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TECHNICAL MEMORANDUM

TO: Marv Coleman – Department of Ecology

FROM: Matt Dalton

DATE: Agency Review Draft: April 1, 2013

SUBJECT: Focused FS
1920 Port of Tacoma Road
Tacoma, Washington
Facility Site ID #30005

REF. NO: USO-029-00

CC: Ty Gaub (US Oil & Refining)
Scott Hooton (Port of Tacoma)
Jim Parvey (City of Tacoma)

This technical memorandum was prepared to meet the requirements of Agreed Order DE 8914 (AO) between the U.S. Oil and Refining Co., Inc. (USOR) and the Washington State Department of Ecology (Ecology), effective May 10, 2012. The overall purpose of the work was to prepare a Remedial Investigation (RI) and focused Feasibility Study (FS) for a portion of the Port of Tacoma Roadway generally located at 1920 Port of Tacoma Road, Tacoma, Washington (Figure 1).

BACKGROUND

In December 2010, asphalt grinding in the vicinity of a former refinery-to-dock petroleum pipeline crossing on Port of Tacoma Road caused several flashes. The suspected cause of the flashes was petroleum vapors emanating from soil beneath the roadway. Because the vapors were in the vicinity of the abandoned pipeline crossing, USOR agreed to complete the site characterization and prepare a focused FS. Dalton, Olmsted & Fuglevand, Inc. (DOF) was retained to assist USOR in meeting the requirements of the AO.

The project area, for purposes of this report, generally lies underneath the heavily used Port of Tacoma Road (Figure 2) and 200 to 300 feet (100 to 150 feet on either side of the former pipeline easement). The paved roadway is approximately 60 feet wide composed

of four traffic lanes and a central turn lane. The entrance to the Washington United Terminal is present on the northeast side of the roadway.

The roadway surface generally consists of asphalt. However, in the area of the December 2010 asphalt grinding, a concrete patch was placed where a section of asphalt paving had already been removed. The approximate location of the concrete patch is shown on Figures 2 and 3.

Four known subsurface utility lines lie beneath the roadway at the approximate locations shown on Figure 4. The lines include a water line, two sewer lines (separate sanitary and storm lines) and a natural gas line.

The initial work by DOF consisted of preparing a "*Site Investigation Work Plan*" (DOF 2011) that became part of the AO (Exhibit C). The plan required that a Health & Safety Plan (HSAP) and traffic control plan be prepared to support field testing. These plans were prepared and the traffic control plan was used to obtain a City of Tacoma (City) permit to drill a series of push-probes in the road right-of-way. The permit (40000180664 – Miscellaneous Construction) was issued on May 10, 2012. In addition, a site access agreement was obtained from the Port of Tacoma (Port) to drill a number of push-probes on Port property. Field sampling and testing was completed on May 19 and 20, 2012, after completing the required buried utility checks.

SUMMARY - FIELD SAMPLING and TESTING RESULTS

Field sampling and testing results are documented in the Site Characterization Report (DOF 2013) prepared by DOF. A draft of this report was submitted to Ecology in October 2012. The final report (March 2013) is included as Attachment A. As noted in the report, the 2012 data were supplemented with other data collected as part of past utility repair and pipeline re-alignment work.

In May 2012, fourteen direct push-probes were drilled and sampled at the locations shown on Figure 3. Drilling/sampling depths ranged between eight and ten feet (all but one probe was to ten feet). Materials encountered during the drilling consisted of:

- **Road Surface Materials** – Six to eight inches of asphalt concrete overlying approximately one-half to two feet of crushed rock.
- **Fine to Medium Sand** – Approximately seven feet of fine to medium sand lies below the roadway materials. The bottom of the unit is approximately eight to nine feet below the roadway surface.
- **Brown Silt** – Lies below the sand strata

During the May 2012 sampling work, the water table was estimated to be approximately seven feet below ground surface. The water table can be expected to fluctuate with season.

Four to five soil samples from each probe were collected and analyzed for the following:

- Petroleum vapors (field measurements using a photoionization detector)
- Gasoline Range Hydrocarbons
- Benzene, toluene, ethylbenzene and xylenes

The range of gasoline range hydrocarbon (TPH-G) concentrations is summarized in the following table.

