WA 98008

Subject: Remedial Investigation Report
Boeing Field Chevron
10805 East Marginal Way South
Tukwila, WA 98168
Ecology Facility/Site No.: 2551
Agreed Order No.: DE-10947

Dear Mr. Myers:

G-Logics is pleased to present this Remedial Investigation (RI) report for the subject property. This report documents the purpose, approach, and results of subsurface exploration efforts conducted to assess the nature and extent of soil, groundwater, and soil-gas impacts beneath the Property and Site. G-Logics requests that Ecology review this document and confirm that the presented information is sufficient to prepare a Feasibility Study, in accordance with the Site's existing Agreed Order.

We appreciate the opportunity to provide our services on this project and trust the information presented in this report meets your needs at this time.

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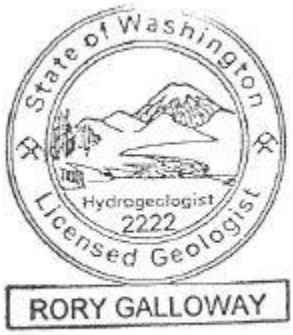
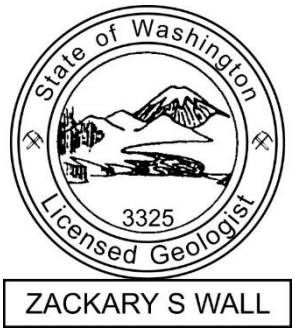
Should you require additional information or have any questions, please contact us at your convenience. Thank you again for this opportunity to be of service.

Sincerely,
G-Logics, Inc.

Rory L. Galloway, LG, LHG
Principal



Zackary S. Wall, LG
Project Geologist



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ACRONYMS AND ABBREVIATIONS

ARARs	Applicable or Relevant and Appropriate Requirements
BTEX	Benzene, Toluene, Ethylbenzene, and total Xylenes
COC	Contaminant/Chemical of Concern
CSM	Conceptual Site Model
DPE	Dual-Phase Extraction
DRO	Diesel-Range Organics
Ecology	Washington State Department of Ecology
EDB	1,2-Dibromoethane (Ethylene Dibromide)
EDC	1,2-Dichloroethane (Ethylene Dichloride)
EFR	Enhanced Fluid Recovery
FS	Feasibility Study
FPR	Free Product Recovery
GRO	Gasoline-Range Organics
LDW	Lower Duwamish Waterway
LNAPL	Light Non-Aqueous Phase Liquid
MTBE	Methyl Tertiary Butyl Ether
MTCA	Model Toxics Control Act
ORO	Oil-Range Organics
PCS	Petroleum-Contaminated Soil
PID	Photoionization Detector
PLPs	Potentially Liable Parties
PSCAA	Puget Sound Clean Air Agency
PVA	Petroleum Vapor-Intrusion Assessment
QAPP	Quality Assurance Project Plan
RCW	Revised Code of Washington
RI	Remedial Investigation
SAP	Sampling and Analysis Plan
TEE	Terrestrial Ecological Evaluation
TIB	Tukwila International Boulevard
TPH	Total Petroleum Hydrocarbons
UST	Underground Storage Tank
WAC	Washington State Administrative Code
WSDOT	Washington State Department of Transportation

EXECUTIVE SUMMARY

This report presents the findings of the Remedial Investigation (RI) performed at the Boeing Field Chevron Site located at 10805 E Marginal Way, Tukwila, Washington. The RI work has been conducted to assess the nature and extent of impacts due to releases from historical and current petroleum service-station operations on the Property.

Service-station operations have been conducted on, or adjacent to, the Boeing Field Chevron property since at least 1941. During this period, the Site has been impacted by at least three separate releases of petroleum products, which are documented in Ecology files for the Site. The first two of these consisted of unquantified releases of petroleum products associated with service-station operations through approximately 1984 (reported in 1990) and a minor release in 1996 of unspecified petroleum product discovered during the removal of an underground storage tank (UST). The most recent release of gasoline product was associated with a fuel-supply line leak, first reported to Ecology in 2003.

Three general phases of environmental assessment and remediation efforts have been conducted at the Site since 1990. The first phase of work was performed in association with releases reported in 1990 and 1996, and a second phase was performed as an initial response to the 2003 release. Following the execution of an Agreed Order, a third phase of activities were initiated for the Site (this RI).

The RI activities pursuant to the Agreed Order included the following tasks.

- Drilling a total of nineteen soil borings,
- the installation of sixteen monitoring wells,
- groundwater sampling for eight quarters,
- video assessment of all accessible on-Property subsurface utilities,
- collection and analysis of stormwater and catch-basin solids samples,
- assessment of existing groundwater-monitoring wells and decommissioning of those wells found to be damaged or improperly constructed,
- completion of two tidal-influence studies,
- completion of an upper saturated zone drawdown test, and
- one air sparge and soil-vapor extraction (AS/SVE) pilot test.

Based on the completed work, petroleum impacts (primarily Gasoline-Range Organics (GRO) and related benzene, toluene, ethylbenzene, and xylene (BTEX) compounds) remain present in soil and groundwater at the Site at concentrations exceeding Ecology's Model Toxics Control Act (MTCA) Method A cleanup levels. Separate-phase petroleum product also remains present intermittently in at least one of the monitoring wells at the Site (IP-7). Based on compiled data, the impacts to soil and groundwater extend from a depth of 8 feet to 25 feet below the ground surface. Impacts appear to be greatest in the immediate vicinity of the western dispenser islands, which is consistent with the location of the 2003 release. Soil-gas samples detected petroleum hydrocarbons at concentrations less than MTCA sub-slab screening levels near the southern property boundary. Accordingly, the soil-vapor to indoor air pathway for buildings located on the south-adjacent property is not considered to be complete.

Groundwater has been observed within two distinct saturated zones at the Site, the lower of which is tidally influenced. Petroleum contaminants have been found to exceed cleanup levels in both saturated zones. Groundwater sampling data, compiled from 2004 through 2019, indicate that groundwater contaminants are not migrating, and that concentrations are largely stable.

GRO and BTEX concentrations have been detected above cleanup levels in soil and groundwater within the Lower Saturated Zone to the west of the Property. However, based on groundwater sampling data from borings and monitoring wells completed within Tukwila International Boulevard (TIB), these impacts do not appear to extend beyond TIB.

Stormwater and catch-basin solids sampling indicate that Site contaminants are not migrating within the property-adjacent storm drain system. Site contaminants have not been detected within the backfill of the utility corridors along TIB.

Based on the findings of the RI Site-characterization efforts, several complementary remedial technologies have been identified for potential implementation and will be discussed and evaluated in the forthcoming Feasibility Study (FS) report.

1.0 INTRODUCTION

This Remedial Investigation (RI) was performed for the Boeing Field Chevron facility located at 10805 East Marginal Way South in Tukwila, WA (Site). Currently the Site is managed under Agreed Order No. DE 10947 with the Washington State Department of Ecology (Ecology) pursuant to the Model Toxics Control Act (MTCA). Specifically, the parties to the Agreed Order are Mr. Rajbir Sandhu, Ms. Pradeep Sandhu, RPNP Corporation (RPNP), and Chevron Environmental Management Company (Chevron), collectively identified as the Parties.

This RI report has been completed following Ecology approval of the RI work plan prepared by Terracon, dated May 24, 2016, (Terracon, 2016) and the requirements of MTCA, including Washington Administrative Code (WAC) 173-340-350. This report also was completed in accordance with Ecology's guidance for remedial investigations and vapor assessments (Ecology, 2016a and 2016b).

1.1 Purpose and Objective

This report is intended to document the nature and extent of petroleum-contaminants resulting from the fuel releases that have occurred on the Site.

1.2 Report Organization

This report is organized per Ecology's *Remedial Investigation Checklist* guidance document (Ecology, 2016a). Primary sections of this report are listed below.

Section 1.0 introduces and describes the purpose of the RI.

Section 2.0 provides background information concerning the Site, including its history, location, description, land uses, and environmental actions at the Property and in the surrounding area.

Section 3.0 discusses the RI activities and findings for the Site.

Section 4.0 presents a discussion regarding the nature and extent of contamination and exposure pathways.

Section 5.0 presents the proposed cleanup levels and points of compliance for the Site.

Section 6.0 presents our conclusions and recommendations, based on the completed work.

Section 7.0 presents our limitations regarding this report.

Section 8.0 presents references used to prepare the report.

2.0 PROPERTY AND SITE DESCRIPTION

This section provides background information for the Site. For the purposes of this document, the following terminology applies:

- "Property," as defined below in Section 2.1 and as shown on Figure 1-1, refers to the legal parcel owned by RPNP (dba Boeing Field Chevron) located at 10805 East Marginal Way South in Tukwila, WA.
- "Site" refers to areas where petroleum contaminants, released at the Property, have come to be located. A Site may include both on-Property and off-Property areas.

2.1 Site/Property Information

The Parties entered into an Agreed Order with the Ecology with the following description of the Site and Property:

Site Name: Boeing Field Chevron

Site Address: 10805 East Marginal Way South, Tukwila, WA

Agreed Order No.: DE 10947

Property Legal Description: PORTION OF GOV LOT 10 IN SE 1/4 OF SECTION 04-23-04 & OF THE W 1/2 OF SW 1/4 OF SECTION 03-23-04 LY BETWEEN WLY MARGIN OF E MARGINAL WAY & ELY MARGIN OF PACIFIC HIGHWAY SOUTH - BAAP ON WLY MARGIN OF E MARGINAL WAY, BEING N 17-20-00 W 1155.44 FT MEASURED ALONG SAID MARGIN, FROM SOUTH LINE OF SECTION 3 TH S 84-43-30 W 30.68 FT TO POINT OF BEGINNING TH N 17-20-00 W 243.58 FT TH N 82-24-36 W 31 FT TH S 18-27-00 W 267.74 FT TH N 84-43-30 E 188.83 FT TO POB LESS PORTION FOR ROAD UNDER WARRANTY DEED RECORDING NO 9604180862

King County Property Tax Parcel: 032304-9064

Property Quadrant Coordinates: Section 3 Township 23 Range 04 Quarter SW

Property Zoning Designation: The Property and surrounding area is zoned as "Manufacturing Industrial Center/Heavy Industrial" by the City of Tukwila, WA.

2.2 Site Contact Information

Contact information for the Site's environmental consultant and the Property's ownership is listed below.

Project Consultant Contact Information:

G-Logics Inc.
40 2nd Avenue SE
Issaquah, WA 98027
Telephone: 425-391-6874
Contact Person: Mr. Zackary Wall, zackaryw@G-Logics.com

Property Owner's Contact Information:

RPNP
c/o Andrew Zabel
Houlihan Law PC
100 N 35th Street
Seattle, WA 98103
Telephone: 206-547-5052
Contact Person: Mr. Rajbir Sandhu (Mr. Andrew Zabel c/o Houlihan Law)

2.3 Site History

This section summarizes information from a review of historical aerial photographs and King County tax records (obtained from the Puget Sound Regional Archives). The aerial photographs were obtained from Environmental Data Resources, NETR Historic Aerials, University of Washington Map Library (US Army Corps of Engineers), and Washington State Department of Transportation (annotated copies attached). Reviewed tax records are attached as Appendix A. The following sub-sections detail the results from this review, which are summarized in Section 2.3.7.

The number of USTs currently present at the Site is discussed in Section 2.4. The number of historical USTs, as well as their locations, size, and capacity (if known), are discussed in the following sections and summarized in Section 2.8. Please note that the actual number and locations of historical USTs is unknown.

2.3.1 1930 Records

According to historical King County tax records, the Property was developed as a restaurant in 1931. This is the oldest documented use of the Property. A photograph in the tax records

dated “1-10-41” shows a building with the word “Eat” on top of a pillar-shaped structure, which the tax record indicates was built in 1931 (Page 1 of Tax Records). Based on aerial photographs in these tax records, it appears that the restaurant structure existed on the Property from 1931 until at least 1941.

A tax record (page 3) dated 1938 includes a photograph of a building with a sign reading “Ben’s Fog Horn”. The building is described as a tavern. The 1938 tax record includes a handwritten notation “void / burned” on a photograph of the building, but the photograph and notation dates are not indicated. The 1938 tax record indicates the tavern building was built in 1931, and apparently burned down sometime after 1938. The restaurant and the tavern appear to be the only commercial structures listed in King County tax records prior to 1941.

2.3.2 1940 Records

An aerial photograph from 1940 (Photo 1) shows three structures to the north of the current Property. Based on geographical references in the 1940 aerial photograph and 1953 aerial photograph (Historical Aerial Photo 2), it appears the tax parcel associated with the current Property extended further north prior to roadway (Boeing Field Access Road) construction. The current Property boundary, based on the PLS, Inc. topographic survey, dated November 30, 2016, included in Appendix B, has been superimposed on the aerial photographs.

An undated tax record (page 9), believed to be from approximately 1941, states that an automobile fueling and service station was constructed (north of the current Property boundary) but no construction date was listed. A photograph dated January 1, 1941 included with the tax record shows a gasoline fueling island branded “Standard Stations Inc.” The photograph shows three pumps, a service-station office, and a large structure in the background, believed to be the 1931 restaurant building. These structures appear to be the same as those seen in the 1940 aerial photograph and, based on the 1940 and 1953 aerial photographs, appear to be located to the north of the current Property boundary. However, it is not conclusive that the service station listed in the tax record is the same as the structure indicated on the 1940 aerial photograph. Figure 2-1 shows the estimated location of the structures relative to the current boundaries of the Property. Although the exact location cannot be verified, the three structures appear to be located near the current intersection of TIB, East Marginal Way South, and the Boeing Field Access Road.

The tax record believed to be from 1941 lists other features including a "grease room," a "hydraulic lift," three fuel pumps, and three USTs, including one 1,000-gallon and two 550-gallon USTs. However, the exact location of these USTs is unknown.

A 1942 note on a split-valuation (page 2) indicates at least one of the buildings (Building #2 – believed to be north of the current Property line) was "operational" as a "cabin camp" with four individual apartments. Based on the split-valuation, this building was remodeled in 1947 (page 2). Nothing on the split valuation record indicates the use of Building #1; however, it is assumed that Building #1 is the gas station discussed in the undated tax record with the 1941 photograph. It appears that a third building (Building #3 on the tax record) was constructed in 1947 although a photograph from 1944 indicates that "Building #3" is present at that time.

2.3.3 1950 Records

A 1953 aerial photograph (Historical Aerial Photo 2) shows the Boeing Field Access Road and adjoining intersection of East Marginal Way South and TIB. In this photograph, two structures interpreted to be the apartments that were constructed in 1942 and 1947 are located on the southern portion of the Property. In 1953 there were two main structures on the north end of the Property, which are understood to be a service station and fueling island (Figure 2-1). The configuration and location of the service station and fueling island are different than the station observed in the 1940 aerial photograph, discussed above.

This configuration is interpreted to be the second fueling station in this area, and the first to be located within the current boundaries of the Property. G-Logics believes the 1940s-vintage gas station was removed with the construction of the Boeing Access Road in the early 1950s. The 1950s-vintage station was then constructed within the Property boundaries. This interpretation is based on the 1940 and 1953 aerial photographs where the building locations changed and tax-assessor records indicating that a gas station operated on the Property between at least 1941 and 1956. Specifically, one of the tax-assessor records includes a note stating "void this sheet-Imp-torn down 7-56" indicates that the service station building and facilities described and depicted in the 1941 tax record were torn down sometime prior to July 1956 for construction of a new station (1955) described in the following paragraph.

