Intertidal Sediment Remedy Operations, Maintenance, and Monitoring Plan

Former Petroleum Terminal #0022 and Manufactured Gas Plant
256 Marine Drive
Astoria, Oregon
(DEQ ECSI Number 1646)

Prepared for:

PacifiCorp *and* **Union Oil Company of California**
September 2019; Revised June 2020

Prepared by:

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DOF DALTON OLMSTED FUGLEVAND

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1 INTRODUCTION

Dalton, Olmsted & Fuglevand, Inc. has prepared this Operations Maintenance Management Plan (OMMP) on behalf of PacifiCorp and Union Oil Company of California (Union Oil), collectively referred to as the Parties, for submerged land within the Columbia River north of a former Petroleum Terminal #0022 and manufactured gas plant (MGP) site located at 256 Marine Drive in Astoria, Oregon (the Site) (Oregon Department of Environmental Quality [DEQ] Environmental Cleanup Site Information [ECSI] database number 1646).

This OMMP specifies the post-construction operations, maintenance, monitoring, and corrective action procedures for the sediment remedy north of the Site. Remedy construction is scheduled for summer 2020.

This OMMP outlines specific performance standards for planned monitoring activities to demonstrate that the long-term objectives for the constructed remedy are being met. The OMMP also details the process for contingency planning and possible response actions in the event that performance standards are not achieved. This OMMP may be revised and updated as necessary, with the DEQ's approval.

1.1 SITE LOCATION

The Site is located in Clatsop County in Township 8 North Range 9 West, Section 7 in Astoria, Oregon (see Figure 1). The Site is bordered to the north by the Astoria Riverfront Trolley (part of the "off-site upland" remedial area), the Columbia House Condominiums (CHC), and the Columbia River (where the "off-site in-water" remedial area is located). Third Street is to the east. Second Street, a former restaurant, and a gas/convenience store are to the west. Marine Drive is to the south. Land use in the vicinity is mixed industrial, commercial and residential.

The overall project area is shown on Figure 1. For ease of reference in design, the facility was divided into three areas as depicted on Figure 2 and that collectively comprise the Locality of Facility (LOF):

- On-site upland, which includes the Parties' property at 256 Marine Drive
- Off-site upland, which includes upland areas north and northeast of the city block denoted as the Site
- Off-site in-water area, which includes the intertidal zone of the Columbia River north of the Site

The on- and off-site upland areas are covered under a separate Upland OMMP and Hazardous Materials Management Plan (HMMP) and not discussed herein. The off-site area referred to as "in-water" in the Amended Record of Decision (AROD, DEQ 2012) for the Site was defined as the "intertidal area" in the Final Design Report (DOF, 2019); the area to be remediated is only intertidal land, and is so referenced in this report. Appendix A contains the OCB Design Plans.

1.2 Project Background

The Site, a former manufactured gas plant and petroleum terminal, was placed on the Confirmed Release List (CRL) and Inventory by DEQ in 1995. Union Oil and PacifiCorp conducted onsite and offsite remedial investigations, risk assessments, and a feasibility study to support a Remedial Action Record of Decision (ROD) (DEQ, 2011) for the LOF, which is defined as the onsite upland area (256 Marine Drive or Site), offsite upland area (upland areas north and northeast of 256 Marine Drive), and offsite in-water area (intertidal zone of the Columbia River north and northeast of 256 Marine Drive) (see Figure 1). In

December 2011, the DEQ issued a ROD for the LOF. The DEQ amended the ROD in May 2012 (DEQ 2012) to incorporate responses to two sets of comments.

Petroleum hydrocarbons, polycyclic aromatic hydrocarbons, and some metals were detected in sediment samples and groundwater discharge samples in the intertidal zone of the Columbia River north of the Site (see Tables 4-28, 4-29, 4-39, and 4-40, and Tables 7-2 through 7-9 of the 2008 Off-Site Remedial Investigation and Risk Assessment [MFA, 2008] and Figure 7-1 of the 2009 Feasibility Study [MFA, 2009]. The extent of a 3,000-square-foot (SF) Sediment Management Area (SMA) was based on limited sediment bioassay results for surface sediment samples and visual observations of a hydrocarbon sheen/light non-aqueous phase liquid (LNAPL) in surface and subsurface sediment. The extent of the LNAPL, about 600 square feet, was defined as a Hot Spot. The extent of the SMA, including the Hot Spot, was refined based on additional surface and subsurface explorations in 2016 (see Investigation Report (DOF 2016) Figures 5 & 6 in Appendix C).

The requirements for the in-water remedial actions are presented in the Amended Remedial Action ROD (AROD) for the Former Unocal/PacifiCorp Astoria Site, dated May 2012 and Sections 1.3 and 1.4 below.

1.3 REMEDIAL ACTION

The selected remedy for the intertidal portion of the project is an organophilic clay barrier (OCB), as summarized in the June 11, 2018, DEQ letter titled: "Clarification of Record of Decision Alternatives, Former Union Oil/PacifiCorp site, Former Petroleum Terminal #0022 and MGP, 256 Marine Drive, Astoria, Oregon, ODEQ ESCI Number 1646" (ODEQ 2018a).

The selected remedy for the intertidal area consists of the following elements that meet requirements of the AROD and the ODEQ's June 11, 2018 and March 14, 2019 letters:

- An organophilic clay treatment barrier within the sediment management area (SMA) and "Contingency Zone," encompassing the sediment hot-spot area. The organophilic clay barrier will be constructed using composite geotextiles which contain organophilic clay inside two layers of geotextile fabric material.
- A treatment barrier that provides enough absorptive capacity for 30 years or more and incorporates a safety factor of 2.1 to 4.3.
- A treatment barrier that prevents the loss of contaminants through potential preferential groundwater flow pathways.
- A protective layer designed to withstand wind and wave action.
- A monitoring program sufficient to detect LNAPL sheens or seeps that may break through the barrier will be implemented post construction.
- An Institutional Control Plan (ICP) for the SMA that includes use and access restrictions.
- An Operations, Maintenance and Monitoring Program (OMMP) that will include annual inspections at a minimum for the first 5 years after remedy construction is complete, once every 5 years at a minimum thereafter, and after major storms or floods. Repairs will be made to the remedy, as needed, based on observations made during the inspections. Inspection elements will be detailed in the final OMMP.

1.4 OBJECTIVES AND MONITORING APPROACH

The following remedial action objectives (RAOs) were established in the AROD (ODEQ 2012):

- *RAO #1*. Protect current and future occupational workers, construction workers, and excavation workers at the Site from unacceptable risk posed through incidental ingestion, dermal contact, and inhalation exposure to soil, light nonaqueous phase liquid (LNAPL), or groundwater containing constituents of concern (COCs) at concentrations exceeding ODEQ generic risk-based concentrations (RBCs).
- *RAO #2*. Protect potential future occupational workers at the Site from unacceptable risk posed by inhalation of COCs in indoor air exceeding ODEQ generic RBCs.
- *RAO #3*. Remediate sediment posing significant toxicity to aquatic organisms.
- *RAO #4*. Minimize the release of LNAPL from site soil and groundwater to the Columbia River sediment and surface water.
- *RAO #5*. Remediate LNAPL hot spots of contamination to the extent feasible.