TPH-G Concentration Ranges – 2012 Probe Soil Samples

Depth Range (feet)	Predominant Material Type	Highest TPH-G Conc. (mg/kg)	No. Samples >1000 mg/kg (a)
1 to 2	Sand	6000 (P3)	8 of 14
3 to 4	Sand	12000 (P6)	9 of 14
5 to 6	Sand	12000 (P6)	9 of 14
7 to 8	Sand	260 (P4)	None
9 to 10	Silt	44 (P6)	None

Note: (a) - Residual saturation level for weathered gasoline in coarse sand and gravelly soils (WAC 173-340-900 – Table 747-5)

Available data indicate that the large majority of highly contaminated soil lies beneath the paved roadway. The northward and southward extent of contaminated soil in the southbound traffic lanes are defined by samples from probes P9 and P14. The northward and southward extent of highly contaminated soil in the northbound traffic lanes could not be confirmed based on the approved probe layout. This was recognized in the field based on PID vapor measurements and soil observations; however time constraints, buried utilities, traffic control and permit conditions did not allow for the sampling of additional probes. However, in our opinion, sufficient data exists to complete a focused FS and develop a plan to address the soil contamination.

REMEDIAL AREA and VOLUMES

Remedial Area. The target remedial area is shown on Figure 5 and is divided into two areas:

- **Core area** with confirmed concentrations of petroleum hydrocarbons greater than residual saturation levels (i.e. greater than 1,000 mg/kg). This area spans the former pipeline crossing with gasoline range hydrocarbon concentrations ranging from 1,100 mg/kg to 12,000 mg/kg and poses the greatest risk to roadway repair activities. The highest concentrations were detected at probe location P6 (adjacent to the concrete patch) to a depth of six to seven feet. The area extends at least 120 feet north and 180 feet south (along the roadway) of the former pipeline alignment and appears confined to the roadway area except for a small area on the north side of the road (location P-9E). In 1997, a TPH-G concentration of 1,910 mg/kg was detected at a depth of four to six feet at P-9E.

- **Peripheral areas** (North Area and South Area) where TPH-G concentrations are between approximately 100 mg/kg and 1,000 mg/kg (i.e. probe location P13) or may have concentrations greater than 100 mg/kg. Two peripheral areas are defined based on historic data. One area (North Area) extends northward from the core area to the existing pipeline crossing and includes a small area defined by probe P13. A second area (South Area) extends to the south to the location of excavations made to repair a water line break in 1997.

  The peripheral areas extend beyond the likely remedial area that will be confirmed based on future testing completed as part of roadway design. The northward and southward extents (in the northbound traffic lanes) of the peripheral areas were defined by available data that indicate that high concentrations of petroleum constituents have not migrated to the end locations. The larger (longer) area was defined so that a caution area could be identified as part of interim actions prior to completion of the actual remedial work, as discussed below.

SOIL QUANTITIES

Soil quantities for each remedial area were estimated based on the areas shown on Figure 5, assuming a contaminated soil depth of seven feet and a volume (cubic yard) to weight (tons) conversion of 1.6. The estimated quantities are summarized below:

Estimated Soil Quantities

Remedial Area	Area (square feet)	Volume (cubic yards)	Tons
Core	18,500	5,000	8,000
North	7,000	3,000	3,000
South	3,800	1,000	1,600

REMEDIAL ALTERNATIVES

A number of remedial alternatives are typically applied to remediation of soil containing concentrations of petroleum hydrocarbons above cleanup levels. Possible alternatives are listed and described below.

Remedial Alternatives

In-Situ Methods	Ex-Situ Methods
Bioventing	Excavation w/ soil treatment
Physical containment	Excavation w/ off-site disposal
Soil vapor extraction	

- **Bioventing** involves the introduction of oxygen (air) into the subsurface to enhance the natural biodegradation of petroleum hydrocarbons. This method is typically applied to remediation of soil constituents, once the primary source material has been addressed. The presence of petroleum product above residual saturation levels limits the effectiveness of this method.

- **Physical containment** includes the installation of a low permeability vertical containment wall and a cap. The presence of the roadway and buried utilities makes implementation of this alternative difficult and physical containment would not permanently remediate the soil contamination.