A tax record from 1955 (page 10) includes a photograph dated "7-6-56" that shows a large canopy covering two fueling islands. The canopy is attached to what appears to be the service-station building. The station is noted as being heated by oil. The service station is

branded as “Standard.” The tax sheet indicates that the station was built in 1955 and though partially obstructed by the photo, lists one UST of an unknown size, one 5,500-gallon UST, one 500-gallon waste-oil UST, and one 500-gallon fuel-oil UST.

2.3.4 1960 and 1970 Records

Tax records from 1963 show that the service station constructed in 1955 was remodeled and relocated in 1963 with two pump island canopies, an expanded service station building (heated by an oil burner and including a lube room), and four USTs. A note in the tax records dated August 1963 indicates that the service station was “moved back from original location and remodeled.” The tax records also indicate that the two apartment buildings located on the southern portion of the Property were removed in the early 1960s, based on a 2-1-1962 entry on the split-valuation form indicating that two improvements were torn down. Tax records include a petition for tax exemption (Page 22) indicating an apartment was torn down in December 1961.

The 1963 tax record lists four USTs: one 500-gallon, one 2,000-gallon, one 5,000-gallon, and one 7,000-gallon UST (Appendix A). On the 1963 tax record there is a note stating that a 16-by-25-foot addition was added to the gas-station building (Figure 2-1).

The 1969 aerial photograph shows the station at its “new” location after it was moved from its previous location in 1963 (Historical Aerial Photo 3). The 1969 aerial photograph also confirms that the apartment buildings were no longer present. The 1976 aerial photograph (Historical Aerial Photo 4) shows a similar station configuration to the 1969 aerial photograph.

2.3.5 1980 Records

An aerial photograph dated 1985 (Photo 5) shows that the aboveground features associated with the station have been removed when compared to the 1976 aerial photograph (Photo 4), and the Property appears to be vacant. Tax sheets understood to be updated in 1986 note that the gas station and facilities were removed in December 1984 (see Tax Records, 1986, page 25).

2.3.6 1990 Records

Tax records from King County indicate that the Property was owned and sold by a Jessie May Zielsdorf on February 8, 1995 to Philip W. Usher. Subsequently, the Property was sold to Pradeep Sandhu on February 15, 1995 and later transferred into the names of Rajbir and Pradeep Sandhu on March 29, 1996. G-Logics understands that the current fueling station

was built for RPNP in 1995/1996. In the 1995 aerial photograph, there appears to be areas of disturbed land, possibly from previous excavations and tank removals on the Property. See Section 3.1 for additional historical information regarding environmental activities conducted on the Property. Tax records and other historical public records dated after 1996 were not reviewed.

2.3.7 Site History Summary

Tax parcel records indicate that the Property was originally occupied by a pub and restaurant, then developed with an automobile fueling and service station from at least 1953, possibly as early as 1941. Another fueling station possibly was located to the north at this time.

A new station was constructed in 1955 replacing this previous station. The 1955 configuration was remodeled and relocated in 1963 after the demolition of apartment buildings (constructed in 1942 and 1947). The relocated 1955 gas station was demolished in 1984. The current station on the Property was constructed in 1995/1996.

2.4 Site Location Description

The Property is located in the Northern Industrial District of the City of Tukwila, WA. This area is zoned as Manufacturing Industrial Center/Heavy Industrial according to the City of Tukwila's Comprehensive Plan and Zoning Map (City of Tukwila, 2015). The surrounding area consists primarily of retail, commercial, and industrial businesses.

The Property is located at the southern corner of the intersection of South Boeing Access Road, East Marginal Way South, and TIB (also referred to as Pacific Highway South). The Duwamish River is located approximately 275 feet to the west of the Property's western boundary. The Property currently is operated as an independent Chevron-branded gasoline service station with six dispenser islands, an automatic car wash, and three USTs, as described below.

- One 15,000-gallon, dual-compartment, steel-clad composite tank with a capacity for storing 7,500 gallons of regular unleaded gasoline and 7,500 gallons of diesel fuel.
- One 15,000-gallon, single-compartment, steel-clad composite tank storing unleaded gasoline.
- One 10,000-gallon, single-compartment, steel-clad composite tank storing unleaded gasoline.

The location of the tanks is shown on Figure 2-5.

2.4.1 Physiography/Topography

The Site is located within the Duwamish River valley at an approximate elevation of 20 feet above mean sea level. The Site topography is generally characterized as flat-lying. A topographic survey performed in November 2016 is included in Appendix B.

2.4.2 Geology

Based on the 2005 United States Geological Survey (USGS) regional geologic map (Troost et al.), the surface in the vicinity of the Site is underlain by alluvium (Qal). Bedrock of the Tertiary Tukwila Formation is exposed nearby to the east, southeast, and southwest of the Site. Alluvial deposits typically consist mostly of unconsolidated silt, sand, and gravel valley fill with some clay and include low-level terrace, marsh, peat, imported fill, and glacial deposits. Qal deposits are associated with stream beds and river valleys. The Duwamish/Green watershed also has been significantly modified by volcanic mudflows, (Booth et al., 2003).

Geologic conditions at the Site were initially characterized during previous investigations and remedial actions, as summarized in the RI Work Plan. Based on the boring logs and other information provided in the RI Work Plan, four generalized lithologic units have been described at the Site. The findings of G-Logics 2016 through 2019 RI field activities, as discussed in Section 3.5 of this report, are generally consistent with geology descriptions provided in the RI Work Plan. The Site geology is described below, beginning at the ground surface and continuing to the explored depths.

- **Ground Surface to approximately 9 feet, Fill Materials.** This unit includes fill installed prior to initial development of the Site area. These fill soils also include backfill associated with environmental excavations and buildings, as well as bedding for utility lines and USTs. Fill materials found at the Site typically include a mixture of sand, silt, and gravel (including cobbles), and occasionally pea gravel, quarry spalls, and/or brick and concrete debris. Based on a review of previous studies, the typical depth range for the fill material at the Site is not clear, but may range from depths of 3 to 14 feet. As described in Section 3.5 of this report, G-Logics' 2016 borings typically encountered loose fill to depths of 3 to 10 feet on the Property, with depths extending 14 to 20 feet within the subsurface utility

corridor located within the TIB right of way west of the Property. For purposes of this report, soils within the vadose zone are typically identified as fill.

- **9 feet to approximately 12 feet, Shallow Silty Sands.** This unit is composed primarily of brown, medium-grained, silty sands, fine-to-medium-grained sand lenses, and thinly (1cm) interbedded silt and sand. Borings typically encountered this unit from the bottom of fill materials to an approximate depth of 12 feet. The soils that make up this unit most likely represent the native materials present prior to area development and/or excavations. Soils located in this depth range generally make up the Upper Saturated Zone (further discussed in Section 2.4.3).

- **12 feet to 18 feet, Fine-Grained Soils**. This unit includes silty clay, sandy silt, silty sand, and organic materials described in previous boring logs as peat. The top of the finer-grained sequence typically is encountered below fill materials and silty sand, at between 12 and 18 feet below the ground surface. The character of this unit varies across the Site, with the unit predominantly composed of sandy silt at the northern end of the property and silty clay in the south. Interbedded- clay, silty clay, and clayey silt are present in the western portion of the Site. These soils are identified as the confining layer in Section 2.4.3.

- **18 feet to Explored Depths, Lower Sand Unit.** The top of this unit is typically encountered at depths of approximately 18 to 20 feet, but shallower sand lenses have been observed at some locations. The sand unit extends to at least 35 feet in depth, the maximum depth explored. Soils in this sequence are generally described as dark gray, poorly-sorted to moderately-sorted, and coarse-grained to very coarse-grained sand with occasional silt. The contact between this lower sand unit and the overlying silt and clay appears to vary from abrupt to gradational. The thick sequence of dark-gray, coarse sands at the Site likely originated from the reworking of volcanic-mudflow material described by Booth et al. (2003). Soils located in this depth range generally make up the Lower Saturated Zone (also discussed in Section 2.4.3).

2.4.3 General Hydrogeology

Previous studies, as well as the results of our recent RI field activities, indicate that two separate water-bearing zones underlie the Site. These two zones are identified as an upper, laterally-discontinuous, perched zone (Upper Saturated Zone) and a lower, semi-confined

aquifer (Lower Saturated Zone). The Upper Saturated Zone occurs within the fill materials described above and also within the shallow silty sands. The Lower Saturated Zone appears to occur within the lower sand unit and is tidally influenced. In general, groundwater in both saturated zones flows toward the Duwamish River.

Boring logs indicate that the two saturated zones are typically separated by a 2 to 6-foot thick layer of clayey silt and organic material. This fine-grained unit appears to act as a confining layer between the Upper and Lower Saturated Zones in most areas within the Site. However, the confining layer appears to thin toward the central portion of the Site, where it is interlayered with sandy lenses. Additionally, during an air-sparge pilot test at the Site (G-Logics, 2019), air introduced into the Lower Saturated Zone (well AS-2) produced bubbling in a nearby well that was screened in the Upper Saturated Zone (well IP-4). This suggests that the confining layer separating the two saturated zones may be semi-permeable, or possibly discontinuous in this area. In other areas, it also is possible that previous remedial excavations and/or excavations for the utility-corridor trench (along TIB) may have disturbed the confining layer. Additional hydrogeology information is discussed Section 3.3 below.

2.4.4 Surface Waters

The Duwamish River is located approximately 275 feet to the west of the Property (Figures 1-1, 1-2, and 1-3). The Duwamish River empties into Elliot Bay approximately 6.5 miles north of the Site. As discussed in Section 4.4, this remedial investigation has shown no communication between Site contaminants and the Duwamish River.

2.5 Surrounding Property and Site Land Use

Information regarding surrounding properties is discussed below.

2.5.1 Surrounding Property Land Use

The property to the immediate south of Boeing Field Chevron is occupied by a mixed-use building containing office spaces and a food-manufacturing facility (Mighty-O Donuts). Currently, G-Logics understands that the office spaces in the building are vacant. The property to the east currently is occupied by a bulk propane distributor (Blue Star Gas). To the west (across TIB) are several commercial properties, including auto repair and storage lots and a neon-sign manufacturer.

2.5.2 Neighboring Property Historical Land Use

G-Logics reviewed the historical tax assessor records for the neighboring properties to the west of East Marginal Way South (see Figure 1-4). Tax records for neighboring properties are included as Appendix A. Details regarding these records are discussed below.

- **Parcel #042304-9158:** A tax record, dated 12-8-1959, indicates that the parcel was occupied by a service station that was constructed in 1960. The fee owner is listed as Signal Oil Co. Inventory details for the parcel indicate that a hydraulic hoist, one 3,000-gallon tank, two 2,000-gallon tanks, and one 250-gallon tank occupied the property. A photograph of the parcel, dated 9-31-1960, shows the fueling canopy and a service garage with two bays.
- **Parcel #042304-9159:** Tax records for this parcel indicate that it was occupied by a home and storage buildings. The storage building was constructed in 1964 (5-5-1964 tax record) and the fee owner was listed as Packaged Homes. Another building listed at the property was constructed in 1979 but few details are given regarding the building use, though a photograph, dated 5-10-1979 shows a storage shed with a propane tank in front of it.
- **Parcel #042304-9169:** Buildings listed for this parcel included a storage building (building #4) that was constructed in 1945 and moved in 1964 (undated tax record). A record dated 11-29-1962 details a Quonset-style office/storage building that was remodeled (and "moved in") in 1962. The fee owner is listed as "Petrolane Liq Gas Corp." Another warehouse was listed on the property in 1962, question marks are located in the date-built field (tax record dated 9-4-1962). The fee owner for this additional warehouse also is listed as the Petrolane Liq Gas Corp. Photographs included on this tax record (dated 12-5-1962 and 9-4-1952) show large propane tanks.
- **Parcel #042304-9083:** An undated tax record discusses a building that was constructed in 1941. A photograph dated 9-30-1941, shows the building occupied by Safeway. The use is described as "machine shop" below a description that was crossed off reading Pacific Salvage Co. A later copy of the tax record has both these uses crossed off and Quality Billiard Manufacturing Company listed. Another photograph included with this record dated 10-1-1952 shows a building occupied by the Pacific Salvage Co. The side of the building is painted with a label saying "Rags, Steel, Tires, Tools, Clothing, Tanks."

  An office constructed in 1955/1956 was listed on a tax record dated (12-8-1955). A later copy of this tax record lists a used car lot as the fee owner.

A tax record dated 2-10-1960 was included in the file for a warehouse that was constructed in 1959/1960. The fee owner for the warehouse was listed as the Pacific Propeller Co.

A tax record dated 12-3-1956 shows an office building that was constructed at an unknown date and moved by April of 1960 (handwritten notation on tax record). The building was occupied by Atlas Glass Heat. A photograph dated 6-9-1958 shows the building with a sign saying "CLEAN GAS OIL HEAT" and "GLASS HEAT". A carpenter shop was constructed on this parcel in 1963 (undated tax record). The fee owner was listed as Pacific Propeller Co. A tax record dated 6-4-1987 has a comment that states the property is occupied by Skagen Marine and that all the buildings are used for a distribution warehouse.

2.6 Environmental Actions on Surrounding Properties

Site-review efforts have identified that several nearby properties are known to have been impacted by petroleum-hydrocarbon contamination. These properties and their status are listed below, and their locations are shown on Figure 1-5.

Site Name	FSID	Address	Site Status	Confirmed Petroleum Impacts
North Winds Weir Intertidal Restoration	5584231	2724 S 112TH St	Cleanup Started	Soil
Husky Truck Center	72897374	11222 E Marginal Way S	No Further Action	Soil
Triad Machinery Inc. Tukwila	86248197	11210 Tukwila International Blvd	Awaiting Cleanup	Groundwater
Northwest Auto Wrecking	2287	10230 E Marginal Way S	Cleanup Started	Soil, Sediment
UPS Freight	2359	11231 E Marginal Way S	No Further Action	Soil
Pape Material Handling	2595	9892 40TH Ave S	No Further Action	Soil
Unified Grocers Norfolk	73338176	3301 S Norfolk St	Cleanup Started	Soil, Groundwater
Pony Express	16492554	11004 E Marginal Way S	No Further Action	Soil
Horizon Ford	23285988	11000 Tukwila International Blvd	No Further Action	Soil
Farwest Taxi	57492659	11180 E Marginal Way	No Further Action	Soil
McConkey Property	97268417	10710 E Marginal S & 10650 27th S	Cleanup Started	Soil

Ecology's *Lower Duwamish Waterway Superfund Site: Pollution Source Control fact sheet*, dated October 2004 (Ecology, 2004) identifies the boundaries of the active sediment remediation within the Lower Duwamish Waterway (LDW) Superfund Site. Based on this information, the Boeing Field Chevron Site is located outside the defined boundaries. Additionally, according to Ecology's *Lower Duwamish Waterway Source Control Areas map* (Ecology, 2017), the Site also is south of the southern-most LDW Source Control Area, the Norfolk storm-drain system. However, Ecology has previously indicated that they consider the Site to be within Ecology's pollution source-control area for the LDW. In an email from Richard Thomas, dated January 16, 2019 (attached), Ecology acknowledged that the Boeing Field Chevron surface flow is not part of the Norfolk basin, but nevertheless, the Site would remain a "potential source" to the LDW Superfund Site due to its proximity to the waterway.