Long-term monitoring will be performed to verify that the remedial action continues to meet the two RAOs that apply to sediment:

- *RAO #3 - Remediate sediment posing significant toxicity to aquatic organisms*.
- *RAO #5 - Remediate LNAPL hot spots of contamination to the extent feasible.*

Monitoring will include:

- Annual inspections for the first five years after remedy construction is complete; and
- Inspections after major storms or, floods, or a major seismic event.

Monitoring to confirm that the RAOs are met will be done by visual inspection. Visual inspections will assess the stability of the overlying gravel and cobble protective armor layer. Visual inspections of the top of the armor layer will also confirm that LNAPL is not present, which is sufficient to demonstrate that sediment toxicity has been remediated and that the hot spot remediation is effective. Repairs will be made to the remedy as needed based on observations made during the inspections.

2 MONITORING

The purpose of visual inspections is to monitor the engineering controls and their effectiveness in their intended purpose of meeting the sediment RAOs. The intertidal sediment cap will be monitored to verify effective containment of underlying contamination. The monitoring program is intended to detect and evaluate any potential changes in cap integrity over time. The intertidal sediment cap was constructed consistent with the project design and specifications. A Plan view of the design is shown on Figure 2. Typical design sections are shown in Figures 3 & 4.

Monitoring will consist of visual inspections performed at regular intervals to identify the ongoing effectiveness of the remedy. Additional visual inspections will be performed following events that might impact the integrity of the cap as described below. Significant natural events requiring performance of a contingency inspection include a 50-year 24-hour storm event, one percent flood discharge (commonly called the 100-year flood event) or greater. Events that trigger a contingency inspection are further described in Section 2.2.

The Parties will be responsible for implementing the OMMP. Current contact information for PacifiCorp and Chevron is provided below and the Parties will notify DEQ of any changes in this contact information.

PacifiCorp
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Environmental Strategy and Policy
825 NE Multnomah, LCT 2000
Portland, OR 97232
(503) 813 5036

Chevron EMC
Julie Lee
6001 Bollinger Canyon Road
San Ramon, CA 94583
(925) 842-0198

2.1 VISUAL MONITORING

Visual monitoring will be performed to identify changes over time and evaluate the physical integrity and stability of the intertidal sediment cap. Visual monitoring will specifically be performed to identify any sheen on the gravel surface above and around perimeter of the OCB area, displacement or erosion of sand and cobble material, or exposed OCB.

Visual monitoring will be completed during periods of daylight during summer months when the predicted tide is below elevation +1 Mean Lower Low Water (MLLW) so that the entire cap may be observed. Performance criteria for the capped area, as discussed in Section 2.1.3, will determine the need for further analysis and corrective action.

2.1.1 Visual Monitoring Procedure

Visual monitoring shall be performed as described below and documented in the field on the Inspection Form included as Appendix B.

1. Perform inspections during daylight hours when the predicted tide is below elevation +1 MLLW.
2. Use hand-held Global Positioning (GPS) unit to locate perimeter of Contingency Zone based on coordinates (see Figures 5A & 5B).
3. Visually inspect sediment surface around perimeter, as located by GPS unit, looking approximately 3 feet in each direction for potential sheen on the sediment surface.
    a. Turn over several rocks within the observation area to look for sheen on or under the rocks.
4. Observe the OCB area for evidence of scour or other disturbance.
5. Document observations on the Inspection Form. (Inspection for to be included in Inspection Report.)
6. Take photos of the OCB area (include SMA, Contingency Zone and background features for reference). Include photos with the Inspection Report.

2.1.1 Visual Monitoring Schedule

Visual monitoring of the condition of the armor layer will be conducted annually for 5 years following construction. Annual monitoring will commence in 2021 (Year 1 monitoring assuming construction in 2020), and end in 2025. Following 5 years of annual monitoring, visual monitoring will be conducted once every 5 years. The post construction completion report to be prepared following construction in 2020 will serve as the baseline condition (T=Year 0) for comparison to future visual monitoring events.

Additional inspections and monitoring will be conducted for events exceeding the design basis as discussed in Section 2.2.

2.1.2 Visual Monitoring Documentation

Appendix B provides a *Cap Inspection Form* to be completed in the field during each inspection. An Inspection Report, that includes the Inspection Form, will be prepared following each Inspection. A photographic log of the area will be made and included with the Inspection Report.

2.1.3 Visual Monitoring Performance Criteria Exceedance

Each visual monitoring event will be compared to the previous event and the baseline condition to identify physical cap changes.

The Performance Criteria described in this section will be used as a basis for evaluating whether physical changes in the cap could reduce the effectiveness and overall performance of the cap. Exceedances of the Performance Criteria described below will trigger further detailed analysis and discussion with the DEQ regarding the need for corrective action to repair or amend the cap consistent with the as-built specifications or baseline condition. Modifications that are not part of the baseline or as-built conditions may also be considered. All actions involving removal or fill below ordinary high water (OHW) will be coordinated with appropriate State and Federal agencies.

The following Performance Criteria apply to the intertidal cap:

- Presence of sheen on granular material in the area of the OCB installation.
- Erosion that exposes the OCB.
- Gullies or rills greater than 6 inches in depth and/or width.
- Other significant abnormalities or physical changes identified by the Inspector.

Exceedance of the performance criteria will be noted on the Inspection Form, included in the photographic log, and discussed in the Inspection Report.

2.2 CONTINGENCY INSPECTIONS

Contingency inspections are non-routine Inspections to observe and record any potential damage to the intertidal cap following unforeseen or unusual events that could potentially damage the cap or lead to future degradation (i.e., erosion, slope failure, etc.).

Contingency Inspections will be performed consistent with methods for regularly scheduled Inspection and are intended to observe specific issues that may have resulted from specific contingency level events to evaluate short term changes.

The following events will be cause for Contingency Inspection:

- A 100-year base flood elevation water surface elevation exceedance,
- A 100 year wind and or wave storm event,
- Grounding of vessel (Class 3[1] and larger)),
- Other events determined by the site Engineer of Record or the Parties to have the potential to damage the cap.

[1] Boats measuring more than 40 feet but less than 65 feet.

Contingency inspections will be performed and reported in a manner consistent with regularly scheduled Inspections. The inspection report will include a description of the event that triggered the inspection and describe the areas of the cap (if any) affected by the specified event. Photographs and measurements will be collected during the inspection and included in the report.

3 RESPONSE AND CORRECTIVE ACTION

If the results of an annual or 5-year monitoring event or Contingency Inspection show impacts to the effectiveness of and/or noted damage to the cap, the response and potential corrective actions will be undertaken by the parties as described in this section.