- **Soil Vapor Extraction** would consist of installing vertical wells or horizontal pipes in the area to be treated and connecting the pipes to a blower and treatment unit to remove petroleum vapors. SVE could be effective in restricting the migration of petroleum vapors but would be unlikely to fully remediate soil containing separate phase product. The system would need to operate and be maintained for a long period of time (years).

- **Excavation with treatment** would consist of removing the contaminated soil, treating the soil (at an off-site location) in a constructed bio-pile and replacing the excavated soil with structural fill. The bio-pile would include a venting system to allow air (oxygen) to flow into the interior of the pile and remove/treat petroleum vapors. Nutrients would be added to soil as the pile is constructed to facilitate biodegradation. Once the soil is treated to a sufficient degree, the soil would need to be disposed off-site.

- **Excavation with off-site disposal** consists of removing the contaminated soil and disposing the soil at an off-site permitted facility, and replacing the excavated soil with structural fill.

Other factors that need to be considered in selecting a remedy are as follows:

- The remediation area lies beneath a heavily used roadway that provides access to the Washington United Terminal (and other facilities). Practical access to the roadway area is highly restricted by heavy truck traffic.

- USOR does not own the roadway or adjacent property.

PROPOSED REMEDY and IMPLEMENTATION

USOR proposes to implement the excavation with off-site disposal option. This alternative would remove the contaminated soil beneath the roadway and allow unrestricted access to make roadway repairs and, to the subsurface, for utility repairs. Because of the heavy use of the roadway, it is not practical to implement the remedy as a

stand-alone remedial effort. Rather, USOR would commit to implement the remedy in the future when resurfacing/replacement of the Port of Tacoma road by the City occurs.

In the interim, USOR proposes the following actions:

- The approximate 600 linear feet area south of the existing pipeline crossing be identified by the City as an area where special pre-cautions are required to make roadway or buried utility repairs. This area includes the core and peripheral areas shown on Figure 5.

- USOR will work with the City to ensure that any required repairs are done safely.

Once a plan for resurfacing/replacing the Port of Tacoma roadway is being prepared, USOR will work with the City to integrate the remedial plan into the roadway construction. This will include the following:

- Drill and sample additional push-probes to fully define the contaminated soil to be removed. This sampling could be coordinated with any geotechnical investigation conducted as part of the roadway work.

- Work with the City to integrate the remedial work into the overall roadway construction project. Issues such as engineering design, protection of utilities, and selection/placement of backfill would be addressed at this stage of the project.