2.7 Historical Environmental Actions at the Site, 1990 to 2012

Information and data from previous environmental assessments conducted from 1990 to 2015 are summarized below. This represents a summary of all documented work completed prior to the development of the RI Work Plan. Copies of these reports are attached in Appendix C (on CD). Exploration and remedial excavation locations are shown on Figures 2-2 and 2-3. Historical explorations also are summarized on Table 1.

2.7.1 Geotech Consultants 1990 Preliminary Environmental Study

In February 1990, Geotech Consultants, Inc. (Geotech), working for a prospective purchaser of the Property, completed a preliminary environmental assessment of soil and groundwater conditions at the Property. According to the Geotech report (Geotech, 1990), documents that were provided by Chevron indicated that the former service station included two pump islands, three fuel USTs, one used oil UST, and a service station building that had previously been removed in December 1984. The information provided by Chevron did not identify the contractor that removed the fueling facilities. Geotech also stated that based on its review of correspondence from Chevron, it was unclear which fuel-distribution lines or USTs had previously been removed. Geotech also stated that the "number, size, and contents of the USTs" was unclear. According to Geotech, the documents supplied by Chevron stated that "there was no evidence of contamination in the tank excavation, that the condition of the removed tanks and piping was described and (sic) 'good' and that there was no reported groundwater contamination."

During its 1990 site characterization efforts, Geotech drilled four borings (B-1 through B-4, Figure 2-3) to depths ranging from 10 to 22.5 feet below the ground surface. According to the report, Geotech analyzed several selected soil samples using EPA method 418.1 for total petroleum hydrocarbons and EPA method 8020 for benzene, toluene, ethylbenzene, and xylene (BTEX). Petroleum contaminant concentrations exceeded then-applicable soil cleanup level of 200 parts per million (ppm) in boring B-1. Boring B-1 was located at the northwest corner of the Property (Figure 2-3). Geotech reported hydrocarbon odors to a depth of 14 feet in this boring. Also, according to the report, petroleum contaminants were present, but at concentrations below 200 ppm, in "near-surface soils" in borings B-2, B-3, and B-4. However, analytical results were not included in the copy of the report made available to G-Logics.

According to the report text, "petroleum" and "trace xylene" were detected in a groundwater sample from boring B-1. According to Geotech, "… groundwater quality beneath the subject Site has been generally unaffected by activities relating to former retail station operations." Though the locations of any remaining USTs or fuel supply lines were unknown, Geotech recommended the removal of any remaining USTs and fuel-delivery lines.

2.7.2 Rittenhouse-Zeman & Associates 1990 Environmental Actions

Based on the conclusions in the 1990 Geotech report, Rittenhouse-Zeman & Associates (RZA, 1990a) was retained by Chevron to observe the removal of the northern pump island foundation and the excavation of petroleum contaminated soils (PCS) in March of 1990. During this effort, a previously unknown 5,000-gallon UST was discovered. In April 1990, RZA supervised the excavation of the 5,000-gallon UST. Results for soil samples analyzed during these remedial efforts are summarized in Table 4-1. Excavation-sample locations are shown on Figure 2-2.

During the 1990 excavation/removal of the 5,000-gallon UST, two more USTs were discovered: one 1,000-gallon and one 2,000-gallon (Figure 2-1). These two additional tanks were removed, and all three tanks were disposed off-site in April 1990. As discussed in Section 2.3.4, the 1963 tax records listed four USTs: one 500-gallon, one 2,000-gallon, one 5,000-gallon, and one 7,000-gallon USTs. Accordingly, it is unclear if the three USTs removed in April 1990 are three of the four listed on the 1963 tax record or from older station configurations. Additionally, RZA's reports (1990a and 1990b) contain figures showing a cluster of former USTs, referred to as the "former known tank field". The source

of the historical UST locations shown in RZA's reports is unclear and it does not provide any other information. This depiction has been carried forward through subsequent reports even though no reference for the tank information is provided.

After the USTs were removed, RZA conducted exploratory excavations to assess the extent of the PCS. Chevron directed RZA to stop the excavation efforts in May 1990. No off-site disposal of the excavated soils from the exploratory efforts is documented in RZA's report (1990a). A subsequent report by RZA (1990b, described below) states that approximately 300 cubic yards of soil were removed during this initial excavation.

In June 1990, RZA conducted additional environmental exploration work. This work is documented in a report titled *Subsurface Environmental Site Characterization and Remediation*, dated August 28, 1990 (RZA, 1990b), and included the drilling of borings B-1 through B-16 (Figure 2-3). RZA completed seven of the borings as monitoring wells, MW-1 through MW-7 (Figure 2-3).

Additional remedial excavations were conducted as part of this work in two areas, the former western pump island and where USTs were discovered during removal of the northern pump islands (Figure 2-1). Approximately 600 cubic yards of additional PCS were removed from the area of the USTs and approximately 900 cubic yards of PCS were removed from the former western pump-island (RZA, 1990b). The excavations generally varied in depth from 3 to 12 feet, with one soil sample collected from a depth of 15 feet.

After excavating soils from these two areas, RZA collected soil confirmation samples and reported that soils containing petroleum hydrocarbon concentrations above cleanup levels remained on the Property but were bounded by borings B-2, B-7, and B-11 through B-15. Groundwater analytical data in RZA's report (1990b) also indicated that wells MW-2, MW-3, MW-4, and MW-6 contained petroleum hydrocarbons at concentrations above cleanup levels. Results for analyzed soil and groundwater samples are summarized in Tables 4-1, 5-1, and 5-2. RZA reported that groundwater levels measured during sampling events indicated that a lower groundwater table and a perched-groundwater table were present on the Property, consistent with the Upper and Lower Saturated Zones previously discussed.

2.7.3 Hart Crowser 1990 to 1994 Environmental Actions

In August 1990, Chevron contracted with Hart Crowser to conduct additional site assessments near the eastern pump-island and in the areas identified by RZA as containing concentrations of petroleum in soil and groundwater above cleanup levels (HC, 1990). Hart

Crowser conducted groundwater sampling, observed the removal of the concrete slabs from the former service station building and the east pump-island, and observed the excavation of test pits in the area of the east pump island and a former service-bay sump (Figures 2-1 and 2-2). Approximately 350 cubic yards of PCS were excavated from the east pump island and service bay sump areas and disposed off-site.

In September 1992, Hart Crowser (HC, 1992) observed the excavation and removal of a 550-gallon used-oil UST and a 550-gallon diesel-oil UST from two areas of the Property (Figure 2-1). Soil samples collected from the bottom and sidewalls of the used-oil UST excavation reported concentrations of petroleum below MTCA Method A cleanup levels. Soil samples collected from the bottom and sidewalls of the diesel-oil UST excavation also reported concentrations of petroleum below MTCA Method A cleanup levels (Table 4-1). Excavation-sample locations are shown on Figure 2-2.

Hart Crowser produced two reports dated March 2, 1993 (HC, 1993a and b) that summarized the work performed from July 1992 through January 1993. The first (HC 1993a) was a Site Assessment Summary Report that summarized efforts to remove soils that were suspected to contain petroleum contamination, which was understood to be affecting groundwater conditions near monitoring well MW-4. The report discussed how "approximately 1,500 cubic yards of PCS were excavated, segregated, and stockpiled or land-farmed" on the Property. The report states that approximately 1,100 cubic yards of soil containing diesel-range organics (DRO), 250 cubic yards of soil containing gasoline-range organics (GRO), and 150 cubic yards of concrete rubble were excavated and disposed off-site. The reported locations of these remedial excavations are shown on Figure 2-1. The Hart Crowser 1993a report does not discuss whether all PCS above cleanup levels was removed from or remediated on the Property.

The second Hart Crowser report dated March 2, 1993 (HC, 1993b) was an addendum to the November 30, 1992 UST report (HC, 1992) and documented the disposal of UST-derived wastes that were generated during the removal of the two 550-gallon USTs.

Another report produced by Hart Crowser dated April 7, 1993 (HC, 1993c) documented groundwater monitoring well installation and sampling efforts conducted in the spring of 1993. Hart Crowser replaced monitoring wells destroyed during the excavation work performed in 1992 (MW-2, MW-3, MW-4, and MW-5). These replacement wells were designated as MW-2R, MW-3R, and MW-4R. In addition to these replacement wells, Hart Crowser also installed monitoring wells MW-8, MW-8A, MW-9, and MW-9A. Based on

G-Logics current understanding of groundwater conditions and the screened intervals provided in the Hart Crowser report, wells MW-8 and MW-9 were installed in the Lower Saturated Zone and wells MW-8A and MW-9A were installed in the Upper Saturated Zone. Results of the Hart Crowser groundwater sampling indicated that petroleum contaminants in the upper unit were below then applicable cleanup levels (Table 5-2). However, petroleum contaminants were present above Method A cleanup levels in groundwater samples collected from the lower unit, specifically in monitoring wells MW-2R, MW-3R, and MW-4R.

In a subsequent Hart Crowser report dated November 29, 1994 (HC 1994), Hart Crowser requested a No Further Action (NFA) opinion letter from Ecology. In the executive summary of this report, Hart Crowser stated that 10 USTs and approximately 2,000 cubic yards of PCS were removed from the Property. However, the reports reviewed by G-Logics document the removal of only five USTs (three by RZA and two by Hart Crowser) and a portion of the 2,000 cubic yards of PCS soil, as reported by Hart Crowser.

In the 1994 report, Hart Crowser also stated that with the exception of monitoring well MW-4R, groundwater quality on the Property met MTCA cleanup levels. Hart Crowser reported that groundwater collected and analyzed from MW-4R periodically exceeded cleanup levels for benzene. Ecology did not issue an NFA opinion in response to Hart Crowser's request.

2.7.4 Pacific Environmental Group 1996/1997 Environmental Actions

According to available King County tax records, the Property was purchased by Pradeep Sandhu in 1995 (Sandhu), who then commissioned the construction of the current gas station in 1996. An aerial photograph from 1995 (Photo 6) shows that the Property as undeveloped, but with several rectangular objects (possibly trailers, sheds, or vehicles).

During the construction of the gas station in July 1996, an excavation contractor uncovered an unknown UST (see Figure 2-1) and caused a release of petroleum product to the environment (reported to Ecology on March 4, 1997). As a result of the UST discovery and release, Chevron retained Pacific Environmental Group, Inc. (PEG) in 1996 to sample and analyze groundwater from several monitoring wells on the Property (PEG 1996a). The analytical results from this sampling showed concentrations of benzene in wells MW-3R and MW-4R exceeded cleanup levels.

The discovered UST was approximately 280 gallons and was excavated and disposed off-site. PEG documented that the UST appeared to be in fair condition with slight to moderate pitting and no observed holes other than those created by the excavator. The PEG report (PEG 1997a) presumed that the UST stored either heating or used oil. The PEG report also notes that although petroleum product may have entered a catch basin on the Property during the discovery and excavation of the UST, that product was promptly removed from the catch basin by vacuum truck.

Soil samples collected from the sidewalls and bottom of the 1996 UST excavation had concentrations of GRO, DRO, and oil-range organics (ORO) above Method A cleanup levels (see Table 4-1). The PEG (1997a) report stated that these petroleum-contaminated soils were left in place due to the structural concerns that a remedial excavation would present for the new building and concrete pavement, understood to be the existing carwash structure.

In September 1997, PEG performed additional environmental investigation work on the Property, installing groundwater monitoring wells MW-10, MW-11, and MW-12 (PEG 1997b). Soil and groundwater samples were collected and analyzed from each of the newly installed wells. Concentrations of petroleum were detected in the soil and groundwater samples collected from well MW-12, and in groundwater samples collected from MW-11, but at concentrations below cleanup levels.

2.7.5 Gettler-Ryan 2003 Environmental Actions

On behalf of Chevron, groundwater monitoring events were conducted by Gettler-Ryan Inc. (GRI) in May and November 2003 (GRI 2003). According to the groundwater analytical table in the GRI 2003 report, concentrations of GRO, benzene, and methyl tert butyl ether (MTBE) in excess of cleanup levels began to appear in monitoring wells MW-10, MW-11, and MW-12 in 1997 and 1998. Increasing concentrations of GRO and benzene in groundwater were reported in 1999 and again in 2003. During groundwater sampling conducted in May and November 2003, 3 to 4 feet of Light Non-Aqueous Phase Liquid (LNAPL) was encountered in MW-11. This was the first occurrence of LNAPL in a monitoring well at the Site.

With the discovery of this LNAPL, a release was reported to Ecology on May 30, 2003. The release was reported by Science Applications International Corporation (SAIC) for Chevron.

2.7.6 PNE Construction 2003/2004 Environmental Actions

In 2003 and 2004, Sandhu contracted with Pacific Northern Environmental Construction (PNE) to perform environmental characterization and remediation work on the Property, in response to the newly discovered gasoline release. G-Logics understands that the work performed by PNE, and the results of those efforts, were not formally documented. Accordingly, the following discussion of PNE's efforts is based on comments made in a subsequent report prepared by Environmental Resolutions, Inc. (ERI), dated March 12, 2004 (ERI, 2004a). Information regarding PNE's efforts also was corroborated in a 2008 conversation that G-Logics had with the equipment operator that performed the work for PNE in 2004. Due to the lack of documentation, G-Logics does not know the initial extent of this release or the extent to which it was excavated.

The report prepared by ERI (ERI 2004a), states that PNE conducted investigations to assess the free-phase product encountered in MW-11. Ecology records indicate that a leaking fuel-supply line to the western pump island was found in 2004, near the middle dispenser (of the western pump island). Upon notification, G-Logics also understands that Ecology ordered the western pump island to be closed until repairs were made, and that the western pump island was closed so that excavations could occur to repair the line and remove petroleum-impacted soil and free product.

Following the discovery of the leaking fuel-supply line, we understand that Sandhu commissioned PNE in January 2004 to excavate approximately 195 tons of PCS from the area surrounding the western pump island. Based on the conversation G-Logics had with the equipment operator in 2008, G-Logics understands that PCS was not excavated from the western edge of the Property (near the sidewalk adjacent to TIB). Figure 2-4 illustrates the approximate areas of the 2004 excavations based on the locations of newer concrete surface patches observed by G-Logics on the Property in 2006.

2.7.7 Environmental Resolutions 2004/2005 Environmental Actions

On behalf of Sandhu, ERI performed a soil and groundwater investigation in February 2004 that included the completion of 10 soil borings (ERI, 2004a). Soil sampling results indicated the presence of GRO and benzene in excess of cleanup levels along the western Property boundary. In July 2004, ERI installed two additional groundwater monitoring wells (MW-13 and MW-14) and collected soil and groundwater samples (ERI 2004b). These samples also indicated the presence of GRO and benzene on the western side of the

Property at concentrations greater than cleanup levels (Tables 4-1 and 5-2). Groundwater analytical results for samples collected in 2004 and 2005 are summarized on Figure 6-1.

ERI produced a report dated December 6, 2004 (ERI 2004c) that included a historical review of releases dating back to 1990. G-Logics reviewed this report and found it to be generally consistent with the information provided in this RI. In this report, ERI also evaluated more recent releases, including the leaking fuel-supply line on the western pump-island discussed above.

In March of 2005, ERI advanced one boring, B-11, west of the Property, in the median strip on TIB (ERI 2005a, Figure 2-4). Neither GRO nor benzene were identified in soil or groundwater in this new boring. DRO was reported in the groundwater at a concentration of 500 µg/L (at the Method A cleanup level).