3.1 RESPONSE

If any of the performance criteria described in this OMMP are exceeded, the Parties will contact the DEQ to discuss the need for further analysis or to determine a plan for corrective action. Actions to correct exceedances will not be initiated without consultation with the DEQ. All other affected governmental jurisdictions will be notified of corrective actions and the Parties will secure all necessary permits before taking action or starting work.

3.2 CORRECTIVE ACTION

Upon observation of an apparent performance criteria exceedance or design event requiring corrective action, an engineering design review will be performed by a licensed Professional Engineer. After the engineering design review is conducted to determine the root cause and appropriate repair method, any cap damage will be mitigated in coordination with the DEQ. Final design/construction drawings are provided as reference for future repairs in Appendix A. Potential corrective actions may include the following:

- If the protective armor material is found to have eroded by more than 50% in thickness over an area greater than 500 square feet, these areas will be re-graded and filled with armor material matching the existing surrounding elevations and with a coarser mix than in the original design.[2]
- If the cap is penetrated by a foreign object, the cause of the penetration will be removed and the cap components repaired to original design specifications.
- If OCB is exposed and/or repair is required, then either:
    - If the OCB in the damaged area of the cap is continuing to function as designed, the exposed OCB section may be repaired by replacing the protective armor cover if the OCB in the damaged area of the cap is continuing to function as designed.
    - If the damaged OCB is no longer functioning, damaged section(s) of OCB will be cut and removed to allow new OCB to be installed and properly attached to the undamaged OCB remaining in place, if the damaged OCB is no longer functioning. All new material added will be overlapped with the existing OCB material. Any sediment displaced or removed from beneath the damaged portion of the OCB during the repair will be transported to an appropriate off-site treatment or disposal facility. Protective armor material will be placed into the cavity over the repairs to the cap.

[2] The original protective armor material was the existing intertidal cobbles, gravels, and sand removed, stockpiled and replaced during the project.

- If the cap shows significant loss of protective armor due to erosion, it is anticipated that the mitigation method will be the placement of additional material per the engineering design specifications for intertidal remediation to prevent further erosion and re-distribute the flow of water in the affected area.

4 REPORTING

Reporting will consist of the preparation of Inspection Reports and Repair Reports as appropriate. An Inspection Report will be prepared for each Inspection performed as required by this OMMP. A Repair Report will be prepared for any repair events.

The Parties will submit the inspection and required repair documentation to the DEQ within 90-days of completing the inspection or repair.

4.1 INSPECTION REPORTS

Monitoring inspection documentation will include:

1. Name of person who performed inspection,
2. Date Inspection was performed,
3. Brief summary of observed conditions (1-3 paragraphs),
4. Annotated Photo Log showing site conditions. The log shall contain 4-6 photos taken during low tide from various angles,
5. A copy of the completed Inspection Form (see Appendix B).

In the event that any remedial actions (repairs) are required, a summary of the remedial components, a description of any planned repairs to be performed, and a schedule for the performance of the repairs will also be included with the inspection memorandum. A Repair Report, as described below, will then be submitted within 90 days of completion of the required repairs.

4.2 REPAIR REPORTS

For required repair work, a Repair Report will be prepared and submitted. The Repair Report will include:

1. Name of Professional Engineer who designed the planned repair,
2. Name of Contractor/Firm who performed the work,
3. Description of the work that was performed
4. Date Work was performed
5. Name of Person/Firm who oversaw work and prepared the repair report (should be same)
6. Annotated Photo Log showing area requiring repair before, during and after work is completed. The log shall contain 4-6 photos taken during low tide from various angles,
7. A copy of the completed Inspection Form (see Appendix B) filled out post construction to document post construction conditions.

5 CONTAMINATED MEDIA MANAGEMENT

No waste products are expected to be generated during any of the cap inspection activities; however, if any wastes are generated, they will be handled in accordance with all applicable state and federal regulations.

6 SITE ACCESS AND INSTITUTIONAL CONTROLS

Institutional controls are non-engineered instruments such as legal and/or administrative controls that help minimize the potential for exposure to contamination. Institutional controls also help protect the remedy by limiting land and resource use, marking boundaries, and implementing monitoring and maintenance programs designed to confirm the long-term effectiveness of the remedial action. Institutional controls will consist of use and access restrictions and boundary marking.

6.1 USE/ACCESS RESTRICTIONS

The following restrictions will be enacted to protect the cap from any interference from public entry and protect persons from entering the area:

Construction Use/Access Restrictions: Access to the intertidal remedial action area will be prohibited during remedy construction.

Post-Construction Use/Access Restrictions: Restrictions on permissible activities within the intertidal remedial action area will be implemented to prevent the release or exposure to the environment of contaminated media. The following activities will be prohibited in the intertidal remedial action area:

- any activity that alters, modifies, pierces, or removes the OCB installed in the SMA and Contingency Zone;
- piling removal or installation;
- dredging or other excavation;
- harvest of shellfish;
- anchoring; and
- beaching or grounding of motorized watercraft.

6.2 BOUNDARY MARKING AND PUBLIC NOTICES

Construction Use/Access Restrictions: The public will be notified of the use/access restrictions set forth in section 6.1 by signage. Signs will be posted in and around the construction area alerting people of construction.

Post-Construction Use/Access Restrictions: The public will be notified of the use/access restrictions set forth in section 6.1 by signage. Signs will be posted and maintained in the proximity of the sediment management area. Signage will face both north (waterward) and south (shoreward) alerting people of the use/access restrictions. The signs will be set at a height to be visible above the high-water mark and lettering will be large enough to be seen from a distance. The signs will read:

The signs will be inspected during the routine visual monitoring events described in Section 2 of Operations, Maintenance, and Monitoring Plan. Any necessary maintenance or repairs to the signs will be addressed at those times.

7 REFERENCES

DOF. 2016. Intertidal Remedial Design Investigation Sampling Summary, Former Petroleum Terminal #-0022 and Manufactured Gas Plant, 256 Marine Drive, Astoria, Oregon. October, 2016.

MFA. 2008. Remedial Investigation/Risk Assessment Report for Off-Site Soil, Groundwater, and Columbia River Sediment, Former Petroleum Terminal No. 0022 and Manufactured Gas Plant, Astoria, Oregon, DEQ ECSI No. 1646. March 28.

MFA. 2009. Pre-Remedial-Design Tasks: Summary of Findings during In-Water Pre-Design Investigations, Former MGP and Petroleum Terminal No. 0022, Astoria, Oregon (DEQ ECSI Number 1646). June 19.

MFA. 2010. Feasibility Study Report, Former Petroleum Terminal No. 0022 and Manufactured Gas Plant, Astoria, Oregon, DEQ ECSI No. 1646. March 12.