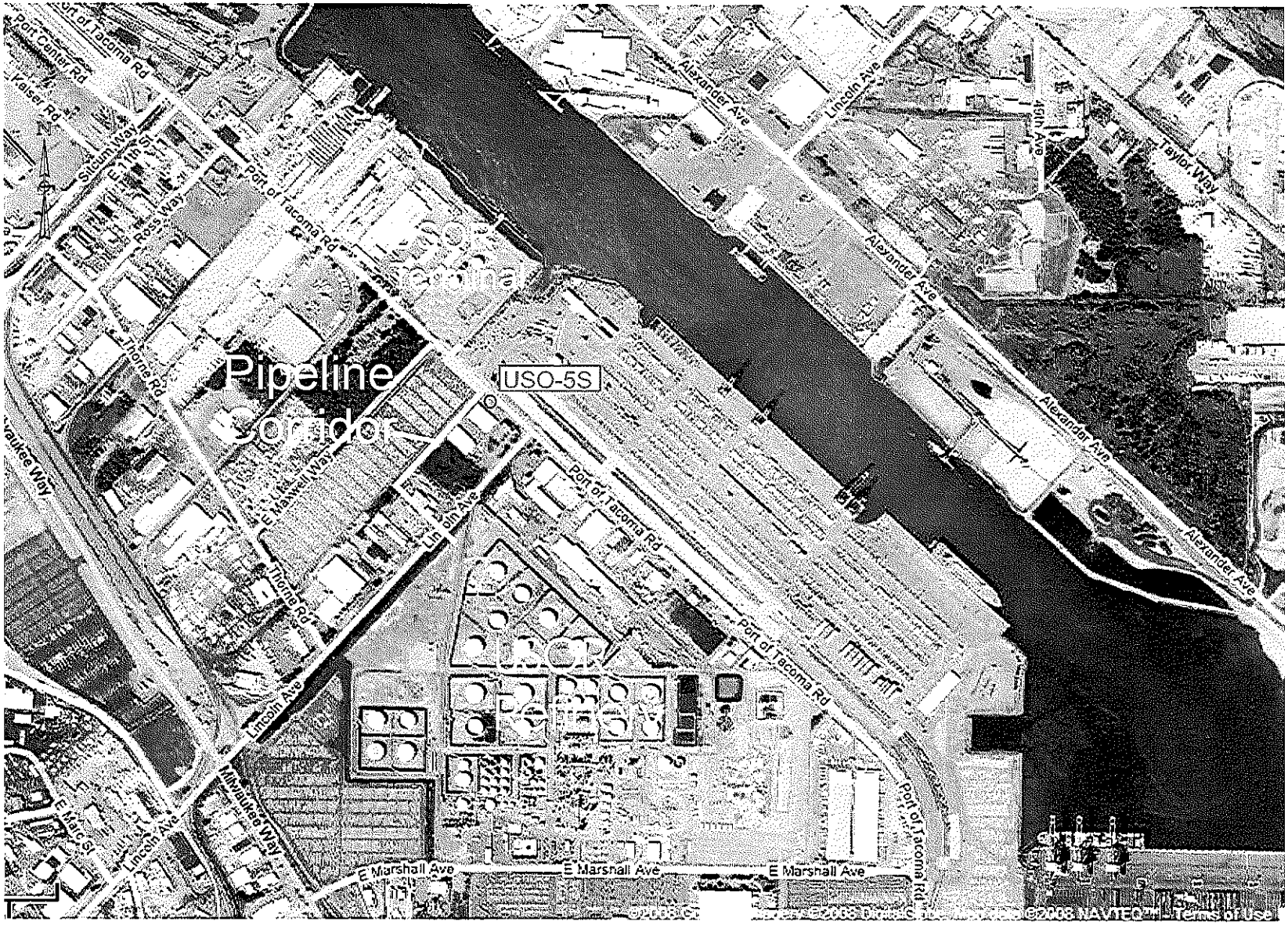
REFERENCES

- DOF (Dalton, Olmsted & Fuglevand, Inc.), 2011, Site Investigation Work Plan, 1920 Port of Tacoma Road, Tacoma, Washington, prepared for U.S. Oil & Refining Co., Agency Draft: November 16, 2011 (Exhibit C to Agreed Order DE 8914).

- DOF, 2013, Site Characterization Report, 1920 Port of Tacoma Road, Tacoma, Washington; prepared for U.S. Oil & Refining Co.

List of Attachments
Figure 1 – Vicinity Map
Figure 2 – Project Area Layout
Figure 3 – Probe Locations – May 2012
Figure 4 – Sample Locations
Figure 5 – Remedial Area

Attachment A – Site Characterization Report (March 2013)