Free-product petroleum (apparently gasoline) was found by ERI in well MW-14 in July 2005, measured at a thickness of 0.15 feet. At this time, MW-11 was found to no longer contain free-product (ERI 2005b).

In August and November 2005, ERI installed three additional groundwater monitoring wells at the Site, specifically MW-15, MW-16, and MW-17 (ERI 2005c). ERI again found free-product in MW-14 and also in MW-15 in August and November 2005. Product thicknesses in the wells typically ranged from 0.15 to 2.5 feet in MW-14, and 0.5 to 3.5 feet in MW-15. ERI removed approximately 1.69 gallons of product by bailer from the affected wells between October 18 and November 30, 2005. In a March 3, 2006 meeting, Ecology communicated to Sandhu and G-Logics that periodic bailing of product was not productive. Ecology also stated that a more effective method of product removal was needed.

Results from this work indicate that GRO and benzene in soil and groundwater were present on the west side of the Property, and in the adjacent right-of-way west of the Property, at concentrations greater than Method A cleanup levels (Figure 6-1).

2.7.8 G-Logics 2006 Enhanced Fluid Recovery

In response to Ecology's request for free-phase product removal, G-Logics began working on behalf of Sandhu in January 2006 (G-Logics 2006a, 2006b, and 2006c). G-Logics coordinated an enhanced fluid recovery (EFR) effort designed to remove LNAPL. The EFR involved a truck-mounted vacuum pump with a "stinger" recovery tube. The stinger was systematically lowered into various monitoring wells approximately four feet below the

initial groundwater level with the intent of creating a "cone of depression" in the vicinity of the monitoring well.

On January 26, 2006, an Emerald Services vacuum truck removed approximately 3,000 gallons of groundwater from monitoring wells MW-14 and MW-15. The extraction was conducted over a four-hour period using an initial vacuum of approximately 20-inches of mercury. Based on low vacuum readings in surrounding wells (0 to 0.06 inches of mercury), and a lack of groundwater level change in the adjacent extraction wells (groundwater in well EX-S, located 12 feet from MW-15, only fell by 0.03 feet), the vacuum in wells MW-14 and MW-15 did not appear to create a significant radius of influence or cone of depression. Approximately 300 gallons of groundwater were removed in the first 15 minutes of operation. The truck vacuum was lowered to approximately 15 inches of mercury, and the suction tip was positioned several feet above the groundwater level, creating a subsequent "slurping" action for product/groundwater removal. The suction continued over a four-hour period, at which time the truck tank had filled. The water in the tank appeared light brown and contained a strong gasoline odor. However, LNAPL was not observed in the tank after allowing it to sit for three days. G-Logics returned to the Site on January 31 and measured 0.01 feet and 0.86 feet of LNAPL in MW-14 and MW-15, respectively.

Based on the EFR results, G-Logics concluded the product observed in MW-14 and MW-15 was the result of migration in the saturated smear zone via capillary action into the well casings. The EFR results did not indicate a readily-recoverable layer of free-floating product beneath the Site. This conclusion was based on the following:

- The measured thickness of LNAPL in wells after a significant volume of fluid was extracted from the wells. (See Table 6 for product-level measurements).
- LNAPL was not observed in the vacuum truck.
- LNAPL was not observed in nearby extraction wells.

2.7.9 G-Logics 2006 to 2008 Additional Exploration and ISCO

To further assess the extent of Site contamination and presence of free product, G-Logics conducted an environmental exploration in April 2006. G-Logics installed borings P-1 through P-8 in the area of MW-14 and MW-15. GRO was detected in soil samples collected

from borings P-4, P-6, and P-8 above Method A Cleanup Levels. Soil-sampling results are summarized in Table 4-1.

G-Logics also installed several injection points/monitoring wells (denoted with the prefix "IP"). These wells were constructed with stainless steel casing materials, to enable the application of chemical oxidants into the subsurface. Well IP-4 was screened in the Upper Saturated Zone from 8 to 14 feet, and IP-3 and IP-5 were screened in the Lower Saturated Zone at 18 to 24 feet. IP-6 and IP-7 were installed to a depth of 23 feet and screened in the Lower Saturated Zone (approximately 17 to 23 feet deep). LNAPL was observed in both of these wells.

Between May and June 2006, G-Logics injected 660 gallons of Fenton's reagent (17% hydrogen peroxide) into wells MW-15, IP-3, IP-4, and IP-5. Prior to the injections, MW-15 consistently contained 2 to 3 feet of gasoline product. After the injections, during two subsequent sampling events on May 8, 2006 and June 19, 2006, MW-15 did not contain LNAPL. However, G-Logics observed approximately 0.10 feet of product in MW-15 approximately one month after the first Fenton's injection. The efforts performed are described in the G-Logics report (G-Logics 2006b). Product-level thickness measurements are summarized in Table 6.

G-Logics observed an additional injection of Fenton's reagent again in August 2006. This work was documented in G-Logics *November 2006 Status Report* (G-Logics 2006c). Approximately 660 gallons of 17% hydrogen peroxide was injected into IP-6 and IP-7 with 330 gallons of 17% peroxide injected into wells IP-3 and IP-4. According to the report, during this injection event a strong reaction to the Fenton's reagent was noted in the form of carbon dioxide emissions, heat, pressure, and foaming in nearby wells, though the report does not specify which wells.

Before the Fenton's reagent injections, MW-14 consistently contained 0.3 to 2.3 feet of product. In the weeks following Fenton's treatment, MW-14 contained 0.02 feet of product. However, when measured again in October 2006, MW-14 contained 1.89 feet of product, IP-7 contained 2.42 feet of product, and IP-6 contained 0.18 feet of product. It should be noted that IP-6 and IP-7 were screened in the Lower Saturated Zone. Currently, it is unknown how free product came to be present at these depths). However, it is possible that the released volume was sufficient to drive LNAPL to the Lower Saturated Zone.

In December 2006 and February 2007, G-Logics conducted two more Fenton's reagent injection events. Approximately 1,320 gallons of 17% peroxide were injected in IP-3, IP-4, IP-5, IP-6, and IP-7 in December 2006. Approximately 660 gallons of 11% peroxide were injected in IP-6 and IP-7 in February 2007.

Following the February 2007 injection, product was not detected in MW-14 or MW-15. However, in October 2007, 2.3 feet of product was recorded in MW-14 and 1.4 feet of product was recorded in MW-15 (as measured with an oil-water interface probe).

In February 2008, G-Logics used an oil-water interface probe, as well as a transparent bailer, to evaluate the presence of free product in the wells. Mr. Arthur Buchan from Ecology was present to observe the test. G-Logics noted that a layer of oily product coated the probe when it passed through a thin petroleum layer, carrying it into the water layer. For comparison purposes, the probe was slowly lowered into and through the product layer and the product thickness was measured using the transparent bailer. Using the slow probe method, MW-14 was measured as containing 1.9 feet of product. However, using a bailer, 0.2 feet of product was measured (G-Logics 2008). Both measurement methods indicated the presence of LNAPL, although the two methods measured significantly different thicknesses of LNAPL.

2.7.10 G-Logics 2008 to 2012 FPR Installation and Operation

Subsequent to the treatment attempts, Ecology issued a Notice of Non-compliance in February 2008. The Notice stated that WAC 173-340-450(4) requires owners and operators of UST systems to take immediate interim measures to recover free product. The Notice also stated that a free-product removal schedule needed to be prepared, submitted, and agreed to by Ms. Carrie Pederson of Ecology by March 5, 2008. The Notice schedule also called for the completion of free product recovery by January 31, 2009.

To address the Notice from Ecology, G-Logics drilled nine borings in March 2008 and completed the borings as product-extraction wells. These wells were identified as EW-1 through EW-9 (Figure 2-4). G-Logics constructed the wells to be used for future groundwater sampling, product extraction (if necessary), and/or soil vapor extraction. Boring locations were selected based on proximity to existing wells that contained product (MW-14, MW-15, IP-6, and IP-7). These wells were positioned near the western Property line, considering convenience for product recovery and soil-vapor extraction lines. GRO and/or BTEX were detected above MTCA Method A cleanup levels in soil samples

collected from all of the borings with the exception of EW-7. Contaminant concentrations appeared to be highest in samples collected from depths below 15 feet.

In addition to the extraction wells, G-Logics drilled four borings in April 2008 on the west side of TIB and completed them as groundwater monitoring wells MW-18 through MW-21 (Figure 2-4). The borings were located approximately 100 feet west of the Property on a public right-of-way, and positioned to evaluate potential impacts on down gradient areas (G-Logics 2008). GRO and BTEX were not detected in any of the analyzed soil samples from these four borings.

Construction of an automated free-product pumping/recovery (FPR) system (using skimmer pumps) began in March 2008. While the FPR system was being installed, G-Logics used absorbent socks to immediately address the free product. The construction of the FPR system required demolition of existing pavements, installation of below-grade conduit, and placement of skimmers in the newly installed recovery wells. The installation of the FPR system was completed in February 2009 and included spill-sensing equipment for the product-recovery collection tank. However, the FPR system was prone to failures and required significant management and monitoring to keep it operating (G-Logics 2009a and 2009b).

G-Logics continued to operate the skimmer pumps and use absorbent socks in multiple wells until May 2010, when product recovery by the skimmer pumps was negligible (G-Logics 2010a, 2010b, 2011). G-Logics continued to collect and replace absorbent socks in multiple wells until March 2012. Approximately 74 gallons of petroleum product was removed from the groundwater with the skimmer pumps and absorbent socks from 2008 to 2012, as summarized in G-Logics report dated April 2, 2012 (G-Logics 2012).

2.8 Summary of UST History

Information regarding historical and current USTs is summarized in the following sections.

2.8.1 Documentation of Historical USTs, 1941-1984

The table below provides a summary of historical USTs at the Site, which is based on review of available tax records, as well as historical UST records obtained from Ecology's UST database. Unfortunately, the documentation of USTs in the mid-20th century was not highly regulated. As such, there are unknowns regarding installation dates, years of service, and possible removal and/or decommissioning dates for many of the tanks listed. Based on our review of the tax records, G-Logics believes that as many as 11 different

USTs may have been utilized at the Site prior to Chevron decommissioning the service station in 1984 (Section 2.7.1).

Records available regarding the 1984 service station decommissioning activities by Chevron do not document the number of USTs that were removed from the Site at that time. Geotech's 1990 report references 1962 station plans furnished by Chevron showing four USTs. Although the closure records are not available, it is likely that the 1984 station decommissioning activities would have included removal of at least the four USTs shown on the 1962 station plans. However, sufficient documentation is not available to determine the exact number of USTs that were present at the Site prior to, or after, the 1984 service station decommissioning activities.

Tax Records/Ecology Summary List of Historical USTs at Boeing Field Chevron				
Year	Quantity	Size (gallons)	Contents	Decommission/Removal Date
1941 (Tax Record)				
	1	1,000	Unknown	Unknown
	2	500	Unknown	Unknown
1955 (Tax Record)				
	1	Unknown	Unknown	Unknown
	1	5,500	Unknown	Unknown
	1	500	Used Oil	Unknown
	1	500	Fuel Oil	Unknown
1963 (Tax Record)				
	1	500	Unknown	Unknown
	1	2,000	Unknown	Unknown
	1	5,000	Unknown	Unknown
	1	7,000	Unknown	Unknown
1971 (Ecology UST Summary)				
	1	111-1,100	Unknown	Unknown
	1	111-1,100	Unknown	Unknown

2.8.2 Documented UST-Decommissioning Activities, 1990-1996

The table below provides a summary of documented decommissioning activities completed for six USTs removed from the Site between 1990 and 1996. Note that Hart Crowser's 1994 *Independent Remedial Action Report Summary* discussed the removal of a total of 10

USTs from the Property; however, supporting documentation for this number was not provided in the report. Based on our review of this and other historical investigation reports, as well as the available UST closure records for the Site, it is unclear whether this was an error by Hart Crowser, or whether this number may have also included the USTs previously reported to have been removed by Chevron in 1984. In either case, G-Logics has not been able to find documentation supporting the removal of 10 USTs from the Site.

USTs Removed from Boeing Field Chevron			
Year/Reference	Quantity	Size (gallons)	Contents
1990			
RZA, 1990a, 1990b	1	1,000	Unknown
	1	2,000	Unknown
	1	5,000	Unknown
1992			
Hart Crowser, 1992	1	550	Used Oil
	1	550	Diesel
1996			
PEG, 1997a	1	280	Used Oil/Diesel
Total	6		

2.8.3 UST Status, 1996-Present

The table below provides a summary of the current UST network at the Site, which was installed in 1996. This information also is discussed in Section 2.4.

Current UST System at Boeing Field Chevron				
Year	Quantity	Size (gallons)	Contents	Construction
1996				
	1	10,000	Premium Unleaded Gasoline	Single compartment, steel clad
	1	15,000	Regular Unleaded Gasoline	Single compartment, steel clad
	1	15,000	7,500 Regular Unleaded 7,500 Diesel	Dual-compartment, steel clad
Total	3			

3.0 REMEDIAL INVESTIGATION

This section summarizes RI activities performed to satisfy the requirements of Agreed Order DE-10947, which was executed by Ecology on July 13, 2015. Terracon, then G-Logics, were retained by the Parties to perform explorations to further characterize the Site. The activities and findings of the RI explorations are presented in the following sections.

3.1 Remedial Investigation Activities

RI exploration locations are shown on Figure 2-5. Soil and groundwater analytical information is summarized on Tables 4-1, 4-2, 4-3, 4-4, 5-1, and 5-2, with the laboratory data reports and validation reports attached in Appendix D. The completed activities are summarized below.

3.1.1 Terracon 2015 Well Inspection and Sampling, and Workplan Preparation

In July 2015, Terracon performed an initial monitoring-well inspection and sampled the existing wells at the Site. Using this initial data, Terracon Consultants prepared an RI Work Plan for the Site, which Ecology approved on June 1, 2016.

In September 2016, G-Logics replaced Terracon Consultants. G-Logics used the Work Plan to guide the RI activities completed for this report with the July 2015 groundwater-sampling results included in Tables 5-1 and 5-2 of this report. GRO and benzene concentration contours from the results of the 2015 groundwater sampling also are shown on Figure 6-3.

3.1.2 2016 Utility Survey

Stormwater at the Property collects in several on-Property catch basins (Figure 4-2). The two catch basins adjacent to the pump-island canopy appear to drain into the Property's oil-water separator, located to the south of the canopy. Other catch basins at the Property appear to discharge collected surface runoff into a bio-swale at the northeast corner of the Property. Runoff enters at the southern end of the swale before entering Tukwila's municipal storm-drain system at the swale's northern end. Based on the outfall elevations, G-Logics estimates that on-Property drain lines are buried at a depth of approximately 3 feet below the ground surface.

Adjacent to the Property, surface-water runoff is collected in several catch basins located along East Marginal Way South and TIB (Figure 3-1). Stormwater collected in these catch

basins eventually drains toward catch basin CB-1003, which discharges into a line crossing TIB toward the southwest (shown on Figures 3-1, 3-2, and 3-3). Based on the catch-basin invert elevations on the survey completed for the RI, G-Logics understands that off-Property municipal storm-drain lines are buried at a depth of approximately 4 to 10 feet below the ground surface.

