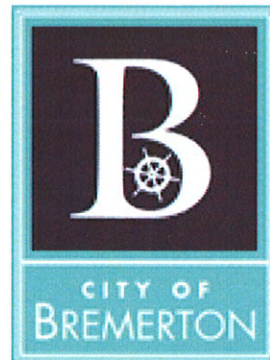


**Work Plan for Remedial
Investigation/Feasibility Study,
Interim Action, and Shoreline
Restoration
Former Chevron Property
Bremerton, Washington**

City of Bremerton



September 2007

Parametrix

Work Plan for Remedial Investigation/Feasibility Study, Interim Action, and Shoreline Restoration Former Chevron Property Bremerton, Washington

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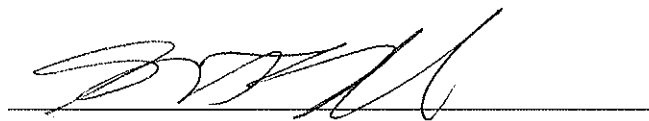
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CERTIFICATION

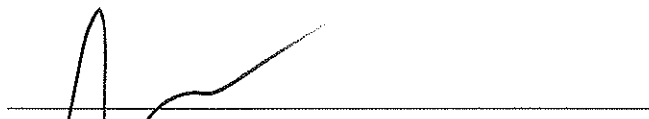
The technical material and data contained in this document were prepared under the supervision and direction of the undersigned.



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KEY TERMS

µg/L	Micrograms per liter
ARARs	Applicable or Relevant and Appropriate Requirements
ASTs	above-ground fuel storage tanks
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
cm/s	centimeters per second
COCs	contaminants of concern
COD	chemical oxygen demand
cPAHs	Carcinogenic PAHs
CSLs	Screening Cleanup Levels
DQIs	data quality indicators
DQOs	Data Quality Objectives
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management
EPH	extractable petroleum hydrocarbons
FID	flame ionization detector
FS	feasibility study
gpm	gallon per minute
HAZWOPER	Hazardous Waste Operation
I.D.	internal diameter
IDW	Investigation derived waste
mg/kg	Milligrams per kilogram
mg/L	milligrams per liter
MHHW	mean higher high water
MTBE	methyl tertiary-butyl ether
MTCA	Model Toxics Control Act
NTUs	nephelometric turbidity units
O.D.	outside diameter
ORP	Oxidation-reduction potential
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PDF	portable document format
PID	photoionization detector

KEY TERMS (CONTINUED)

PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
RI/FS	remedial investigation/feasibility study
RPD	relative percent difference
SEPA	State Environmental Policy Act
SOPs	standard operating procedures
SPT	split-spoon
SQSs	sediment quality standards
SVE	soil vapor extraction
TM	technical memorandum
TOC	total organic carbon
TPH	total petroleum hydrocarbons
USCS	Unified Soil Classification System
UV	ultra-violet
VOCs	volatile organic compounds
VPH	volatile petroleum hydrocarbons

1. INTRODUCTION AND BACKGROUND INFORMATION

This document presents a work plan for conducting a remedial investigation/feasibility study (RI/FS), interim action, and shoreline restoration at the Former Chevron Property located at 1310 Highland Avenue in Bremerton, Washington (Figure 1-1). The site, which formerly contained a bulk fuel distribution facility, was purchased by the City of Bremerton in 2005 for development as an addition to the adjacent Evergreen Park.

The RI/FS is to be performed to aid in the development of cleanup actions for addressing residual petroleum contamination at the site. Residual petroleum contamination exists in soil and groundwater as a result of past fuel releases. Cleanup actions developed during the RI/FS to treat residual contamination will be implemented at the site as an interim action. Following the interim action, shoreline restoration will be implemented to restore the intertidal environment as habitat for important species such as forage fish and salmon.

This work plan was developed in cooperation with the Washington State Department of Ecology (Ecology) under an Agreed Order. Work is to be done in an expedited manner under the Governor's Puget Sound Initiative. The initiative focuses on cleaning up contamination as well as restoring Puget Sound. Ecology recognizes that site cleanups can be designed and implemented in a manner that improves habitat values and provides for shoreline restoration in conjunction with remedial actions. While planning the cleanup, and making cleanup decisions, Ecology and the City will evaluate opportunities to perform remedial actions in a fashion that coincidentally enhances habitat. Elements of the remedial action will be evaluated for restoration opportunities in consultation with Ecology as plans for cleanup are developed.