1000 0 1000 2000

Approx. Scale in Feet

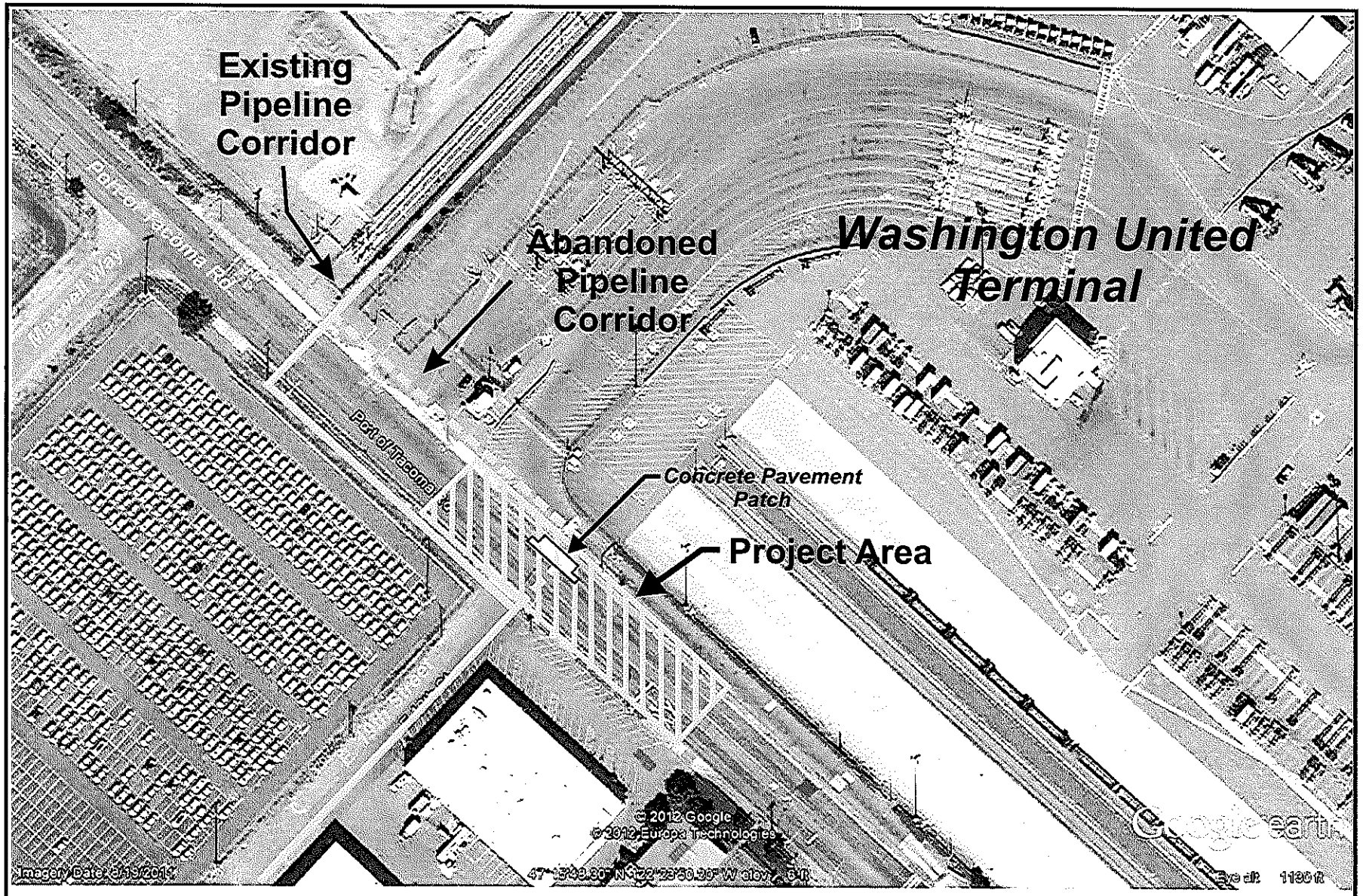
U. S. Oil & Refining Co.
Refinery to Dock Pipeline Replacement