Using a video camera, G-Logics viewed sanitary sewer and storm drain lines on the Property and surrounding municipal storm drains adjacent to the Property. This work was performed on September 29 and 30, 2016. The recorded videos are included on an attached compact disc (Appendix K). A brief narrative for each video recording is presented in Appendix J. Locations corresponding to each video are included on Figure 4-2.

Based on a review of the recorded video, the viewed subsurface piping appeared to be in good condition. However, several blockages were encountered in shallow, small-diameter cleanout lines on the Property, where debris halted progress of the video survey. The approximate locations of these blockages are shown on Figure 4-2 and noted with a red "x" symbol. Municipal storm drains along East Marginal Way South and TIB appeared to be clear of obstructions, cracks, root infiltration, and other visible damage. Based on the results of the video survey and catch-basin sampling (described in Section 3.3 below), additional work was not recommended or conducted to further assess the drain lines on the Site.

3.1.3 2016 Monitoring Well Assessment

In September 2016, G-Logics assessed accessible groundwater-monitoring, injection, and extraction wells associated with the Site. The results of the well assessment were tabulated and are presented on Table 2-1. Recommendations for repairs or decommissioning are summarized in Table 2-1. Well-decommissioning dates also are included on Table 2-1.

During the monitoring-well assessment, G-Logics noted that two wells (EX-N and EX-S, reportedly constructed by PNE) appeared to be screened from the ground surface to the bottom of the well (14-15 feet below the ground surface). Well logs for EX-N and EX-S could not be found. However, G-Logics understands through previous conversations with PNE (no report was prepared) that these wells were installed in excavation-backfill materials.

3.1.4 2016 and 2017 Catch-Basin Solids and Stormwater Sampling

To provide information on possible petroleum contaminants within the municipal stormwater system adjacent to the Property, G-Logics collected representative samples of catch-basin solids (where possible) and stormwater from selected catch basins. As specified in the RI Work Plan, stormwater samples were collected following significant rain events. Selected catch-basin locations are presented in Figures 3-2 and 3-3. In total, G-Logics attempted to collect catch-basin solids and stormwater samples after three different rain events. The sampling events are discussed below. Results of conducted analyses are summarized in Section 3.3.1.

3.1.4.1 October 3, 2016 Sampling Event

On Monday, October 3, 2016, G-Logics attempted to sample catch-basin solids along the eastern curb of TIB, which forms the western boundary of the Property. The basins were found to contain approximately 1 foot of standing water with abundant leaf and garbage debris. Catch-basin solids were not encountered in sufficient quantities to sample.

3.1.4.2 October 27, 2016 Sampling Event

G-Logics returned to the Property on October 27, 2016 for a second attempt to sample catch-basin solids and stormwater. A very small amount of solids were present in catch basins CB-1002 and CB-1068 and G-Logics was only able to collect enough material for limited analyses. No other catch basins contained sufficient quantities of solids to sample. The locations of the sampled catch basins are shown on Figures 3-2 and 3-3. Catch basin solids and stormwater sampling methods and sample analyses are described below in greater detail.

The attempted sampling, identified above, followed within 24 hours of a storm event, which occurred on October 26, 2016. According to online records, 1.46 inches of precipitation were recorded at Boeing Field/King County International Airport on October 26. Sampling methods are discussed in Appendix F.

During the October 27 sampling effort, G-Logics also was able to obtain stormwater samples from catch basins CB-1001, CB-1002, CB-5, and CH-1068. G-Logics collected stormwater samples in accordance with the RI Work Plan. Specifically, the Work Plan references the Environmental Protection Agency's Industrial Stormwater Monitoring and Sampling Guide (EPA 2009). Stormwater sampling occurred within 24 hours following the October 26 storm event. Samples were collected by gently lowering a clean disposable bailer into the standing water of the basin allowing it to fill with water. The bailer was then

retrieved and emptied into laboratory-provided sample bottles. A new bailer was used at each sampling location.

The collected stormwater and catch basin-solid samples were submitted to Fremont Analytical Laboratory and analyzed for petroleum hydrocarbons by methods NWTPH-Gx (GRO) and NWTPH-Dx (DRO and ORO). Other analyses were not performed on catch basin solids samples due to insufficient sample quantity. Results of the stormwater analyses are presented in Table 3-1. Results for the collected solids samples are presented in Table 3-2. Analytical-laboratory reports for the analyzed catch-basin solids and stormwater samples are attached in Appendix D.

3.1.4.3 February 10, 2017 Sampling Event

On February 10, 2017, G-Logics sampled stormwater from four catch basins. G-Logics attempted to collect solids samples from the catch basins as well. However, solid quantities were not sufficient for sampling.

The stormwater samples were submitted to Fremont Analytical Laboratory and analyzed for GRO, DRO, and ORO as well as BTEX, MTBE, 1,2-dichloroethane (EDC), ethylene dibromide (EDB), hexane, naphthalene, and total and dissolved lead.

3.1.5 October 2016 Soil Exploration

On October 21, 2016, G-Logics began efforts to drill 16 soil borings, GLB-1 through GLB-16, as shown on Figure 2-5. All boring locations were air-knifed and vacuum-extracted to a depth of at least 5 feet, for protection of possible underground utilities. Soil samples were collected at a depth of 3 feet using a hand-auger before advancing further, except for borings GLB-1, 2, 3, and 4 (located west of the Property, in the median of TIB). All borings were completed using direct-push drilling methods. The borings extended to a depth of 25 to 35 feet. During drilling, continuous-core soil samples were collected for soil classification, field screening for contamination, and possible chemical analysis.

To provide soil-gas data pending the initial results of the Site exploration, G-Logics installed two permanent soil-gas monitoring points (GLVP-1 and GLVP-2) along the southern Property boundary. These points are located near the off-Property buildings that could be at risk for vapor intrusion. The points are screened at a depth of 7 feet below the ground surface. Additional information regarding soil-gas monitoring point construction and installation methods is included in Appendix F.

Soil samples collected in this initial effort were delivered to Fremont Analytical. Select samples were submitted for rush analysis by NWTPH-Gx and NWTPH-Dx methods. The selection of samples was determined based on visual and olfactory observations of the soil conditions and the noted PID readings. Initially, only analysis for GRO, DRO, and ORO were requested, as these were considered to be the primary contaminants at the Site. Additional analysis for MTBE, EDB, EDC, BTEX, hexane, carcinogenic polyaromatic hydrocarbons (cPAHs), and volatile-petroleum hydrocarbons (VPHs) were requested based on the findings of the reported concentrations of GRO, DRO, or ORO. Results of the soil-sample analyses are discussed in Section 3.3.2.

3.1.6 November 2016 Exploration and Monitoring Well Installation

With the information collected from the initial 2016 exploration, G-Logics planned and coordinated a second drilling exploration at the Site. The findings of the initial exploration and the planned efforts for the second exploration were documented in a memo prepared by G-Logics dated November 9, 2016 (G-Logics 2016a). The memo provided the findings of the initial exploration and reasoning for the second exploration.

For the second exploration effort, three additional soil borings (GLB-17, GLB-18, and GLB-19) were drilled and ten additional groundwater monitoring wells (MW-22 through MW-28) were installed at the Site. Again, all boring locations were air-knifed and vacuumed to a depth of 5 feet, for protection of possible underground utilities. All borings were completed using direct-push drilling methods.

As shown on Figure 2-5, GLB-17 was drilled between MW-27 and MW-28 and was intended to provide information on the southeast extent of the contamination. Borings GLB-18 and GLB-19 were drilled in TIB to provide information regarding the potential presence of contaminants west of the Property. Monitoring wells MW-22 through MW-25 were intended to monitor conditions in the utility corridors to the west of the Property on the east side of TIB.

G-Logics installed several “paired” wells to provide information from the Upper and Lower Saturated Zones at the same physical locations. At each of these locations, two wells were installed approximately 3 to 4 feet apart (Figure 2-5), with one screened in the Upper and one screened in the Lower Saturated Zone. These wells are identified as MW-26S, MW-26-D, MW-27S, MW-27D, MW-28S, and MW-28D. The “S” represents the Upper (i.e., shallow) Saturated Zone and the “D” represents the Lower (i.e., deep) Saturated Zone.

Well-construction information for these monitoring wells is summarized in Table 2-2 and shown on boring logs (Appendix E).

3.1.7 December 2016 Monitoring Well Decommissioning

Based on the information obtained during the two initial rounds of RI field activities (see Sections 3.1.5 and 3.1.6), G-Logics verified the presence of a confining layer separating the Upper and Lower Saturated Zones. The well-assessment efforts discussed above in Section 3.1.3 identified 19 wells that were screened across the confining layer. (i.e., within both saturated zones), creating potential migration pathways between the two saturated zones. Based on these findings and the regulations that govern the construction of groundwater monitoring wells (*Minimum Standards for Constructing and Maintenance of Wells, WAC 173-160*), these 19 monitoring wells were decommissioned in December 2016, as shown on Figure 4-3. Specifically, G-Logics decommissioned extraction wells EW-1 through EW-9, monitoring wells MW-10 through MW-17, and the wells previously identified as EX-N and EX-S. Decommissioning reports are attached in Appendix G.

The wells were decommissioned by ESN Northwest (ESN). As recorded on the decommissioning reports in Appendix G, 17 two-inch wells were decommissioned by over-drilling using an 8-inch auger. Over-drilling methods were used as a best practice to provide a seal through the confining layer.

Well logs for EX-N and EX-S could not be found. However, G-Logics understands through previous conversations with PNE that these wells were installed in excavation-backfill materials. Additionally, the well casings were too large to be drilled out (6-inch and 4-inch diameter well casings, respectively). Per ESN and the above-referenced Ecology standards, well EX-N had to be pressure grouted because the casing diameter was too large to over-drill. Well EX-S also was too large to over-drill with ESN's equipment. However, because it appeared to be screened to the surface, this well could not be pressure grouted and instead was filled with bentonite chips. ESN stated that all three methods of decommissioning (over drilling, pressure grouting, and backfilling with bentonite) are industry standard and approved by Ecology.

3.1.8 January 2018 Exploration and Monitoring Well Installation

After reviewing data collected in 2016, additional information was requested by Ecology regarding vapor-intrusion risks to nearby structures, extent of soil and groundwater contamination near the northern and western boundaries of the Site, and tidal influence at the Site. To address the identified data gaps, G-Logics planned and coordinated soil-gas

sampling, additional drilling, and monitoring-well installations at the Site. These activities are described below.

3.1.8.1 Soil-Gas Sampling

As part of our soil-vapor intrusion assessment (discussed in Section 3.3.5), G-Logics collected soil-gas samples from the permanent monitoring points installed in 2016 (see Section 3.1.5). Samples were collected from an approximate depth of 7 feet below the ground surface using a 1 Liter Summa® canister. Samples were submitted to Fremont Analytical Laboratory for APH fraction, naphthalene, and BTEX analysis.

3.1.8.2 Drilling and Well Installations

Four additional groundwater monitoring wells were installed at the Site (MW-24D, MW-29S, MW-29D, and MW-30). As with the two previous explorations, all boring locations were air-knifed and vacuumed to a depth of at least 5 feet for protection of possible underground utilities. The borings were completed using direct-push drilling methods.

As shown on Figure 2-5, MW-24D and MW-30 were advanced in the median of TIB and were intended to provide information on the western extent of contaminants in the Lower Saturated Zone. Wells 29S and 29D were installed to provide information regarding contaminants at the north end of the Site. As discussed in Section 3.1.6, well MW-29S was screened in the Upper Saturated Zone and well MW-29D was screened in the Lower Saturated Zone. Well-construction information for these monitoring wells is summarized in Table 2-2 and shown on boring logs (Appendix E).

Soil samples were collected and delivered to Fremont Analytical. Based on the findings of the previous RI explorations, select soil samples were analyzed for GRO, DRO, ORO, and BTEX compounds. Results of the analyses are discussed in Section 3.3 and summarized on the attached Tables 4-1 through 4-4. Analytical laboratory reports and chain-of custody forms are attached in Appendix D.

3.1.9 2016 and 2018 Tidal-Influence Studies

Tidal fluctuations in the Duwamish River can influence near-shore groundwater elevations, which in turn may affect the movement of groundwater and Site contaminants. To calculate mean groundwater elevations and hydraulic gradients (vertical and lateral), two tidal-influence studies have been conducted at the Site. These studies are further described below.

3.1.9.1 2016 Tidal-Influence Study

On October 12, 2016, water-level transducers were placed in eight wells across the Site (Figure 8-1). Measurements were recorded at two-minute intervals over a period of one week. This information is included in Appendix I. Wells were chosen for transducer placement based on their screened intervals and their location at the Site, as discussed below.

- **Upper Saturated Zone Wells:** Wells IP-4 and MW-18. IP-4 is located in the central-western portion of the Property, on the east side of TIB and the utility corridor (located in TIB). MW-18 is located west of TIB, directly west of IP-4. These two locations provided an assessment of the Upper Saturated Zone independent of influence from the Lower Saturated Zone.
- **Lower Saturated Zone Wells:** Wells IP-3, MW-19, and MW-21, were screened in the Lower Saturated Zone. IP-3 is located in the central-western portion of the property, on the east side of TIB and the utility corridor (located in TIB). MW-19 and MW-21 are located on the west side of TIB, west of IP-3. These three locations provided an assessment of the Lower Saturated Zone.
- **Wells Screened Across the Confining Layer:** The remaining wells MW-12, 13, and 14 were screened across both the Upper and Lower Saturated Zones. These wells are generally located in the central and western portion of the Property. Note, these wells were decommissioned in December 2016 (see Section 3.1.7).

3.1.9.2 2018 Tidal-Influence Study

For the 2018 tidal study, pressure transducers were placed in several paired wells (MW-27S, MW-27D, MW-28S, MW-28D, MW-29S and MW-29D). Each well pair consists of two adjacent wells, with one well screened in the Lower Saturated Zone (labeled "D") and one well screened in the Upper Saturated Zone (labeled "S"). Transducers also were placed in existing wells screened within the Upper Saturated Zone (IP-4, MW-18) and the Lower Saturated Zone (IP-3, MW-19 and MW-21). The locations of these wells are shown on Figure 8-2. As with the 2016 study described above, wells were chosen based on their screened intervals and their location at the Site relative to likely tidal influence. Measurements were recorded at fifteen-minute intervals over a period of one week. This information is included in Appendix I.

3.1.10 2016 to 2018 Groundwater Monitoring

G-Logics collected quarterly groundwater samples from Site monitoring wells from November 2016 to November 2018. At least four consecutive quarters of groundwater

samples were collected from each well, using low-flow techniques. The collected groundwater samples were submitted to Fremont Analytical and analyzed for GRO, DRO, ORO, total and dissolved lead, and several petroleum-related VOCs. Methods for low-flow groundwater sampling are provided in Appendix F. Water-quality parameters recorded during sampling are included in Table 7 and in Appendix M. Groundwater-monitoring results are discussed in Section 3.3.3 and summarized on Tables 5-1 and 5-2.

3.1.11 2019 Pilot-Test Well Installation and Sampling

In April 2019, G-Logics conducted an air sparge/soil-vapor extraction Feasibility Study Pilot Test at the Site. As part of this work, G-Logics advanced six soil borings, completing two as air sparge/ groundwater-monitoring wells (AS-1 and AS-2), one as a soil-vapor extraction well (SVE-1), and three as vadose-zone observation points (TW-1, TW-2, and TW-3. Locations for these six borings are shown on Figure 2-5. Soil sampling results for each boring are presented in Table 4-1 and groundwater sampling results for AS-1 and AS-2 are presented in Table 5-1. Additional findings of the pilot test were documented in our report, dated August 14, 2019.