Conceptual cleanup actions have been developed based on existing environmental data and are presented here as a proposed interim action. Stakeholder approval will be obtained prior to the implementation of the interim action selected based on the RI/FS. Shoreline restoration actions are described briefly. Detailed restoration plans will be developed as part of the design package for construction of the Evergreen Park addition.

This RI/FS work plan includes two companion documents required under an Agreed Order. A public participation plan is included in Appendix A. A State Environmental Policy Act (SEPA) environmental checklist is included in Appendix B.

1.1 SITE DESCRIPTION AND HISTORY

The Former Chevron Property is a 1.4 acre waterfront property located on the Port Washington Narrows (Figure 1-1). The site formerly contained a bulk fuel distribution facility, which operated from prior to 1946 until circa 1988. Existing and former site features are shown on Figures 1-2 through 1-4. In 1946, the northern boundary of the site was defined by the wooden bulkhead shown in Figure 1-4. Based on aerial photographs, the facility was expanded northward to its present boundaries between 1946 and 1963 (Hart Crowser 1989a).

Products handled at the former bulk fuel distribution facility consisted primarily of diesel and gasoline (Hart Crowser 1989a). The site is divided into two operations areas known as the "upper yard" and "lower yard" (Figure 1-4). The lower yard was the former location of fuel loading and offloading operations. Fuel was offloaded from barges at a fueling pier in the Port Washington Narrows and pumped through above-ground piping to twelve ASTs located in the upper yard. Fuel was loaded from the ASTs to tanker trucks at four loading

racks in the lower yard through above-ground piping. An exception is piping south of the former garage (shown in Figure 1-4), which extended underground beneath the driveway to supply fuel to the southwestern loading rack. All above-ground structures were removed by the end of 1988. It is not known whether the underground piping in the vicinity of the former garage was removed.

Soils in the upper yard consist of glacial till underlain by interbedded dense silts and silty sands (outwash). This soil unit was consolidated during the most recent glaciation and, as a result, is typically very dense and relatively impermeable. The lower yard is underlain by silty sand fill, which was used to extend the lower yard into Port Washington Narrows. The fill is underlain by silty sand outwash at a depth of approximately 20 feet below ground surface (bgs). The results of slug testing performed by Hart Crowser (1989b) indicate that the hydraulic conductivity of the fill soils is 5×10^{-5} centimeters per second (cm/s).

Groundwater occurs at depths of approximately 8 to 10 feet bgs in the lower yard and 15 to 17 feet bgs in the upper yard. Previous site explorations investigated the possible presence of separate upper and lower water bearing units in the upper yard. However, study results indicate that the potential lower water bearing unit did not likely consist of a distinct, second water bearing zone (PEG 1994).

1.2 SHORELINE RESTORATION AND FUTURE SITE USES

After the interim action has been successfully implemented, the shoreline will be restored. Restoration will be designed to return the majority of the site's shoreline to a natural beach profile. All bulkheads and existing fill soils along the site's southern shoreline will be removed. The new beach will be sloped to match existing natural beaches in the area and will be surfaced with sands and gravels appropriate for forage fish spawning (beach nourishment). The sands and gravels will be sized to be both conducive for spawning and to resist erosive tidal forces. To the north of this new beach, a pocket beach will be constructed which will also be surfaced with beach nourishment.

The interim action will address contaminated soil at the site, including soil near the shoreline. However, it is estimated that up to 2,500 cubic yards of residual potentially-contaminated soil may be removed from the shoreline as fill soils are excavated to create the new beaches. Following excavation, the new beach surfaces will be formed by placing beach nourishment to grade.

In addition to the bulkhead removal and beach construction, all existing creosote piling, the derelict pier, and concrete rubble along the shoreline will be removed. A native riparian buffer consisting of native trees, shrubs, and grasses will be planted at the transition zones between the constructed beaches and the uplands. The purpose of the buffer is to provide shading, leaf litter, and stabilization against slope erosion. Upland portions of the site will be landscaped with grass, trees, and paths. A representation of the completed park concept is provided in Figure 1-5.