ODEQ. 2018. Oregon Department of Environmental Quality letter titled "Clarification of Record of Decision Alternatives, Former Union Oil/PacifiCorp site, Former Petroleum Terminal #0022 and MGP, 256 Marine Drive, Astoria, Oregon, ODEQ ESCI Number 1646," dated June 11, 2018

ODEQ. 2019a. March 14, 2019 Comment Letter "Three In-Water (Intertidal) Remediation Documents, Former Union Oil/PacifiCorp Site, Former Petroleum Terminal No. 0022 and Manufactured Gas Plant, 256 Marine Drive, Astoria, Oregon, DEQ ECSI Number 1646"

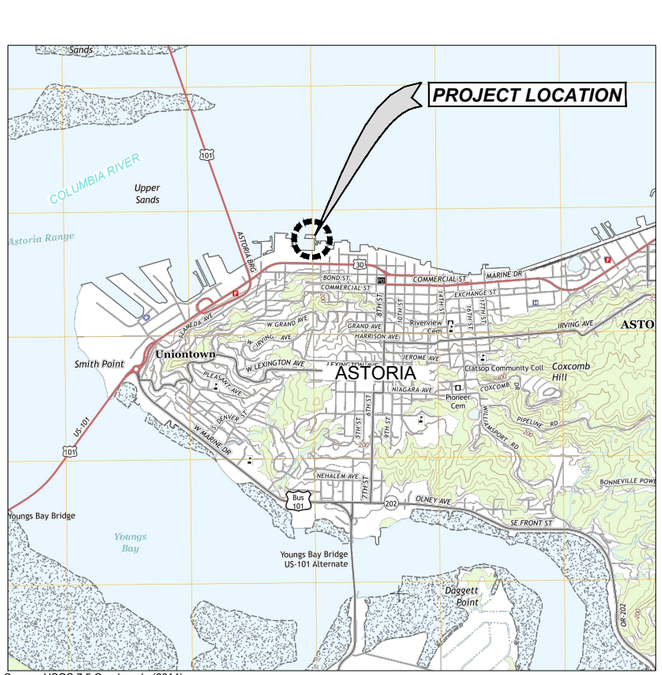
ODEQ. 2019b. April 25, 2019 Approval Letter "Approval – In-Water Remediation Documents, Former Union Oil/PacifiCorp Site, Former Petroleum Terminal No. 0022 and Manufactured Gas Plant 256 Marine Drive, Astoria, Oregon, DEQ ECSI Number 1646"

OMMP Figures

IN-WATER (INTERTIDAL) AREA

Operations, Maintenance and Management Plan

FORMER PACIFICORP / UNOCAL ASTORIA SITE
ECSI #1646
256 MARINE DRIVE
ASTORIA, OREGON



Source: USGS 7.5 Quadrangle (2014)

PROJECT VICINITY MAP
(NOT TO SCALE)

PACIFICORP / UNION OIL COMPANY OF CALIFORNIA
ASTORIA, OREGON

SHEET INDEX	
FIGURE	**SHEET TITLE**
1	COVER SHEET, VICINITY MAP AND SHEET INDEX
2	IN-WATER REMEDY PLAN (PER DESIGN)
3	IN-WATER REMEDY CROSS SECTIONS (PER DESIGN)
4	IN-WATER REMEDY CROSS SECTIONS (PER DESIGN)
5A	SMA CONTINGENCY BOUNDARY LEGAL
5B	SMA CONTINGENCY BOUNDARY LEGAL - MAP

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PACIFICORP / UNOCAL SITE
ASTORIA, OREGON
IN-WATER (INTERTIDAL) OCB REMEDY OMMP

COVER SHEET,
VICINITY MAP AND SHEET INDEX

DALTON OLMSTED FUGLEVAND

FIGURE
1

August 29, 2019

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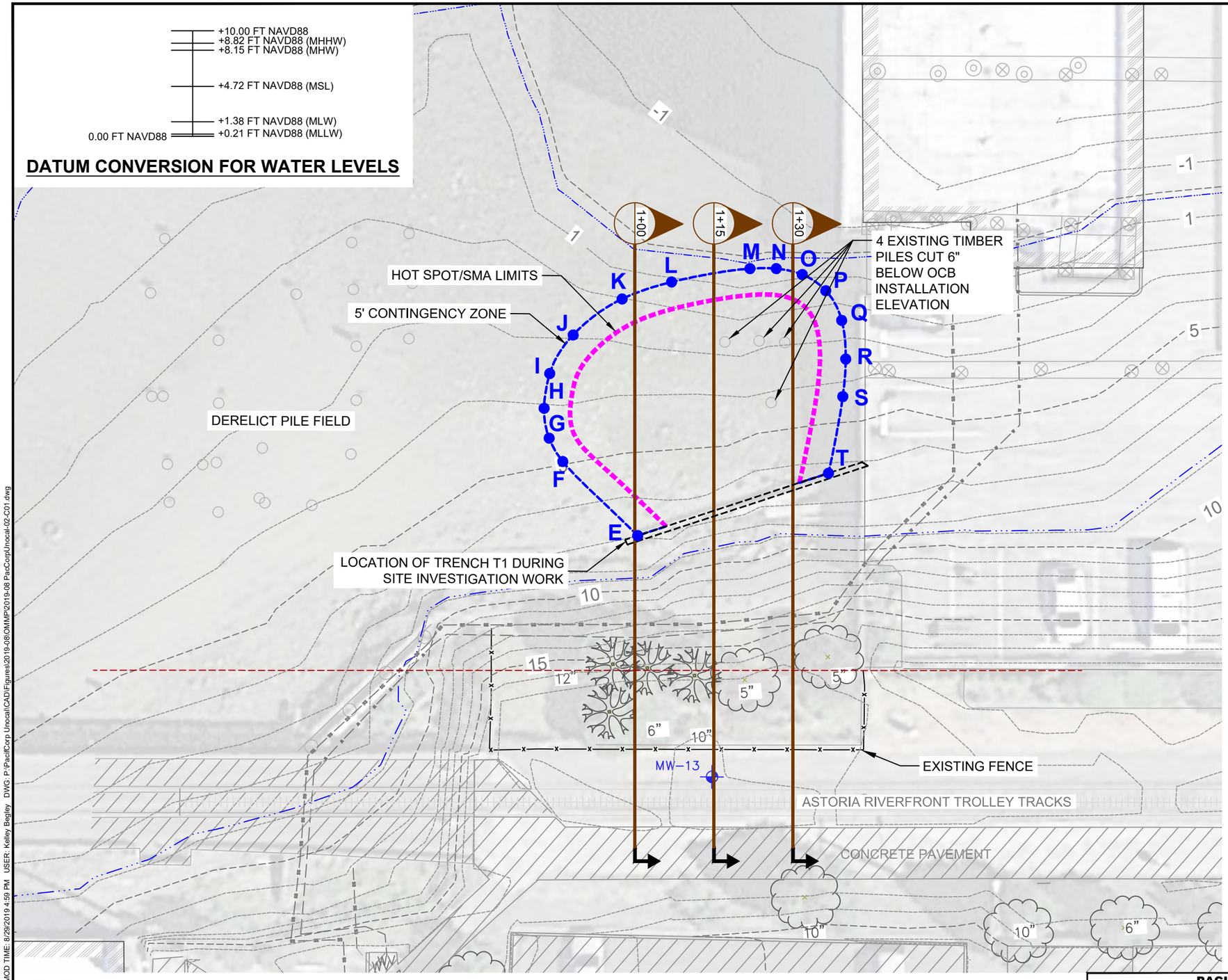