3.2 Quality Assurance/Quality Control

Quality Assurance/Quality Control (QA/QC) during G-Logics exploration efforts included procedures for sample collection, storage, tracking, documentation, and analysis in accordance with the Terracon Quality Assurance Project Plan (QAPP), prepared as part of the RI Work Plan. G-Logics also completed chain-of-custody documentation during the exploration efforts.

3.3 Site Characterization Findings

The findings of G-Logics RI efforts are described below. Exploration locations are shown on Figure 2-5. GRO and benzene concentrations at the Site are presented on Figures 5-1 through 5-4. Figures 6-1 through 6-5 and 7-1 through 7-4 present groundwater-contaminant concentrations over time. Vertical interpretations of the geological and contaminant conditions are provided on cross-sections A-A’ and B-B’ (Figures 10-1 and 10-2, respectively). Summary analytical data is presented in Tables 3-1 and 3-2 (catch-basin samples), 4-1 through 4-4 (soil samples), 5-1 and 5-2 (groundwater samples), and 8 (soil-gas samples). For soil and groundwater samples, historical and recently collected data are included in the tables, along with data-reference sources (e.g. RZA, 1990).

Laboratory reports and chain-of-custody forms are attached as Appendix D. Boring logs from the Site exploration work are attached as Appendix E. G-Logics field sampling methods are described in Appendix F.

3.3.1 Catch-Basin Solids and Stormwater Sampling Results

Our findings concerning the potential presence of petroleum contaminants originating from the Site in catch basin solids and stormwater are presented below.

- Findings from the survey videos, previously discussed in Section 3.2.1, indicate that the storm-drain system is intact and no obvious signs of damaged lines were observed.
- Evidence of immiscible petroleum product, sheens, or strong odors was not noted during sampling of catch basins.
- Only limited amounts of solids, in most cases insufficient for sampling, were found in the catch basins, which we understand are routinely cleaned.
- As would be expected in road-side catch basins, low concentrations of petroleum contaminants (GRO and/or ORO) were found in the solids samples collected from catch-basins both upstream and downstream of the subject Property.
- Concentrations of GRO and related contaminants were not detected above laboratory reporting limits in the analyzed stormwater samples.
- DRO and ORO were detected at concentrations slightly above laboratory-reporting limits in stormwater samples collected from catch basins CB-1002, CB-1003, and CB-1004, but below MTCA cleanup levels.

Based on these findings, it is G-Logics' opinion that petroleum contaminants are not likely to be entering the municipal storm-drain system from the subsurface releases originating from the Site. Accordingly, additional storm-drain system sampling is not planned.

3.3.2 Soil-Boring Findings

Soil borings encountered well-graded silty, gravelly sands to a depth of approximately 12 feet, over a layer of silt with abundant reeds/grasses (confining layer) to approximately 18 feet. Borings advanced to greater depths typically encountered fine-to-coarse-grained dark gray/black sand from 18 feet to the explore depths (lower saturated zone). Groundwater was encountered during drilling in all borings at depths ranging from 9 to 12 feet. The observed subsurface soil conditions generally are consistent with the descriptions provided in Section 2.4.2.

Borings completed in the areas of the utility corridor, UST removals, and remedial excavations generally encountered fill soils, including sands and gravels with occasional wood and concrete overlying native soils such as the fine-grained unit and/or lower sand unit. Additionally, sample recovery was poor in borings advanced within the utility corridor, possibly indicating the corridor was backfilled with aggregate.

Summarized below are G-Logics findings regarding soil contaminants at the Site. Analytical results for the collected soil samples are summarized on Tables 4-1 through 4-4.

- Selected soil samples were analyzed for GRO, DRO, ORO, gasoline related VOCs (BTEX, EDB, EDC, MTBE, and lead), cPAHs, Naphthalene, and/or VPHs (see Tables 4-1 through 4-4).
- Concentrations of GRO were detected in soil samples collected from seven borings, specifically, GLB-7, 9, 10, 12, 14, 15, and 16, as well as from AS-2, SVE-1, and TW-3. However, only six samples (collected from beneath the dispenser-island canopy) contained concentrations above the Method A cleanup level.
    - Specifically, a sample from GLB-14, collected at a depth of 17 feet, reported a concentration of GRO at 215 mg/kg. Three samples collected from GLB-15, collected at depths of 9, 12, and 18 feet, reported concentrations of GRO at 70.8, 37.2, and 3,510 mg/kg, respectively (Table 4-1).
    - GRO was detected at a concentration of 928 mg/kg in one soil sample collected from AS-2 (19 foot depth), 3,560 mg/kg in a sample collected from SVE-1 (9 foot depth), and 153 mg/kg in a sample from TW-3 (9 foot depth).
- GRO and BTEX compounds were not detected in soil samples collected from depths shallower than 9 feet.
- Benzene was detected above the Method A cleanup level, in soil samples collected from borings GLB-7, GLB-9, GLB-10, GLB-14, GLB-15, GLB-16, GLB-19, and MW-23, AS-2 and TW-3.
- Benzene was the only contaminant above Method A cleanup levels reported in soil west of the Property, specifically in four borings, GLB-7, GLB-9, GLB-19, and MW-23.
- Ethylbenzene, toluene, and/or xylenes were reported above Method A cleanup levels in samples from borings GLB-14, GLB-15, AS-2, TW-3, and SVE-1.
- N-Hexane was detected but below Method B cleanup levels (non-cancer, direct contact) in 15 of the samples collected from borings GLB-7, GLB-10, GLB-12, GLB-14, GLB-15, GLB-16, and GLB-18 (Table 4-1).

- DRO was not detected in any of the analyzed soil samples collected during the RI efforts. Two samples, specifically in GLB-9 and GLB-18, at depths of 10 and 14 feet respectively, contained ORO at concentrations below the MTCA Method A cleanup level (Table 4-1).
- A total of 69 soil samples were analyzed for naphthalene, 1-methylnaphthalene and 2-methylnaphthalene but only five (from borings GLB-7, GLB-14, and GLB-15) reported detectable concentrations and all were below MTCA cleanup levels (Tables 4-2 and 4-3).
- In addition to the samples analyzed for naphthalene, a total of 26 soil samples were analyzed for cPAHs by EPA Method 8270 (SIM, low-detection). The 26 analyzed samples were selected based on the detected concentration of GRO in the initial sample, as well as being collected from areas identified for this analysis in the Work Plan (*Table A-3, Section 2.3*). With the exception of one analyzed sample containing a detectable concentration of benzo(a)pyrene, none of the analyzed samples reported detectable concentrations of cPAHs. The sample from boring GLB-12, at a depth of 10 feet, reported a detectable concentration of benzo(a)pyrene at 71.5 µg/kg (Tables 4-2 and 4-3). This concentration is below the Method A Cleanup Level of 100 µg/kg for benzo(a)pyrene.
- MTBE, EDB, and EDC were not detected in analyzed soil samples at the Site. While concentrations were not detected, the laboratory-reporting limits for EDB and MTBE were above the MTCA Method A CULs in several samples.
- Lead was detected in the analyzed samples at concentrations ranging from approximately 1 to 14 mg/kg, below the Method A cleanup level (Table 4-1).
- Four soil samples were analyzed for VPHs (Table 4-4). Three of the four samples reported detectable concentrations of VPHs, however, due to the presence of benzene at concentrations above the MTCA Method A soil cleanup level, further calculations were not performed to develop Method B cleanup levels.
- No analytes were detected at concentrations above laboratory reporting limits in soil samples collected in the median strip on TIB west of the Property.

3.3.3 Groundwater Sampling Findings

G-Logics installed monitoring wells MW-22 through MW-30 to provide additional information regarding soil and groundwater impacts and groundwater elevations. Groundwater samples have also been collected from monitoring wells AS-1 and AS-2, which were installed in association with pilot test activities conducted at the Site in April

2019. Per the RI Work Plan, the collected groundwater samples were analyzed for GRO, DRO, ORO, lead, BTEX, MTBE, EDB, EDC, hexane, naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene. The findings of the analyzed groundwater samples are summarized below and included in Tables 5-1 and 5-2.

- GRO and other petroleum-related contaminants were consistently detected above MTCA Method A cleanup levels in wells located near the western pump islands. These wells include IP-3, IP-4, IP-5, AS-1, and AS-2.
- GRO and other petroleum contaminants also consistently exceeded cleanup levels in several wells that were historically located in this area, but are now decommissioned (see Section 3.1.7). These wells include MW-10, MW-11, MW-14, and MW-15, EW-1, EW-2, EW-7, EW-8, and EW-9.
- LNAPL has historically been observed in several wells across the Site, as shown on Figures 6-1 through 6-3 and in Table 6. The extent of LNAPL at the Site has diminished over time.
- LNAPL has remained intermittently present in monitoring well IP-7 (an on-Property well). Observed LNAPL thickness has ranged from trace to 6.00 feet. LNAPL has not been observed at any other monitoring wells at the Site from 2016 through 2019.
- EDB was detected in groundwater samples collected in 2015, but was not detected in subsequent samples collected from 2016 through 2019. Analytical results for samples collected during March of 2018 showed elevated detection limits, which were above cleanup levels (Table 5-1).
- GRO and other petroleum-related contaminants were not detected above cleanup levels in wells located across TIB to the west (MW-18, MW-19, MW-20, MW-21), with the exception of MW-21, where benzene was detected at 2.61 µg/L.
- In December 2016, benzene and GRO were detected above cleanup levels in samples collected from well MW-23. Contaminants were not detected above laboratory reporting limits in subsequent samples collected from this well (Table 5-1 and Figures 7-1 and 7-2).
- In November 2018, GRO and benzene contaminants were not detected above cleanup levels in wells MW-23, MW-24, MW-25, and MW-29S, located within the TIB utility corridor (Figure 6-4). However, naphthalene was detected slightly above cleanup levels in samples collected from well MW-29S.
- GRO and benzene were not detected above cleanup levels in groundwater samples collected from MW-24, which is located in the median of TIB and screened in the Upper Saturated Zone.

- For Lower Saturated Zone wells located in the median of TIB (MW-24D, and MW-30), GRO and/or benzene have been detected above cleanup levels (Figure 6-5).
- During the August 2018 quarterly sampling, GRO and ORO were detected in well MW-27D (located on the eastern side of the Property) at concentrations slightly above cleanup levels.

3.3.4 Tidal-Study Findings

The findings of G-Logics 2016 and 2018 tidal-influence studies indicated tidal fluctuations were minimal to non-existent in wells screened in the Upper Saturated Zone. Additionally, tidal fluctuations were minimal to non-existent in well MW-12 (decommissioned in 2016). MW-12 was screened across both saturated zones and was located the farthest from the Duwamish River (approximately 320 feet from the east shore of the river).

Tidal fluctuations were observed in all other wells that were either screened in the Lower Saturated Zone or in both Upper and Lower Saturated Zones. As anticipated, the greatest groundwater elevation fluctuations occurred in the wells closest to the Duwamish River, such as MW-19 and MW-21. Transducer locations and a summary of the tidal-study results are shown on Figures 8-1 and 8-2. Graph 1 shows groundwater-elevations at the Site compared to Duwamish River tidal stages during the weeks of October 12, 2016 and January 25, 2018.

Daily mean high-tide and low-tide groundwater elevations were calculated for each well (January 17, 2018 through January 23, 2018). These values were used to obtain a 7-day average of mean high tide and low tide groundwater elevations for the week that the study was performed. These average elevations and interpreted contours are presented on Figure 9-2.

As shown on Figure 9-2, at high tide the interpreted groundwater-flow direction on the Property is towards the Duwamish, while the interpreted direction west of the Property (within TIB) is away from the Duwamish. This temporary gradient reversal on the western half of the Site indicates that during periods of high tide, water levels are more tidally-influenced to the west, closer to the river, and less so to the east.

Based on the results of the tidal-influence studies, the following conclusions regarding mean-groundwater elevations, tidal fluctuations, hydraulic gradients, and tidal influence of the Duwamish River on the Property are presented below.

- Mean groundwater elevations were calculated using the Serfes Method over a 72-hour period (Serfes, 1991). Mean groundwater elevations on the Property ranged from 6.61 to 7.84 feet. Mean groundwater-flow directions in shallow-zone wells were to the west and southwest (Figure 9-3).
- In monitoring wells screened within the Lower Saturated Zone, groundwater exhibited tidally-influenced elevation fluctuations ranging from 2.23 feet (low-low tide, MW-21) to 10.69 feet (high-high tide, MW-27). The magnitude of elevation changes was greatest near the shoreline and decreased with distance inland, as shown on Figures 8-1, 8-2, and 9-1 through 9-3.
- The lag time of water-level changes was shortest near the Duwamish and increased with distance inland. Water-level elevations closely follow tide stages. Average lag times ranged from 60 minutes (well MW-21) to 135 minutes (MW-27D).
- Mean vertical-hydraulic gradients were calculated for three well pairs: a mean downward gradient of 0.66 ft/ft in MW-27S/27D, 0.60 ft/ft in MW-28S/28D, and 0.64 ft/ft in IP-4/3.
- A net horizontal hydraulic gradient of 0.0054 ft/ft was calculated across the Site based on mean groundwater elevations. Lateral gradient flows generally to the southwest and west, in the direction of the Duwamish River. Interpreted horizontal-gradient directions are presented on Figures 9-1, 9-2, and 9-3.
- As shown on Figure 9-2, a horizontal-gradient reversal was observed beyond the western property boundary. As expected, during high tide, the horizontal gradient west of the Property boundary appears to be toward the Property. At low tide, this apparent gradient reverses, toward the Duwamish River.

3.3.5 Petroleum Vapor-Intrusion Assessment Findings

Given the presence of petroleum contamination at the Site and based on Ecology's *Guidance for Evaluating Soil Vapor Intrusion in Washington State*, dated October 2009, revised February 2016 (Ecology 2016b), G-Logics performed an initial vapor-intrusion assessment for the Site.

For this assessment, soil and groundwater analytical results from GLB-17, MW-27S, MW-27D, MW-28S, and MW-28D were compared to the lateral and vertical separation distances presented in Step 6 and Step 7 of the *Implementation Memorandum No. 14* guidance document (Ecology 2016c). Based on the analytical results, the nearest surrounding structures (the convenience store on the Property and a building on the adjoining southern property) are outside of the lateral-separation distance of 30 feet.

Based on the guidance documents and the possibility for soil-vapor preferential pathways at the Site, G-Logics collected soil-gas samples from the two soil-gas probes installed at the Site in October 2016 (GLVP-1 and GLVP-2, shown on Figure 2-5). Collected soil-gas samples were analyzed for petroleum constituents, specifically APH fractionation, BTEX compounds and naphthalene. Soil-gas samples were compared to screening levels in accordance with Ecology guidance *Petroleum Vapor Intrusion (PVI): Updated Screening Levels, Cleanup Levels, and Assessing PVI Threats to Future Buildings, Implementation Memorandum No. 18* (Ecology 2018). The applicable screening levels were not exceeded in either of the two analyzed samples (see Table 8).

3.4 Contaminants of Concern

DRO, GRO, ORO, BTEX, naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, and MTBE were found to be present at the Site at concentrations exceeding MTCA cleanup levels, in either soil or groundwater. Accordingly, these compounds have been retained as possible contaminants of concern (COCs) for the Site.