Under the current schedule, the interim action will be implemented in 2008 and shoreline restoration will occur during the open fish window (approximately July through October) in 2009/2010 (see Section 6 for a proposed schedule). Shoreline restoration will occur not earlier than one year following the interim action in order to allow the enhanced bioremediation step (see Section 3 for a description) time to reduce subsurface contamination. The goal of the bioremediation is to reduce contamination to below cleanup

levels. This will reduce the level of effort required to manage any residual contaminated soils as they are excavated for beach construction.

1.3 EXISTING ENVIRONMENTAL DATA

1.3.1 Initial Assessments

Environmental work at the site began in 1988 following demolition of the bulk fuel facility (GeoEngineers 1988). Initial site work consisted of the installation and sampling of nine monitoring wells (MW-4 through MW-12) and seven test pits (TP-1 through TP-7). Soil and groundwater samples were analyzed for contaminants of concern (COCs) consisting of total petroleum hydrocarbons (TPH), gasoline, diesel, and benzene, toluene, ethylbenzene, and xylenes (BTEX). Based on the discovery of gasoline and diesel contamination in soils and groundwater, an additional nine test pits (TP-8 through TP-16) were excavated and soil samples from each pit were collected and analyzed (Hart Crowser 1989b). Test pits were located throughout the site, including at former tank, piping, and loading rack locations (Figure 1-4). Monitoring wells were located across the site to provide an assessment of site-wide groundwater conditions. Test pit and monitoring well logs are provided in Appendix C.

During these explorations, soil samples were collected from the monitoring well borings and test pits at regular intervals for field screening using visual/olfactory methods and a flame ionization detector (FID). Samples were generally selected from locations indicating the potential for hydrocarbon contamination based on the field screening. The greatest soil impacts were found in the lower yard, with gasoline concentrations as high as 25,000 milligrams per kilogram (mg/kg) and diesel concentrations as high as 17,000 mg/kg. Reported concentrations were generally lower in upper yard soils, with gasoline concentrations of up to 250 mg/kg and diesel concentrations of up to 1,400 mg/kg. Historical soil sampling results are shown on Figure 1-6.

As shown in Figure 1-6, highly-impacted soils were generally confined to the area behind the buried wooden bulkhead where the fuel loading racks were located. Impacted soils generally occur in a “smear zone” located above the groundwater table. Historical groundwater depth measurements at the site suggest that the smear zone is approximately 3 to 5 feet thick. Near-surface contaminated soils were discovered in only one location, Test Pit TP-9, beginning at a depth of 2 feet bgs and extending to the groundwater table.

Historical groundwater sample results are shown on Figure 1-7. As shown, groundwater contamination has been detected in the majority of the monitoring wells, with TPH concentrations as high as 1,742 milligrams per liter (mg/L). In addition, floating free product was measured in some of the wells at thickness of up to 4 feet. The locations of wells where free product has been measured historically are shown on Figure 1-7.

1.3.2 Soil Vapor Extraction

Chevron installed a soil vapor extraction (SVE) system at the site in 1990 to address floating product and soil contamination. The system consisted of a series of eleven shallow extraction wells connected via a piping manifold to a blower and thermal oxidizer. An additional three monitoring wells (MW-13 through MW-15) were installed to increase the available monitoring network. The SVE system was operated from 1990 until 1994 when it was shut down due to diminishing returns. It was estimated that a total of approximately 195,000 pounds of hydrocarbons were removed during system operation (Emcon 1995).

1.3.3 Post-SVE Assessment

An additional nine monitoring wells (MW-16 through MW-24) were installed at the site in 1993 to expand the available monitoring network (PEG 1994). Soil samples were collected from the borings at regular intervals and field screened using visual/olfactory methods and a photoionization detector (PID). Thirteen soil samples selected from the borings were analyzed for gasoline, diesel, heavy oil, BTEX, lead, and polycyclic aromatic hydrocarbons (PAHs). Gasoline and diesel concentrations exceeding Model Toxics Control Act (MTCA) Method A criteria were detected in only four of the nine wells (MW-19 through MW-22). Benzene exceeded MTCA A criteria in two of these wells. Heavy oil and lead concentrations (where detected) did not exceed MTCA A criteria in any sample. No carcinogenic PAHs were detected. Non-carcinogenic PAHs at concentrations exceeding MTCA A criteria were only detected in one sample which also contained a high concentration of diesel.