LEGEND:

- HOT SPOT/SMA AREA LIMITS
- 5' SMA CONTINGENCY AREA
- SMA CONTINGENCY AREA COORDINATE ID
- APPROXIMATE EXISTING CONCRETE RUBBLE LIMITS
- CONTROL POINT
- PROPERTY LINE
- WATER ELEVATION - MLLW (0.21 FT NAVD88)
- WATER ELEVATION - MHHW (8.82 FT NAVD88)
- EXISTING CONTOUR MAJOR
- EXISTING CONTOUR MINOR
- EXISTING CHAIN LINK FENCE
- EXISTING TIMBER PILE
- EXISTING TROLLEY TRACKS
- EXISTING MONITORING WELL
- EXISTING SEWER LINE
- EXISTING WATER LINE
- APPROXIMATE EDGE OF EXISTING VEGETATION
- APPROXIMATE EDGE OF EXISTING RIP-RAP
- EXISTING BUILDING
- CROSS SECTION LOCATION AND ID

CONTINGENCY ZONE COORDINATES:

POINT	NORTHING	EASTING
E	937984.1	7356312.9
F	937999.0	7356299.6
G	938003.6	7356297.3
H	938009.4	7356296.8
I	938015.9	7356298.3
J	938022.9	7356303.2
K	938029.1	7356312.9
L	938031.7	7356322.5
M	938033.2	7356337.5
N	938032.9	7356342.5
O	938031.5	7356347.3
P	938028.1	7356351.6
Q	938022.3	7356354.2
R	938014.9	7356354.5
S	938007.9	7356353.5
T	937993.5	7356349.8

(SEE FIGURES 5A & 5B FOR DETAILS)

NOTES:

1. BASE MAP INFORMATION FROM STATEWIDE LAND SURVEYING DATED MAY 2016.
2. HORIZONTAL COORDINATE SYSTEM IS NORTH AMERICAN DATUM OF 1983 (NAD83).
   VERTICAL COORDINATE SYSTEM IS NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

10 0 10
Scale in Feet

PACIFICORP / UNOCAL SITE
ASTORIA, OREGON
IN-WATER (INTERTIDAL) OCB REMEDY OMMP

IN-WATER REMEDY PLAN

DALTON OLMSTED FUGLEVAND

FIGURE 2

August 29, 2019

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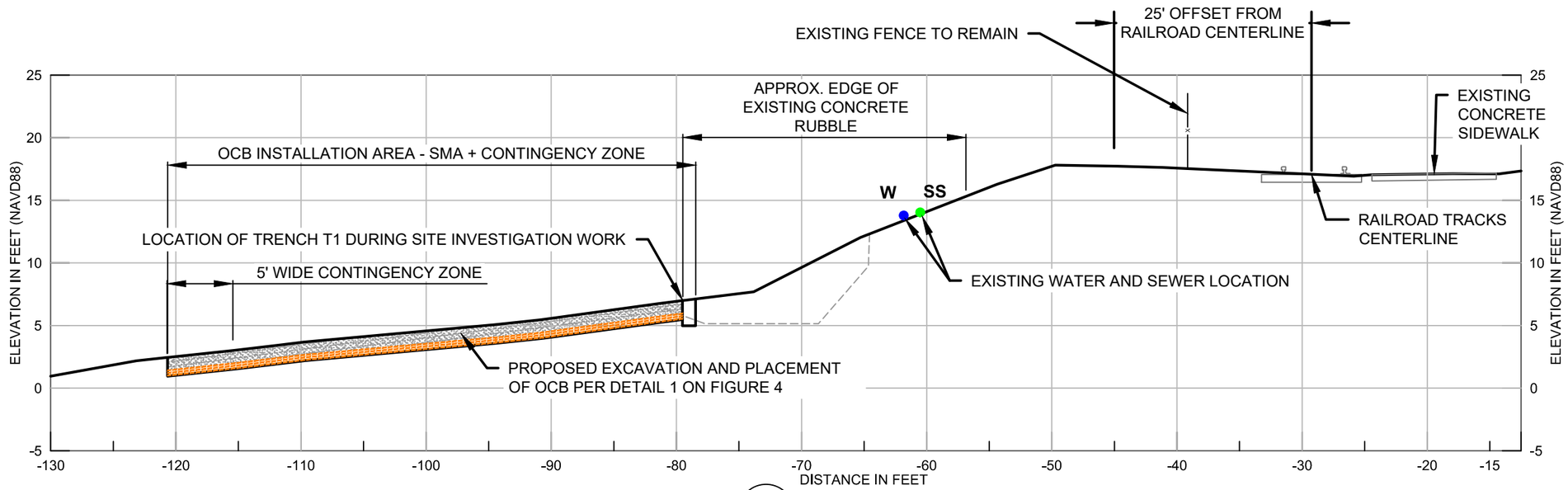


1+00 CROSS SECTION

LEGEND:

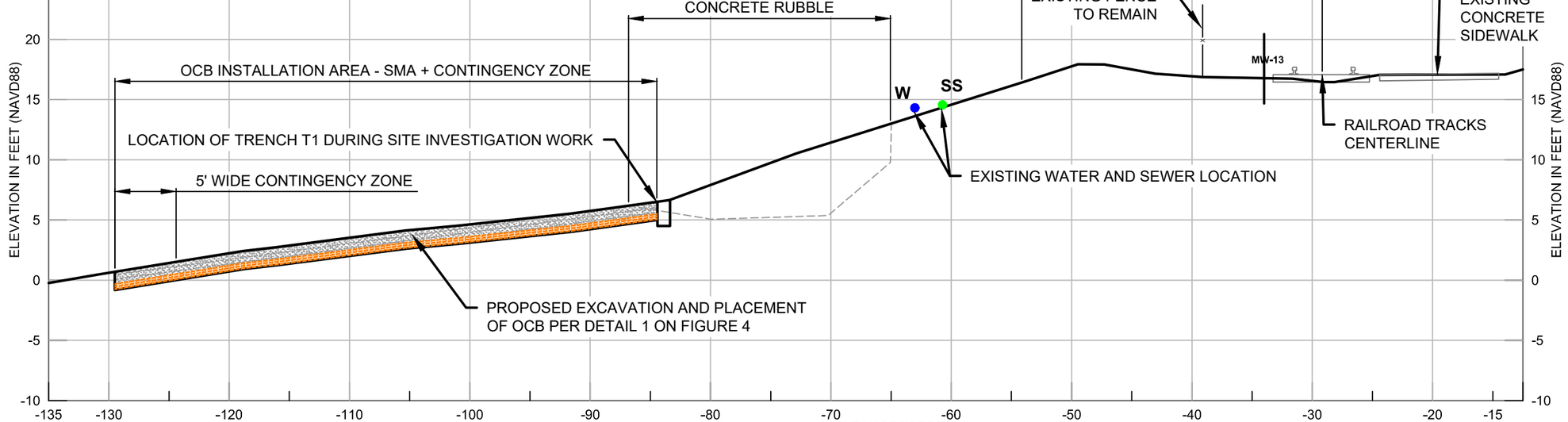
- ORGANOPHILIC CLAY BARRIER (OCB)
- EXISTING GRADE SURFACE
- EXISTING CONCRETE RUBBLE