Several contaminants have been shown to occur in close association with GRO and benzene, therefore remedial efforts directed toward a cleanup of GRO and benzene likely would result in the reduction of related contaminant concentrations. Based on the data presented in this report, GRO and benzene are considered the primary contaminants of concern (indicator chemicals) for the Site, as discussed in more detail below.

3.4.1 Contaminant Findings, GRO

In the Upper Saturated Zone, GRO is present in soil and groundwater at concentrations above Method A cleanup levels in the central and western portions of the Property. Based on historical analytical data and recent exploration findings, as described in this report, GRO in excess of cleanup levels does not extend significantly beyond the western boundary of the Property. Specifically, as shown on Figures 5-2, 5-3, 6-4, 7-1, and 7-2, GRO was not detected in the vadose and Upper Saturated Zones beyond the north-bound turning lane of TIB.

In the Lower Saturated Zone, GRO is present in soil and groundwater at concentrations above Method A cleanup levels in the central and western portions of the Property, as well as beneath TIB, as shown on Figures 5-4, 6-5, 7-3, and 7-4. GRO also has been detected in well MW-20 west of TIB (August and November 2018), but at concentrations below Method A cleanup levels.

3.4.2 Contaminant Findings, Benzene

In vadose soils and Upper Saturated Zone soil and groundwater, benzene is present at concentrations that exceed Method A cleanup levels in the central and western portions of the Property, but does not appear to extend significantly beyond the western boundary of the Property (Figures 5-2, 5-3, 6-4, 7-1, and 7-2). In Lower Saturated Zone soils and groundwater, benzene has been detected at concentrations above Method A cleanup levels in the central and western portions of the property, as well as beneath TIB (Figures 5-4, 6-5, 7-3, and 7-4). Benzene was detected at a concentration of 2.6 µg/L in one groundwater sample collected from well MW-21 (November 2016). Benzene has not been detected in subsequent groundwater samples collected from this well. Additionally, benzene has not been detected in other wells west of TIB.

4.0 CONCEPTUAL SITE MODEL

This section summarizes our Conceptual Site Model (CSM) including the nature and extent of Site contaminants, media of concern, and potential exposure pathways based on historical data as well as data generated by the exploration efforts discussed above. This Conceptual Site Model will provide the basis for a review of cleanup-action alternatives and for the selection of appropriate cleanup actions. Visual representations of the CSM are presented on Figures 11-1 and 11-2.

4.1 Contaminant Release

As described above in Section 2.0, three historical releases of petroleum hydrocarbons have been identified on the Property. The first documented release was reported to Ecology in 1990, and was associated with historical service-station operations that occurred on the Property prior to 1984. For this release, historical environmental reports identified DRO and GRO in subsurface soil and groundwater samples.

The second documented release (unspecified petroleum product), reported in 1996, was associated with a UST discovered during the construction of the current station. The most recent release (GRO) was reported in 2003, after a fuel line leaked gasoline in the vicinity of the western pump island.

Historical reports documenting past releases, assessments, and cleanup efforts that occurred from 1990 to 2012 are presented in Appendix C. The findings of previous reports and the

analytical data obtained during recent RI Site characterization activities indicate that the primary COCs for the Site are GRO and benzene (see Section 3.4).

4.2 Fate and Transport

As discussed in Section 2.4.3, two distinct groundwater-bearing zones are present at the Site. Both the Upper and Lower Saturated Zones appear to be impacted by petroleum contaminants. Recently (sampling in 2017, 2018, and 2019), only well IP-7 (screened in the Lower Saturated Zone) has been found to contain LNAPL. Prior to Fenton's Reagent treatment in 2006 (see Section 2.7), LNAPL was found in as many as five wells.

Site contaminants have been transported from the source area on the Property by leaching and groundwater flow and have been distributed primarily by dispersive (solution) and advective (movement) transport mechanisms within the saturated zones. These mechanisms are affected by factors such as tidal fluctuation (Lower Saturated Zone), soil-grain size, soil permeability, soil porosity, sorption/retardation characteristics of the soil, the volume of the release, and biodegradation of the contaminants.

Beyond the western boundary of the Property, Site contaminant concentrations appear to decrease significantly. Based on soil and groundwater samples collected from within TIB and within the utility corridor west of the Property boundary, it does not appear that contaminants are being transported in the backfill of the utility corridor. Specifically, several borings were advanced within or adjacent to the utility corridor (GLB-6, 7, 8, 9, 11, 18, 19, MW-23, and MW-25). Site contaminants were not detected in soil samples collected from these borings to depths of 15 feet. While shallow (less than 15 feet bgs) soil samples were not able to be collected from all boring locations within the utility corridor (e.g. MW-23), available soil samples and field screening data do not indicate that the utility corridor is a preferential pathway for contaminant migration.

Within the Lower Saturated Zone, Site contaminants were detected in soil samples collected at depths of 18 feet and deeper. These results indicate that contaminants within the Lower Saturated Zone also are not impacting the utility corridor, but instead have extended beneath it.

4.2.1 Soil-Gas Fate and Transport

For soil vapors located above the water table, the primary transport mechanisms are diffusion and advection (assuming subsurface-pressure differences). Possible receptors are discussed in Section 4.4.3 below.

4.2.2 Summary: Nature and Extent of Contamination

Based on the existing sampling data, the extent of soil contamination at the Site is shown on Figure 5-1. The interpreted extent of groundwater contamination is shown on Figures 6-4, 6-5, and 7-1 through 7-4. Two cross-sections are provided as Figures 10-1 and 10-2, showing the interpreted vertical extent of contamination in both soil and groundwater at the Site. A schematic representation of the general conceptual Site model is shown on Figure 11-1.

Based on compiled data, petroleum impacts (resulting from fueling-system leaks) currently are greatest in the immediate vicinity of the western-dispenser islands, which is the reported location of the 2003 release. Contaminants remain present at concentrations exceeding MTCA Method A cleanup levels in soil and groundwater (both saturated zones). Residual contaminants are present, but at much lower concentrations, in the vadose soils at the Site. LNAPL also remains present in at least one of the monitoring wells, which is screened within the Lower Saturated Zone.

As shown on Figures 6-1 through 6-5, Site contaminants do not appear to be migrating laterally over time. These figures also indicate that the extent of LNAPL at the Site has substantially diminished over time.

GRO and benzene impacts to soil and groundwater have been found to extend off the Property into the right-of-way for TIB. However, based on soil and groundwater-sampling data from borings and monitoring wells completed in the right-of-way (wells MW-18 through MW-21, MW-24), these impacts do not appear to extend to the west, beyond TIB.

Samples collected from stormwater and catch-basin solids, as well as subsurface-soil and groundwater sampling within the backfill of the TIB municipal-utility corridor, indicate that Site contaminants are not migrating within the storm drains or within the utility corridor backfill.

4.3 Potential Receptors

Given the information presented in Sections 4.1 and 4.2, and the current land use at the Site, potential receptors of soil, groundwater, and soil-gas contaminants include construction and utility-maintenance workers. Based on the TEE (presented in Section 5.2), terrestrial biota also are considered to be potential receptors. Potential receptors to Site contaminants are shown on Figure 11-2.

4.4 Potential Pathways of Exposure

Potential exposure pathways for the different Site media are described below.

4.4.1 Soil Pathway

Contaminated soils typically present a potential impact to human health and the environment through possible ingestion and direct contact, as well as diffusion into subsurface groundwater. If contaminated soils are exposed, inhalation of particulates may present a potential for exposure. In addition, contaminants volatilizing from contaminated soils may also present a potential for exposure through vapor intrusion. Contaminated soils at this Site are not currently present at the ground surface and are predominantly covered by paved surfaces or buildings. However, direct contact with these contaminated soils by workers could occur during future redevelopment excavations and/or utility maintenance activities.

Based on the results of a simplified Terrestrial Ecological Evaluation (TEE) that was performed, terrestrial plants, soil biota, and wildlife are considered as potential receptors to contaminants in soil at the Site. Further discussion of the TEE is presented in Section 5.2, and the TEE is included in Appendix L.

4.4.2 Groundwater Pathway

Based on the current (and probable) future use of the Site, ingestion and dermal contact with contaminated groundwater by on-site employees, customers, or visitors is not expected to occur; however, direct contact or ingestion of groundwater by workers could occur during future redevelopment excavations and/or utility maintenance activities.

Specifically, the Site and surrounding areas are served by municipal water. According to the Washington Department of Natural Resources and Ecology well-log databases, drinking-water supply wells are not located within the Site or in downgradient locations (Appendix H).

Groundwater beneath the Site is hydrogeologically connected to the Duwamish River, which is located down-gradient from the Site (approximately 275 feet west of the western boundary of the Property). While groundwater is ultimately in communication with the Duwamish, recent explorations indicate Site contaminants (soil and groundwater) are not present at concentrations above detection levels beyond the median of TIB.

Based on stormwater and catch-basin solids samples, as well as subsurface-soil and groundwater samples collected within the backfill of utilities along TIB (wells MW-23, 24, 25, and 29S), Site contaminants are not migrating within or along the Tukwila municipal utility corridor.

4.4.3 Soil-Vapor Pathway

Soil-vapor contaminants present a potential risk to human health through possible inhalation. Potential pathways for soil-vapor exposure are discussed below.

4.4.3.1 Vapor Intrusion, On-Property Structures

A potential exposure pathway exists for volatile contaminants to migrate into indoor air via vapor intrusion. However, the nearest occupied structures are outside of the lateral and/or vertical separation distances from the boundary of Site contamination, as presented in Ecology's *Implementation Memorandum No. 14*, dated March 31, 2016 (Ecology 2016).

Subsurface utilities are present at the Property. While the backfill for subsurface utilities can present a preferential pathway for soil vapor to enter occupied buildings, the entire property is underlain by various generations of backfilled material. Therefore, backfill used in utility installations likely would not introduce a preferential pathway for soil-gas migration.

Furthermore, soil-sampling data indicate that GRO and petroleum-related VOC concentrations are generally below Method A cleanup levels in vadose soils (shallower than 9 feet below the ground surface, Figure 5-2) throughout most of the Site. Soil gas samples indicate a limited amount of petroleum-related contaminants in soil-gas at the Site. Finally, given the Site's current use as an active gas station, petroleum vapors likely are already present in the Property structures. Accordingly, the exposure pathway for vapor intrusion into on-Property buildings is not considered to be complete.

4.4.3.2 Vapor Intrusion, Off-Property Structures

Petroleum contaminants were detected at concentrations less than MTCA Method B sub-slab screening levels in soil-gas samples collected near the southern property boundary. Accordingly, the soil-vapor pathway to buildings located on the south-adjacent property is not considered to be complete.

4.4.3.3 Vapor Intrusion, Site Construction Activities

Inhalation exposure to particulates and/or vapors could occur for construction workers performing invasive work at the Site or utility repair or maintenance activities. Although the use of ventilation and protective equipment (respirators and protective garments) would mitigate potential exposures, the exposure pathway is considered to be complete.

4.4.4 Surface-Water Pathway

Surface-water runoff at the Site is collected by catch basins, conveyed to the City of Tukwila's municipal stormwater system, and ultimately discharged to the Duwamish River (outfall location is unknown). The surrounding area is mostly paved (other than the on-property drainage swale and landscaped median in TIB) or covered by buildings. As such, impacted soil and groundwater do not come in direct contact with surface water runoff. Groundwater samples from downgradient monitoring wells and wells located within the utility corridor indicate that the high-permeability soils located within the utility corridor backfill are not acting as a preferential pathway for Site contaminants to impact surface water. Therefore, at this time, impacts to surface water are not considered to be a complete exposure pathway.

5.0 PROPOSED CLEANUP STANDARDS

MTCA "establishes administrative processes and standards to identify, investigate, and cleanup facilities where hazardous substances have come to be located" (WAC 173-340-100). Soil and groundwater cleanup levels promulgated under MTCA when combined with the applicable point of compliance are the standards that determine when additional investigation or cleanup is necessary. Additional information regarding cleanup levels and points of compliance are discussed below.

5.1 Primary Contaminants of Concern

As described in Section 3.4 above, GRO and benzene have been identified as the indicator chemicals for cleanup. Further review of these contaminants is discussed in the following Sections.

5.2 Terrestrial Ecological Evaluation

Under certain circumstances, a TEE is required to establish soil cleanup levels that are protective of the environment. The regulation establishes a tiered process for evaluating potential risks to terrestrial ecological receptors. This process is set forth in MTCA in WAC

173-340-7490 through 173-340-7494. WAC 173-340-7491 identifies conditions that cause a Site to be excluded from the TEE requirements.

5.2.1 Conditions Requiring a TEE

Site conditions that are required for a TEE exemption are:

- Contamination is below 15 feet without institutional controls, or below 6 feet with institutional controls.
- Contamination is (or will be) covered by buildings or pavement (future development or paving shall include a completion date acceptable to Ecology for such action).
- Concentrations are below natural background.
- Insufficient contiguous undeveloped land (for petroleum contamination, less than 1.5 acres existing on the Property, or within 500 feet of the Property).

If a Site is not exempt, a TEE (either Site-specific or Simplified) must be performed. A Site-specific TEE must be performed under the following conditions:

- The contamination is located on or directly adjacent to an area where management or land use plans maintain native or semi-native vegetation.
- The area of contamination is used by threatened or endangered species.
- The Property contains 10 acres of native vegetation within 500 feet of contamination.

If none of the conditions requiring a Site-specific TEE apply, a Simplified TEE can be conducted. The Simplified TEE process is intended to identify those Sites which do not have a substantial potential for posing a threat of significant adverse effects to terrestrial ecological receptors, and thus may be removed from further ecological consideration during cleanup. No further TEE is required at a Site where conditions include any of the following:

- Land use at the Site and surrounding area makes substantial wildlife exposure unlikely (Table 749-1 in WAC 173-340 is used to make this evaluation).
- If the contaminant concentrations are below those given in Table 749-2 (WAC 173-340) within the point of compliance (15 feet with no institutional controls, 6 feet with institutional controls).
- Area of soil contamination is less than 350 square feet.

5.2.2 Conclusion Regarding Applicability of a TEE

Based on the above criteria, the Site cannot be considered exempt from TEE requirements. G-Logics therefore conducted a Simplified TEE for the Site (Appendix L.), and concluded that ecological receptors should be considered at this Site regarding the establishment of soil cleanup levels.

5.3 Cleanup Levels

Proposed cleanup levels for the Site COCs are listed below.

5.3.1 Proposed Soil Cleanup Levels

Based on the completed Simplified TEE, soil cleanup levels are either those listed in Table 749-2 (WAC 173-340) or the Method A cleanup levels, whichever is most conservative. These cleanup levels address all the potential soil exposure pathways (i.e., direct contact, protection of groundwater, and vapor intrusion). If a soil contaminant does not have a published concentration in Table 749-2, then the Method A or the most conservative Method B cleanup level (CUL) will be used.

Soil CULs (mg/kg)

Analyte	Method A Unrestricted Land Use	Table 749-2 Unrestricted Land Use(a)	Most Conservative Method B	Proposed Cleanup Level
TPH-G	30	200	--	30
TPH-D	2,000	460	--	460
Benzene	0.03	--	18	0.03
Toluene	7	--	6,400	7
Ethylbenzene	6	--	8,000	6
Xylenes	9	--	16,000	9
cPAH (b)	0.1	300	--	0.1
Naphthalene	5	--	1,600	5
1-Methylnaphthalene	--	--	34	34
2-Methylnaphthalene	--	--	320	320

(a) Soil CUL for unrestricted land use as per Table 749-2 WAC 173-340.