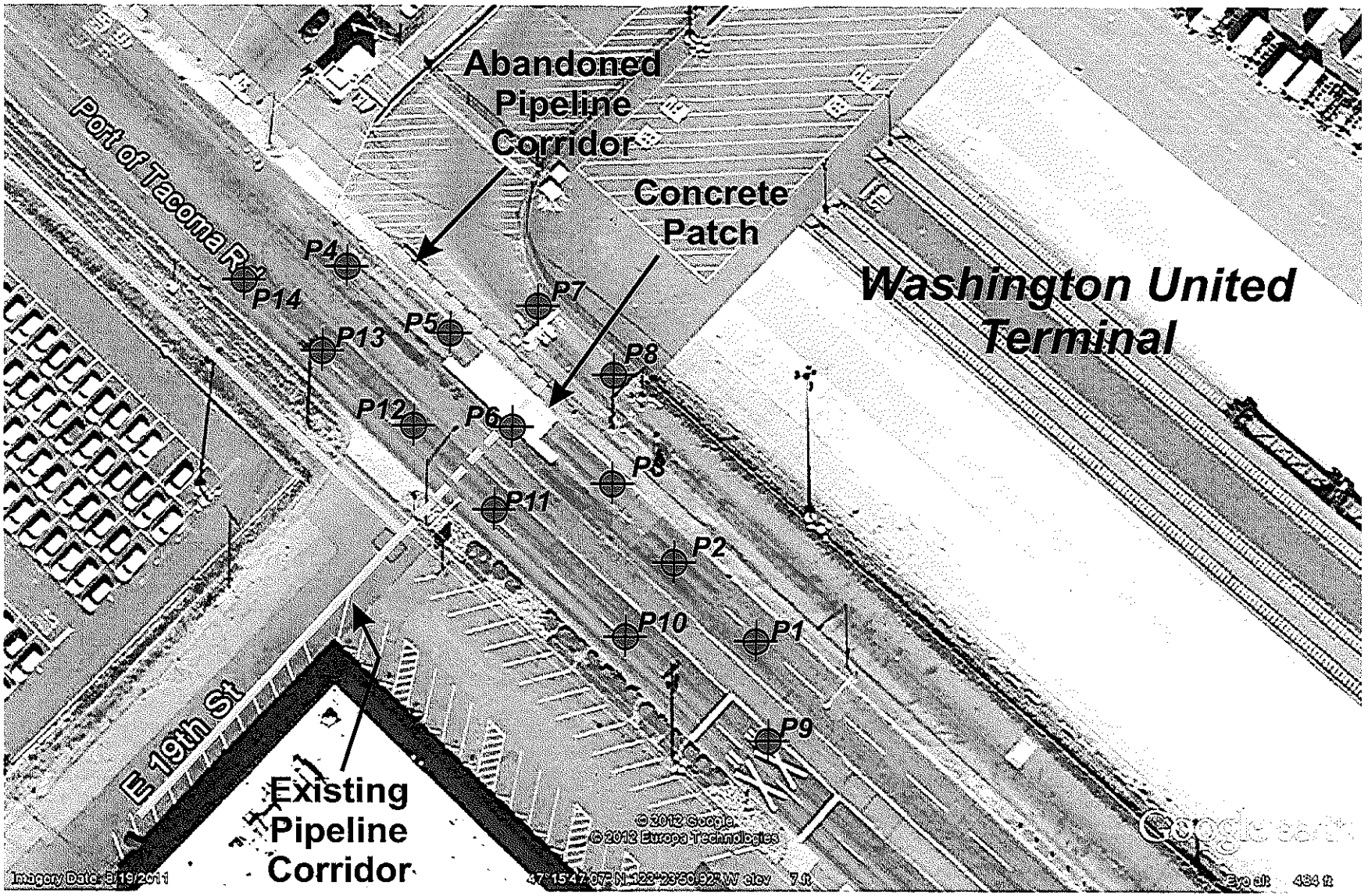
VICINITY MAP

FIGURE 1

USO-021 March 2008

Dalton, Olmsted & Fuglevand, Inc.


Existing Pipeline Corridor
Abandoned Pipeline Corridor
Washington United Terminal
Concrete Pavement Patch
Project Area
Port of Tacoma
Taylor Way
Alexander Ave
© 2012 Google
© 2012 Europa Technologies
Imagery Date: 8/19/2011
Eye alt 1136 ft
0
220
Scale in Feet
(approximate)
N
Ref: Layout a.cdr
1920 Port of Tacoma Road
Tacoma, Washington
Project Area Layout
USO-023-00
FIGURE 2
July 2012
Dalton, Olmsted & Fuglevand, Inc.