Groundwater samples were collected from all site wells (including new and existing wells) with the exception of those that were dry or that contained floating product (floating product was measured in four of the wells ranging from 0.01 to 0.39 feet thick). Twelve groundwater samples were collected and analyzed for the same constituents as the soil samples. Wells located in the lower yard generally showed the highest impacts, with gasoline concentrations exceeding MTCA A criteria in four wells. Diesel concentrations did not exceed MTCA A criteria. The upper yard wells did not contain gasoline or diesel at concentrations exceeding MTCA A criteria. An exception is MW-23, which slightly exceeded the gasoline criteria. BTEX compounds exceeded MTCA A criteria in five wells. Total lead exceeded the MTCA A criteria in six wells. Carcinogenic PAHs (cPAHs) concentrations exceeded MTCA A criteria in three wells (MW-13, MW-14, and MW-22).

1.3.4 Historical Groundwater Monitoring

Periodic groundwater monitoring was conducted at the site quarterly from 1994 to 1997 and semi-annually from 1998 to 2003. All site wells were included in the monitoring program during at least one sampling event. Groundwater samples were analyzed for gasoline, diesel, BTEX, heavy oil, and total lead. The second-to-last groundwater monitoring report (GRI 2002) is excerpted in Appendix D. Table 1-1 of this report provides a summary of all monitoring data for all wells. As shown, floating product thicknesses decreased with time, particularly through the period of SVE system operation. Gasoline, diesel, and BTEX concentrations have also generally decreased over time. An exception is in wells MW-16 and MW-18, where gasoline and diesel concentrations have fluctuated with no discernable pattern. Lead, where sampled, has declined below the MTCA A criteria. Exceptions are MW-4 and MW-9. The detected concentrations of gasoline and diesel from the latest sampling event in each well are included on Figure 1-7.

1.3.5 Current Assessments

1.3.5.1 Sediment

The following discussion presents the results of a sediment characterization study conducted at the site by the City. The discussion also presents the City's position regarding the adequacy of the study for the purpose of characterizing impacts to the sediments. The City acknowledges that Ecology is currently conducting a sediment investigation at the site and will develop an independent opinion regarding sediment impacts and the possible need for sediment remediation.

Sediment Testing

Prior to purchasing the property in 2005, the City conducted sediment sampling on the beach adjacent to the site (Parametrix 2006). The scope of the sampling was developed in coordination with Ecology NW Region staff. The purpose of the sampling was to provide an assessment of site sediments to support both the decision to purchase the property and a future aquatic land lease from the Washington Department of Natural Resources (for the future Bremerton Boardwalk project). Sampling was conducted according to the requirements of the Washington State Sediment Management Standards (173-204 WAC) to determine compliance with applicable marine sediment quality standards (SQSs).

Sediment sample locations are shown on Figure 1-4. Sediment samples were collected from 12 locations within intertidal and subtidal areas. Surface sediment grab samples were collected at all 12 locations from the top 10 centimeters. Intertidal samples were collected during low tide events using hand scoops. Subtidal samples were collected from a boat using a Van Veen sampler. At five of the intertidal sample locations, subsurface grab samples were collected from a depth of 2 feet using a shovel and hand scoops. These samples are indicated on Figure 1-4 by the presence of an “S” in the sample number.

The majority of the shoreline at the site has been armored with concrete rubble. Intertidal samples were collected near the toe of the concrete rubble from sediments exposed during low tide. The sediment substrate consisted of sand-, gravel-, and cobble-sized particles. A photograph showing the location of sediment sample C-6 is provided in Figure 1-8. Fifteen sediment samples (14 field samples and one duplicate) were analyzed for the marine SQSs chemical criteria list, diesel, and motor oil. An exception is the intertidal samples, which were not analyzed for polychlorinated biphenyls (PCBs) since this contaminant has not been identified as a potential COC at the site. Subtidal samples were analyzed for PCBs for the purposes of the future aquatic lease. Sediment sample results were compared to SQSs, which were exceeded for PAHs in one intertidal surface sediment sample (C-8).

To further assess the presence of PAHs at the site, three additional surface sediment samples were collected (C-11, C-12, and C-13) and analyzed for PAHs. The SQSs for PAHs were not exceeded on any of the three samples.