(b) Method A CUL for benzo(a)pyrene.

5.3.2 Proposed Groundwater Cleanup Levels

Because of the Site's proximity to the Duwamish River and its inclusion in the Upper Reach Source Control Area (Ecology, 2017), groundwater-contaminant cleanup levels at

the Site are required by Ecology to be based on protection of surface-water, as summarized below. Method A cleanup levels for the protection of drinking water also are listed below.

Groundwater CULs (µg/L)

Analyte	Protection of Drinking Water	Protection of Surface Water	Proposed Cleanup Level
TPH-G	800	800 (a)	800
TPH-D	500	500 (a)	500
Benzene	5	1.6	1.6
Toluene	640	130	130
Ethylbenzene	700	31	31
Xylenes	1,600	--	--
cPAH TEQ	0.2	0.000016	0.000016
Naphthalene	160	1.4	1.4
1-Methylnaphthalene	1.5	--	1.5
2-Methylnaphthalene	32	--	32

(a) Method A groundwater CULs used as surface water CULs per WAC 173-340-730(3)(b)(iii)(C).

If, during the course of Site cleanup, these cleanup levels become impracticable to achieve (e.g., cost versus benefit considerations), land use restrictions and/or alternative cleanup levels may be considered (such as remediation levels).

5.3.3 Proposed Soil-Gas Screening Levels

Proposed soil-gas screening levels are based on Ecology guidance *Petroleum Vapor Intrusion (PVI): Updated Screening Levels, Cleanup Levels, and Assessing PVI Threats to Future Buildings, Implementation Memorandum No. 18* (Ecology 2018). Per the guidance and per Ecology's Cleanup Levels and Risk Calculation (CLARC) tables (as of June 2020), soil-gas screening levels for air-phase hydrocarbon petroleum fractions have been replaced with a generic Method B total petroleum hydrocarbon (TPH) screening level. Proposed screening levels are listed below.

Air Cleanup/Screening Levels (µg/m^3)

Analyte	Indoor Air	Sub-Slab Soil Gas
TPH	140	4,700
Naphthalene	0.0735	2.5
Benzene	0.321	11
Toluene	2,290	76,000
Ethylbenzene	457	15,000
Xylenes	45.7	1,500

5.4 Remediation Levels

When it is not practicable (cost-effective) to restore a Site to the cleanup standards, MTCA allows use of "remediation levels" (WAC 173-340-355). Remediation levels are concentrations that help to guide the selection of different cleanup actions and, by definition, exceed cleanup-level concentrations. Remediation levels will be discussed in the forthcoming FS.

5.5 Points of Compliance

Points of compliance are the locations at a Site where cleanup levels must be met (173-340-700). MTCA establishes standard points of compliance but site-specific points of compliance can be established for a particular media and remedy. For example, if the cleanup action involves containment of hazardous substances, the soil cleanup levels will typically not be met at the standard points of compliance but the cleanup action will include additional measures (e.g., institutional controls) to protect human health and the environment (173-340-740(6)(f)).

5.5.1 Points of Compliance, Soil

For protection of groundwater, the standard soil point of compliance is all soils throughout the Site.

5.5.2 Points of Compliance, Groundwater

The standard groundwater point of compliance is the uppermost level of the saturated zone extending vertically to the lowest depth where Site contaminants exceed cleanup levels (throughout the plume of contaminated groundwater).

5.5.3 Points of Compliance, Soil Gas

As stated above, the building on the Property is a convenience store for an active gas station. Because of this, petroleum and petroleum-related VOC concentrations in indoor-air inside the building are likely to be elevated due to normal business operations at the Property. Indoor air samples collected inside the building likely would be biased high due to the contribution of ambient-air sources (active fueling operations). As such, G-Logics recommends that sub-slab soil gas beneath the store building be the point of compliance for the Site and sub-slab screening levels be used to compare analytical results.

6.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Based on the completed RI work at the Site, G-Logics has concluded that petroleum impacts remain present in vadose-zone soil, and in soil and groundwater in both saturated zones at concentrations exceeding MTCA Method A cleanup levels. LNAPL also remains present in at least one of the monitoring wells screened within the Lower Saturated Zone (IP-7). Additionally, LNAPL also may be present in the Upper Saturated Zone, given the high GRO concentrations detected in well IP-4. Contaminant impacts are greatest in the immediate vicinity of the western-dispenser islands, which is the confirmed location of the 2003 release.

Site contaminants appear to be limited in vertical and lateral extent and significant off-property migration does not appear to be occurring. Specifically, GRO and benzene impacts to soil and groundwater extend into the TIB right-of-way. However, based on soil and groundwater sampling data from borings and monitoring wells MW-18 through MW-21, these impacts do not appear to extend to the west, beyond TIB. Contaminant attenuation appears to be occurring over this lateral distance. The identified concentrations are not indicative of source migration or other mass movement. Furthermore, Site contaminants are not migrating within or along the Tukwila municipal utility corridor, as indicated by stormwater, catch-basin solids, subsurface-soil, and groundwater sampling within the backfill of utilities along TIB (wells MW-23, 24, 25, and 29S).

Contaminant impacts are lowest in the vadose soils (depths ranging from 0-9 feet) throughout the Site. This is likely due to previous remedial excavations (2004, undocumented) in the area of the 2003 release. Based on comparison of the contaminant concentrations detected in vadose-zone soil and soil-gas samples with applicable screening levels, vapor-intrusion is not considered to be a risk for nearby occupied structures.

This Site presents geological and land-use complications that may limit the selection of a single cleanup action alternative. Accordingly, several complementary technologies should be considered in the Feasibility Study (FS). Based on the evaluation of the current data set for this Site, the nature and extent of hazardous substances at the Site has been sufficiently characterized to initiate the FS process.

7.0 LIMITATIONS

The performed scope of services was intended to provide an assessment of contamination in soil, groundwater, and soil vapor at the Boeing Field Chevron Site. However, this effort

may not identify all potential concerns or to eliminate all risk associated with the Site. The scope of work on this project was presented in the identified work plans and limited to those items specifically identified. Other activities not specifically included in the presented scope of work (in work plans, correspondence, or this report) are excluded and are therefore not part of our services.

This report is prepared for the sole use of the report addressees, as well as the Washington Department of Ecology. The scope of services performed may not be appropriate for the needs of other users. Re-use of this document or the findings, conclusions, or recommendations presented herein, are at the sole risk of said user(s). Any party other than our client who would like to use this report shall notify G-Logics of such intended use by executing the "Permission and Conditions for Use and Copying" contained in this document. Based on the intended use of the report, G-Logics may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements will release G-Logics from any liability resulting from the use of this report by any unauthorized party.

Land use, site conditions (both on-site and off-site), and other factors will change over time. Since site activities and regulations beyond our control could change after the completion of this report, our observations, findings, and opinions can be considered valid only as of the date of this report.

No warranty, express or implied, is made.

8.0 REFERENCES

(City of Tukwila, 2015), *Comprehensive Plan and Zoning Map*, prepared by the City of Tukwila, publication 16-09-006, dated December, 2015

(Ecology, 2015), *Agreed Order No. DE 10947*, prepared by the Washington Department of Ecology, effective date July 13, 2015

(Ecology, 2016a), *Remedial Investigation Checklist*, prepared by the Washington Department of Ecology, publication 16-09-006, dated May, 2016

(Ecology, 2016b), *Guidance for Evaluating Soil Vapor Intrusion in Washington State*, prepared by the Washington Department of Ecology, dated October 2009, revised February 2016

(Ecology, 2016c), *Updated Process for Initially Assessing the Potential for Petroleum Vapor Intrusions, Implementation Memorandum No. 14*, prepared by the Washington Department of Ecology, publication 16-09-046, dated March, 2016.

(Ecology, 2017), *Lower Duwamish Cleanup Sites Update*, prepared by the Washington Department of Ecology, publication 17-09-260, dated January, 2017.

(Ecology, 2018), *Petroleum Vapor Intrusion (PVI): Updated Screening Levels, Cleanup Levels, and Assessing PVI Threats to Future Buildings, Implementation Memorandum No. 18*, prepared by the Washington Department of Ecology, publication 17-09-043, dated January 10, 2018.

(ERI, 2004a) Environmental Resolutions 2004, *Soil Probe Investigation*, report prepared by Environmental Resolutions, Inc. for Boeing Field Chevron, report dated March 12, 2004

(ERI, 2004b) Environmental Resolutions 2004, *Groundwater Monitoring Well Installation*, report prepared by Environmental Resolutions, Inc. for Boeing Field Chevron, report dated October 19, 2004

(ERI, 2004c) Environmental Resolutions 2004, *Historical Site Summary, New Release Evaluation, and Lifecycle Cost Estimate*, report prepared by Environmental Resolutions, Inc. for Boeing Field Chevron, report dated December 6, 2004

(ERI, 2005a) Environmental Resolutions 2005, *Soil Probe Investigation*, report prepared by Environmental Resolutions, Inc. for Boeing Field Chevron, report dated April 11, 2005

(ERI, 2005b) Environmental Resolutions 2005, *Groundwater Monitoring Report*, report prepared by Environmental Resolutions, Inc. for Boeing Field Chevron, report dated December 8, 2005

(ERI, 2005c) Environmental Resolutions 2005, *Groundwater Monitoring Well Installation*¸ report prepared by Environmental Resolutions, Inc. for Boeing Field Chevron, report dated December 28, 2005

(Geotech, 1990) Geotech Consultants, Inc. 1990, *Preliminary Environmental Study*, report prepared by Geotech Consultants, Inc. for Chevron U.S.A. Inc., report dated February 21, 1990

(G-Logics, 2006a), *Status Report for Fenton's Reagent Injection*, report prepared by G-Logics, Inc. for Boeing Field Chevron, report dated May 18, 2006

(G-Logics, 2006b), *July 2006 Status Report, Fenton's Reagent Injection,* report prepared by G-Logics, Inc. for Boeing Field Chevron, report dated July 24, 2006

(G-Logics, 2006c), *November 2006 Status Report, Fenton's Reagent Injection,* report prepared by G-Logics, Inc. for Boeing Field Chevron, report dated November 30, 2006

(G-Logics, 2008), *Subsurface Site Characterization*, report prepared by G-Logics, Inc. for Boeing Field Chevron, report dated May 19, 2008

(G-Logics, 2009a), *Status Memo for Free-Product Recovery*, report prepared by G-Logics, Inc. for Boeing Field Chevron, report dated January 29, 2009

(G-Logics, 2009b), *Status Memo for Free-Product Recovery, February through July, 2009*, report prepared by G-Logics, Inc. for Boeing Field Chevron, report dated September 15, 2009

(G-Logics, 2010a), *January 2010 Free-Product Recovery Update*, report prepared by G-Logics, Inc. for Boeing Field Chevron, report dated January 29, 2010

(G-Logics, 2010b), *May 2010 Free-Product Recovery Update (Draft)*, report prepared by G-Logics, Inc. for Boeing Field Chevron, report dated June 28, 2010

(G-Logics, 2011a), *March 2011 Free-Product Recovery Update*, report prepared by G-Logics, Inc. for Boeing Field Chevron, report dated March 30, 2011

(G-Logics, 2011b), *September 2011 Free-Product Recovery Update*, report prepared by G-Logics, Inc. for Boeing Field Chevron, report dated September 27, 2011

(G-Logics, 2012), *April 2012 Free-Product Recovery Update*, report prepared by G-Logics, Inc. for Boeing Field Chevron, report dated April 2, 2012

(G-Logics, 2016a), *Findings of the Initial Exploration Effort and Proposed Additional Explorations*, report prepared by G-Logics, Inc. for Boeing Field Chevron, report dated November 9, 2016

(G-Logics, 2016b), *Well Closure Recommendations*, report prepared by G-Logics, Inc. for Boeing Field Chevron, report dated November 21, 2016

(G-Logics, 2019), *Feasibility Study Pilot Test Report, Air Sparge/Soil Vapor Extraction*, report prepared by G-Logics, Inc. for Boeing Field Chevron, report dated August 14, 2019.

(GRI, 2003) Gettler-Ryan 2003, *Groundwater Monitoring and Sampling Report*, report prepared by Gettler-Ryan, Inc. for Chevron Products Company, report dated December 16, 2003

(HC, 1990) Hart Crowser 1990, *Summary of Work to Date*, report prepared by Hart Crowser, Inc. for Chevron U.S.A., Inc., report dated December 27, 1990

(HC, 1992) Hart Crowser 1992, *Soil Sampling and Analysis Results, Underground Storage Tank (UST) Removal and Closure*, report prepared by Hart Crowser, Inc. for Chevron U.S.A., Inc., report dated November 30, 1992

(HC, 1993a) Hart Crowser 1993, *Site Assessment and Remediation Report – Soils*, report prepared by Hart Crowser, Inc. for Chevron U.S.A., Inc., report dated March 2, 1993

(HC, 1993b) Hart Crowser 1993, *Addendum to Tank Closure Report (November 30, 1992)*, report prepared by Hart Crowser, Inc. for Chevron U.S.A., Inc., report dated March 2, 1993

(HC, 1993c) Hart Crowser 1993, *Site Assessment and Remediation Report – Groundwater*, report prepared by Hart Crowser, Inc. for Chevron U.S.A., Inc., report dated April 7, 1993

(HC, 1994) Hart Crowser 1994, *Independent Remedial Action Report Summary*, report prepared by Hart Crowser Inc. for Chevron U.S.A., Inc., report dated November 29. 1994

(PEG, 1996) Pacific Environmental Group 1996, *Groundwater Monitoring and Sampling Activities*, report prepared by Pacific Environmental Group, Inc. for Chevron U.S.A., Inc., report dated April 24, 1996

(PEG, 1997a) Pacific Environmental Group 1997, *Environmental Investigation – Undocumented Storage Tank*, report prepared by Pacific Environmental Group, Inc. for Chevron U.S.A., Inc., report dated March 4, 1997

(PEG, 1997b) Pacific Environmental Group 1997, *Environmental Assessment*, report prepared by Pacific Environmental Group, Inc. for Chevron U.S.A., Inc., report dated December 4, 1997

(RZA, 1990a) Rittenhouse-Zeman & Associates 1990, *Summary of Remedial Activities*, report prepared by Rittenhouse-Zeman & Associates, Inc. for Chevron U.S.A. Inc., report dated May 23, 1990

(RZA, 1990b) Rittenhouse-Zeman & Associates 1990, *Subsurface Environmental Site Characterization and Remediation*, report prepared by Rittenhouse-Zeman & Associates, Inc. for Chevron U.S.A. Inc., report dated August 31, 1990

(Serfes, 1991), *Determining the Mean Hydraulic Gradient of Ground Water Affected by Tidal Fluctuations.* GROUND WATER, Vol. 29, No. 4, July-August 1991.

(Terracon, 2016), *Remedial Investigation Work Plan*, prepared by Terracon Consultants, Inc. for Boeing Field Chevron, Ecology-approved work plan dated May 24, 2016

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Remedial Investigation Report
Boeing Field Chevron
10805 East Marginal Way South
Tukwila, WA 98168

G-Logics Project 01-0410-M
October 7, 2020

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