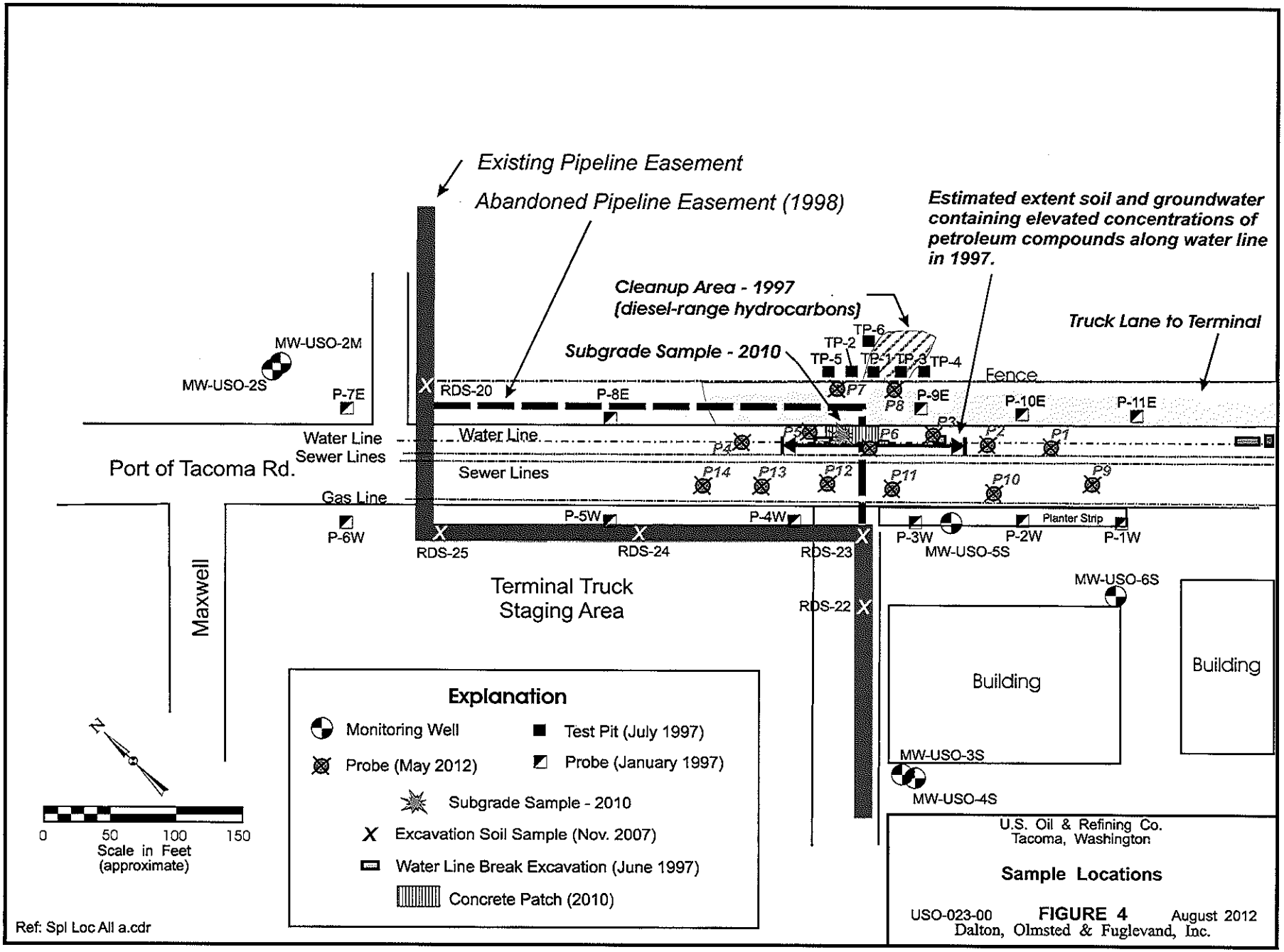
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1920 Port of Tacoma Road
Tacoma, Washington