In accordance with the Sediment Management Standards, an additional sediment sample was collected from the location of sample C-8 for the purpose of a bioassay test to “confirm” whether or not the sediment complied with the applicable SQSs biological criteria. The results of the bioassay test demonstrated that there was no statistically significant difference between the test sediment and reference sediment and that the sediment passed both the SQSs and less stringent sediment Cleanup Screening Levels (CSLs) evaluation criteria. CSLs are used as cleanup levels for sediment cleanups while SQSs are a regulatory and management goal for the quality of sediment throughout the state.

Although the bioassay test was performed according to 173-204-WAC, the test did not include exposure of the test specimens to ultra-violet (UV) radiation as is recommended in Sub-appendix D to the Ecology guidance document for preparing sediment sampling plans (Ecology 2003). UV radiation exposure is recommended for sediments in intertidal and shallow subtidal areas that contain PAHs. Certain PAHs are photo-reactive and may exhibit higher toxicity when exposed to UV light. Although UV exposure was not

performed, it is observed that the bioassay test results met the SQSs criteria, which are more stringent than the CSLs. To fail both the SQSs and CSLs criteria would require a large increase in effects due to UV radiation. A technical memo reporting the sediment sampling results is excerpted in Appendix E (Parametrix 2006).

Conceptual Model and Adequacy of Sediment Testing

A cross section of the site (Section A) is depicted on Figure 1-9. The location and depths of sediment samples C-6 (surface) and C-6-S (2 feet bgs) are shown on the section. The conceptual location of sediments that would potentially be most impacted (or “smeared”) by floating product is also shown. According to the conceptual model, sample C-6 was collected from the location most likely impacted by historical floating product (if present), which is the near-surface sediments. Thus, the near-surface sediments are representative of worst-case conditions at the site. This observation would not be valid if the exposed intertidal beach sediments consisted of recent deposits (deposited following the removal of the majority of floating hydrocarbons from the site by the soil vapor extraction (SVE) system. However, the absence of fines and the presence of large gravel and cobbles in the beach sediments indicate that the beach is being eroded rather than gaining sediments by deposition.

The above discussion supports the selection of near-surface sediment samples as appropriate for the site. The purpose for sampling sediments at greater depths would be to delineate the potential vertical extent of contamination to aid in evaluating cleanup options. Since surface sediments are in compliance with SQSs, no sediment cleanup is anticipated for the site.

Evaluation of Concern

The 18 sediment samples collected constitute a “station cluster” (WAC 173-204-510 [2]) in that they are “spatially and chemically similar.” According to the Sediment Cleanup Standards (WAC 173-204-510 to 590), station clusters “of potential concern” are identified by grouping three stations with the “highest concentration of each chemical contaminant identified in WAC 1873-204-520, cleanup screening levels criteria.” The three stations are then evaluated by comparing the average concentrations for the three stations to the CSLs. If the average contaminant concentrations exceed the CSLs, the station cluster is defined as “of potential concern”. Sediment results are compared to CSLs in Table 2 of the technical memorandum excerpt in Appendix E. As shown in the table, none of the sediment sample chemical results exceeds the CSLs, which categorizes the station cluster as being of “low concern”.

In addition to the chemical evaluation, the three stations within the cluster with the highest level of biological effects, determined by the biological testing requirements, are to be identified (if available). If the biological effects at each of the three stations exceed the CSLs biological criteria, the station cluster is defined as “of potential concern”. However, since only a single bioassay test was required to “confirm” the sediments from station C-8, only one set of biological test data is available, and an evaluation of biological effects for three stations within the cluster cannot be made. Note that the results of the single biological test did not exceed the SQSs biological effects criteria, supporting the “of low concern” designation.

1.3.5.2 Monitoring Well Survey

A survey of all existing groundwater monitoring wells at the site was conducted on October 24, 2006. Sixteen existing wells were located, as indicated on Figure 1-4. Depths to groundwater and thickness of floating product (if present) were measured in each well using an electronic oil/water interface probe. Floating product was measured in only two of the wells (MW-16 and MW-18) located in the upper yard. The thickness of product measured was 0.03 feet (approximately 3/8 inch) in each of the two wells. The horizontal location and top of casing vertical elevation for each well were measured by survey on November 16, 2006. Groundwater elevations presented on Figure 1-7 are based on the survey. General groundwater flow directions indicated on the figure are based on the measured elevations.