ABBREVIATIONS:

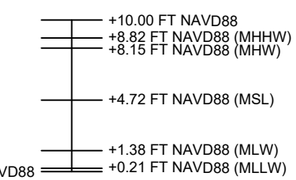
MHHW = MEAN HIGHER-HIGH WATER LEVEL
MLLW = MEAN LOWER-LOW WATER LEVEL

NOTE:

1. VERTICAL DATUM REFERENCED TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) IN UNITS OF FEET.



1+15 CROSS SECTION



DATUM CONVERSION FOR WATER LEVELS

5 0 5
Scale in Feet

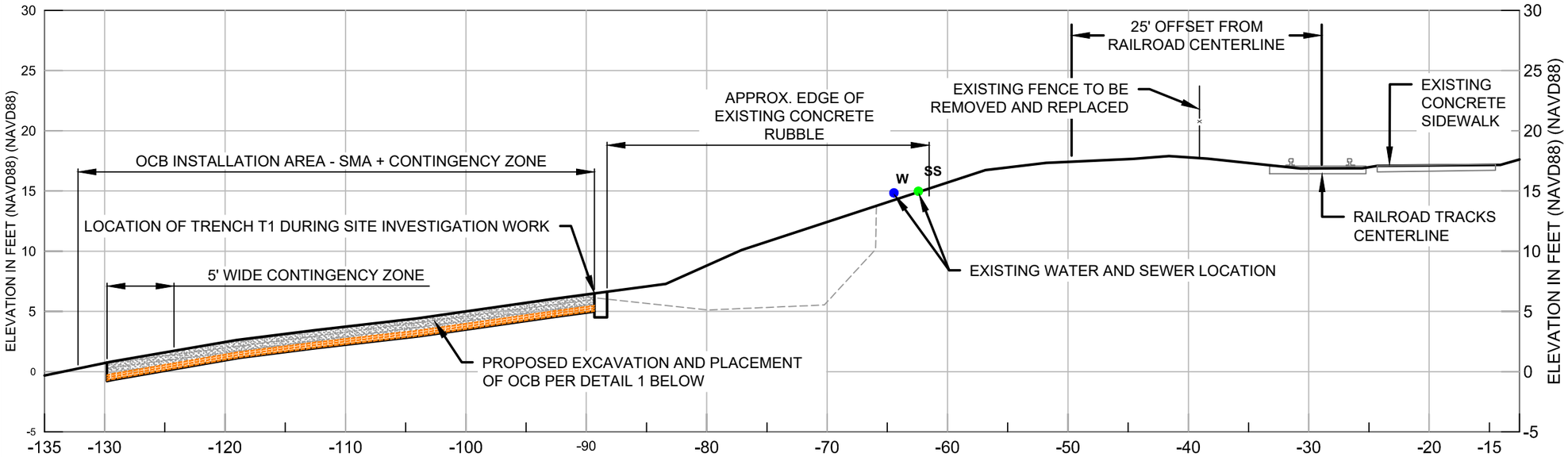
PACIFICORP / UNOCAL SITE
ASTORIA, OREGON
IN-WATER (INTERTIDAL) OCB REMEDY OMMP

IN-WATER REMEDY PLAN CROSS SECTIONS

DALTON OLMSTED FUGLEVAND

FIGURE 3

August 29, 2019



1+30 CROSS SECTION

LEGEND:

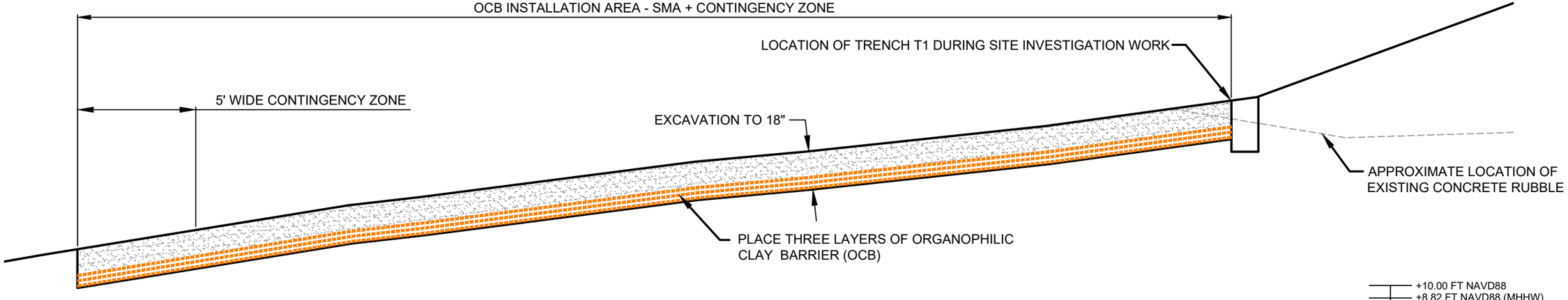
- ORGANOPHILIC CLAY BARRIER (OCB)
- EXISTING GRADE SURFACE
- EXISTING CONCRETE RUBBLE

ABBREVIATIONS:

MHHW = MEAN HIGHER-HIGH WATER LEVEL
MLLW = MEAN LOWER-LOW WATER LEVEL

NOTE:

1. VERTICAL DATUM REFERENCED TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) IN UNITS OF FEET.



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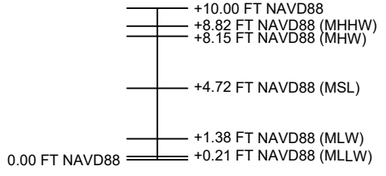


DATUM CONVERSION FOR WATER LEVELS

5 0 5
Scale in Feet

PACIFICORP / UNOCAL SITE
ASTORIA, OREGON

IN-WATER (INTERTIDAL) OCB REMEDY OMMP

IN-WATER REMEDY PLAN
CROSS SECTIONS

DALTON OLMSTED FUGLEVAND

FIGURE 4

August 29, 2019

Mitigation Area Easement 12-30-18

AN EASEMENT AREA WITHIN A PORTION OF THOSE CERTAIN LANDS CONVEYED TO THE STATE OF OREGON BY DEED RECORDED IN BOOK 482 OF DEEDS AT PAGE 798, RECORDS OF CLATSOP COUNTY, AS SITUATED IN THE SOUTHEAST QUARTER OF SECTION 7, TOWNSHIP 8 NORTH, RANGE 9 WEST WILLAMETTE MERIDIAN, CITY OF ASTORIA, COUNTY OF CLATSOP, STATE OF OREGON, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS, TO WIT:

COMMENCING AT POINT "A", MARKED BY A 5/8 INCH X 30 INCH REBAR WITH YELLOW PLASTIC CAP STAMPED, "S.W.L.S. INC. 503-665-7777", MARKING THE NORTHEAST CORNER OF LOT 4 BLOCK 2 OF THE "MC CLURE" PLAT TO ASTORIA;

THENCE, ALONG THE NORTH LINE OF BLOCK 2 OF SAID "MC CLURE" PLAT, ON A BEARING OF THE NAD83/2001 EPOCH 2010.000 OF THE NORTH ZONE (ZONE 3601), OF THE STATE OF OREGON, SOUTH 86°14'20" EAST FOR A GRID DISTANCE OF 200.05 INTERNATIONAL FEET TO POINT "D", THE NORTHWEST CORNER THEREOF, MARKED BY A 5/8 INCH X 30 INCH REBAR WITH YELLOW PLASTIC CAP STAMPED, "S.W.L.S. INC. 503-665-7777, SAID COURSE AND DISTANCE BEING THE SAME AS SOUTH 88°35'47" EAST FOR A DISTANCE OF 200.03 IN GROUND INTERNATIONAL FEET, FOUND ON CLATSOP COUNTY RECORD OF SURVEY FILED UNDER SURVEY NUMBER CS-B-13404, JULY 13, 2017, OFFICE OF CLATSOP COUNTY SURVEYOR;

THENCE, DEPARTING THE "MC CLURE" PLAT USING SAID ZONE 3601 GRID BEARING AND GRID DISTANCES, NORTH 33°49'41" EAST FOR A DISTANCE OF 86.77 FEET TO POINT "E", AND **THE POINT OF BEGINNING**;

THENCE, THE FOLLOWING ZONE 3601 BEARING AND GRID DISTANCES DESCRIBING THE PERIMETER OF SAID EASEMENT;

THENCE, NORTH 41°34'45" WEST FOR A DISTANCE OF 20.00 FEET TO POINT "F";
THENCE, NORTH 26°34'17" WEST FOR A DISTANCE OF 5.14 FEET TO POINT "G";
THENCE, NORTH 05°51'27" WEST FOR A DISTANCE OF 5.75 FEET TO POINT "H";
THENCE, NORTH 13°04'30" EAST FOR A DISTANCE OF 6.69 FEET TO POINT "I";
THENCE, NORTH 35°00'51" EAST FOR A DISTANCE OF 8.56 FEET TO POINT "J";
THENCE, NORTH 57°27'19" EAST FOR A DISTANCE OF 11.53 FEET TO POINT "K";
THENCE, NORTH 74°48'55" EAST FOR A DISTANCE OF 9.93 FEET TO POINT "L";
THENCE, NORTH 84°06'21" EAST FOR A DISTANCE OF 15.08 FEET TO POINT "M";
THENCE, SOUTH 86°16'34" EAST FOR A DISTANCE OF 5.00 FEET TO POINT "N";
THENCE, SOUTH 73°28'13" EAST FOR A DISTANCE OF 5.06 FEET TO POINT "O";
THENCE, SOUTH 51°43'03" EAST FOR A DISTANCE OF 5.42 FEET TO POINT "P";
THENCE, SOUTH 24°24'06" EAST FOR A DISTANCE OF 6.39 FEET TO POINT "Q";
THENCE, SOUTH 02°12'35" EAST FOR A DISTANCE OF 7.37 FEET TO POINT "R";
THENCE, SOUTH 08°17'10" WEST FOR A DISTANCE OF 7.15 FEET TO POINT "S";

43 NORTH W. AVA AVE. Gresham, Oregon 97030 www.statewidesurveying.com survey@statewidesurveying.com Phone 503 65.7777

THENCE, SOUTH 14°20'26" WEST FOR A DISTANCE OF 14.79 FEET TO POINT "T";
THENCE, SOUTH 75°39'06" WEST FOR A DISTANCE OF 38.08 FEET TO POINT "E", AND **THE POINT OF BEGINNING** SAID ENCLOSED EASEMENT AREA 2,169 SQUARE FEET, OR 0.050 ACRES, MORE OR LESS.

SUBJECT TO: COVENANTS, RESTRICTIONS, EASEMENTS, AND LEASES OF RECORD.

POINT ZONE 3601 TABLE

POINT	NORTH	EAST	DESCRIPTION
"A"	937898.87	7356464.23	NORTHEAST BLOCK 2
"B"	937704.23	7356451.39	NORTHWEST BLOCK 2
"C"	937717.40	7356251.78	PERIMETER POINT
"D"	937912.00	7356264.61	PERIMETER POINT
"E"	937984.08	7356312.92	PERIMETER POINT
"F"	937999.04	7356299.65	PERIMETER POINT
"G"	938003.64	7356297.35	PERIMETER POINT
"H"	938009.36	7356296.76	PERIMETER POINT
"I"	938015.87	7356298.27	PERIMETER POINT
"J"	938022.88	7356303.18	PERIMETER POINT
"K"	938029.08	7356312.90	PERIMETER POINT
"L"	938031.68	7356322.49	PERIMETER POINT
"M"	938033.23	7356337.49	PERIMETER POINT
"N"	938032.90	7356342.48	PERIMETER POINT
"O"	938031.46	7356347.33	PERIMETER POINT
"P"	938028.10	7356351.59	PERIMETER POINT
"Q"	938022.28	7356354.23	PERIMETER POINT
"R"	938014.92	7356354.51	PERIMETER POINT
"S"	938007.85	7356353.48	PERIMETER POINT
"T"	937993.52	7356349.82	PERIMETER POINT
"B"	937704.23	7356451.39	SOUTHEAST BLOCK 2
"C"	937717.40	7356251.78	SOUTHWEST BLOCK2

REGISTERED PROFESSIONAL LAND SURVEYOR
OREGON
JULY 29, 1988
GREGORY D. SPURLOCK
2370
EXPIRES: 06/30/20

43 NORTH W. AVA AVE. Gresham, Oregon 97030 www.statewidesurveying.com survey@sta

PACIFICORP / UNOCAL SITE
ASTORIA, OREGON
IN-WATER (INTERTIDAL) OCB REMEDY OMMP

SMA CONTINGENCY BOUNDARY LEGAL

DALTON OLMSTED FUGLEVAND

FIGURE 5A

August 29, 2019

MAP TO ACCOMPANY EASEMENT DESCRIPTION

EASEMENT

EASEMENT SITUATED IN SOUTHEAST QUARTER OF SECTION 7, TOWNSHIP 8 NORTH, RANGE 9 WEST, WILLAMETTE MERIDIAN, CITY OF ASTORIA, COUNTY OF CLATSOP, STATE OF OREGON.