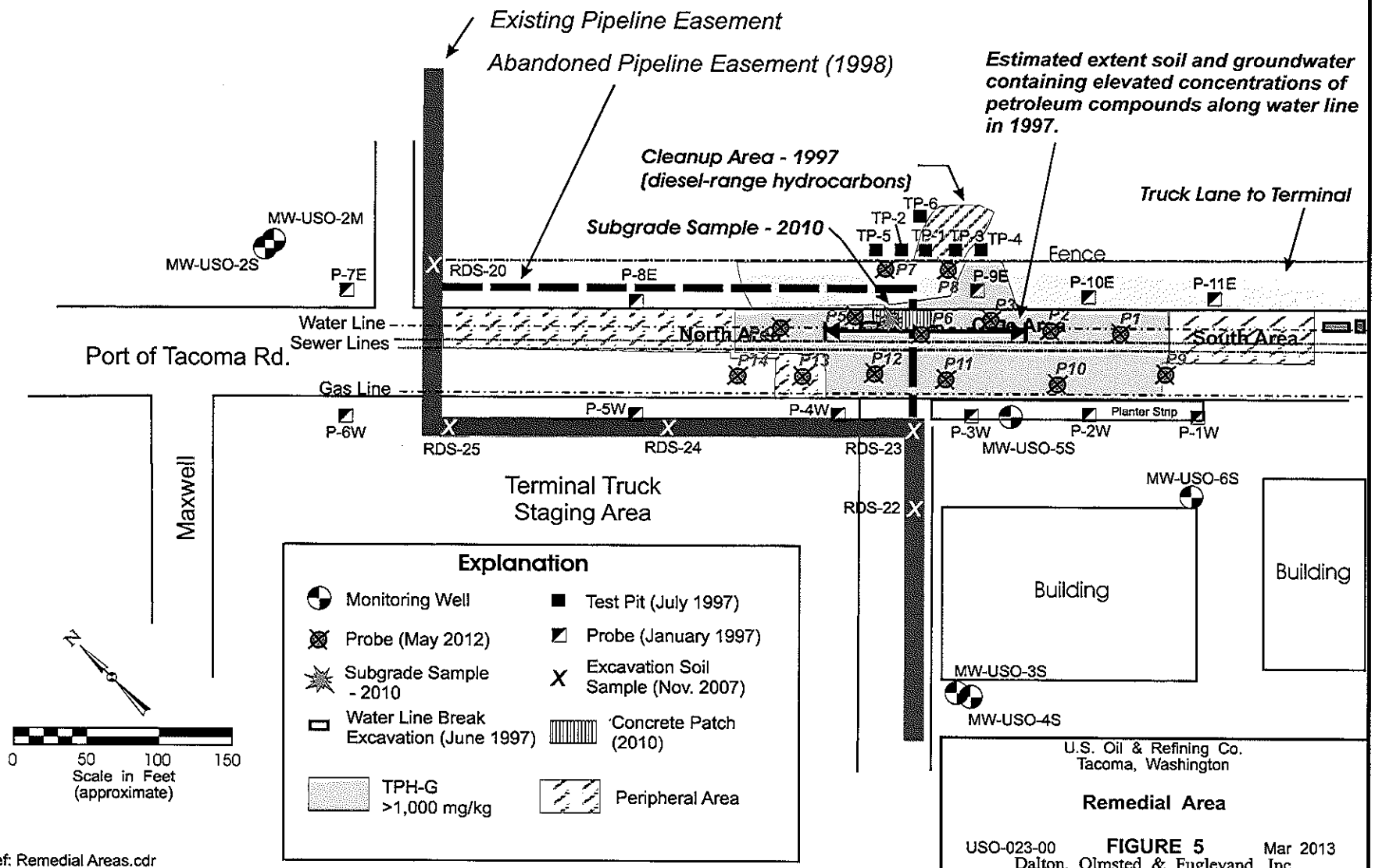
Probe Locations - May 2012

USO-023-00 **FIGURE 3** July 2012

Dalton, Olmsted & Fuglevand, Inc.


Existing Pipeline Easement
Abandoned Pipeline Easement (1998)
Estimated extent soil and groundwater containing elevated concentrations of petroleum compounds along water line in 1997.
Cleanup Area - 1997
(diesel-range hydrocarbons)
Truck Lane to Terminal
Subgrade Sample - 2010
MW-USO-2M
MW-USO-2S
P-7E
RDS-20
P-8E
TP-6
TP-2
TP-5
TP-1
TP-3
TP-4
Fence
P-9E
P-10E
P-11E
Water Line
Sewer Lines
Port of Tacoma Rd.
Gas Line
P-6W
P-5W
P-4W
RDS-25
RDS-24
RDS-23
RDS-22
Terminal Truck
Staging Area
Maxwell
Planter Strip
P-3W
P-2W
P-1W
MW-USO-5S
MW-USO-6S
Building
Building
MW-USO-3S
MW-USO-4S
Explanation
Monitoring Well
Test Pit (July 1997)
Probe (May 2012)
Probe (January 1997)
Subgrade Sample - 2010
Excavation Soil Sample (Nov. 2007)
Water Line Break Excavation (June 1997)
Concrete Patch (2010)
N
0
50
100
150
Scale in Feet
(approximate)
Ref: Spl Loc All a.cdr
U.S. Oil & Refining Co.
Tacoma, Washington
Sample Locations
USO-023-00
FIGURE 4
August 2012
Dalton, Olmsted & Fuglevand, Inc.

DRAFT - SUBJECT TO REVISION



Ref: Remedial Areas.cdr

U.S. Oil & Refining Co.
Tacoma, Washington

Remedial Area

USO-023-00 **FIGURE 5** Mar 2013
Dalton, Olmsted & Fuglevand, Inc.

ATTACHMENT A
SITE CHARACTERIZATION REPORT
1920 PORT OF TACOMA ROAD
TACOMA, WASHINGTON
MARCH 2013