CONTROL, EASEMENT VERTICES

POINT	NORTHING	EASTING
A	937898.87	7356464.23
B	937704.23	7356451.39
C	937717.40	7356251.78
D	937912.00	7356264.61
E	937984.08	7356312.92
F	937999.04	7356299.65
G	938003.64	7356297.35
H	938009.36	7356296.76
I	938015.87	7356298.27
J	938022.88	7356303.18
K	938029.08	7356312.90
L	938031.68	7356322.49
M	938033.23	7356337.49
N	938032.90	7356342.48
O	938031.46	7356347.33
P	938028.10	7356351.59
Q	938022.28	7356354.23
R	938014.92	7356354.51
S	938007.85	7356353.48
T	937993.52	7356349.82

LEGEND

- 5/8" IRON ROD WITH YELLOW PLASTIC CAP MARKED "S.W.L.S. INC. 503-665-7777
- 1.17" COPPER DISK MARKED "SWLS INC 6657777"
- EASEMENT

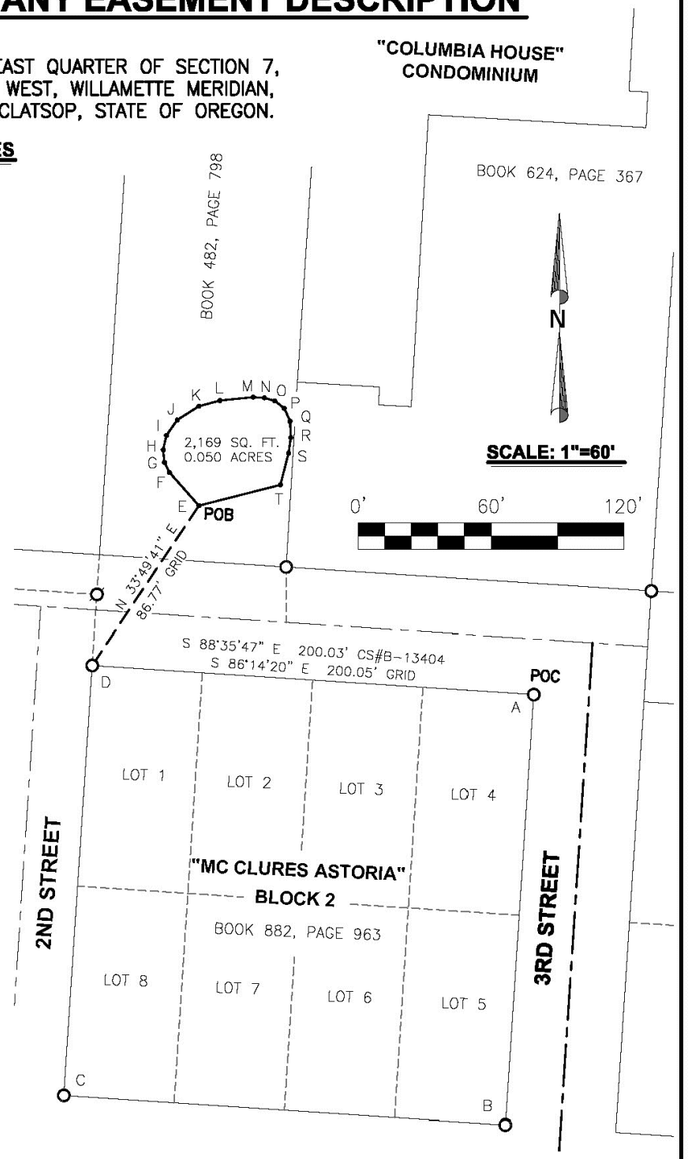
DATUM

NAD83/2011 EPOCH 2010.0000 OREGON STATE PLANE NORTH ZONE 3601, INTERNATIONAL FEET

REGISTERED PROFESSIONAL LAND SURVEYOR

OREGON
JULY 29, 1988
GREGORY D. SPURLOCK
2370

EXPIRES: 06/30/20



DRAWN DATE: **12/29/18**	DRAWN: **G.W.E.**	STATEWIDE LAND SURVEYING INC. 43 NW AVA AVE. GRESHAM, OR 97030 O: 503-665-7777 F: 503-665-7988	SWLS
REVIEW DATE: **12/29/18**	REVIEWED: **G.D.S.**		
SCALE: **1"=50'**	JOB NUMBER: **2016-052-2**		

PACIFICORP / UNOCAL SITE
ASTORIA, OREGON
IN-WATER (INTERTIDAL) OCB REMEDY OMMP

SMA CONTINGENCY BOUNDARY LEGAL - MAP

DALTON OLMSTED FUGLEVAND

FIGURE 5B

August 29, 2019

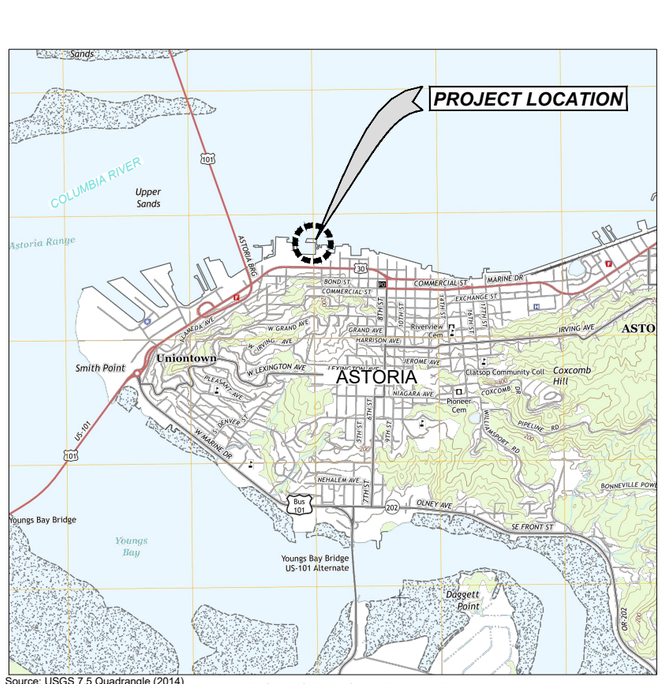
Appendix A

OCB Design Plans

IN-WATER (INTERTIDAL) AREA

Operations, Maintenance and Management Plan

FORMER PACIFICORP / UNOCAL ASTORIA SITE
ECSI #1646
256 MARINE DRIVE
ASTORIA, OREGON



Source: USGS 7.5 Quadrangle (2014)

PROJECT VICINITY MAP
(NOT TO SCALE)

PACIFICORP / UNION OIL COMPANY OF CALIFORNIA
ASTORIA, OREGON

SHEET INDEX	
FIGURE	**SHEET TITLE**
1	COVER SHEET, VICINITY MAP AND SHEET INDEX
2	IN-WATER REMEDY PLAN
3	IN-WATER REMEDY CROSS SECTIONS
4	IN-WATER REMEDY CROSS SECTIONS
5	SMA CONTINGENCY BOUNDARY LEGAL

DALTON OLMSTED FUGLEVAND
1236 NW FINN HILL RD POULSBO, WA 98370
(360) 394-7917

CALL BEFORE YOU DIG: 811 or (800) 332 - 2344

PACIFICORP / UNOCAL SITE
ASTORIA, OREGON
IN-WATER (INTERTIDAL) OCB REMEDY

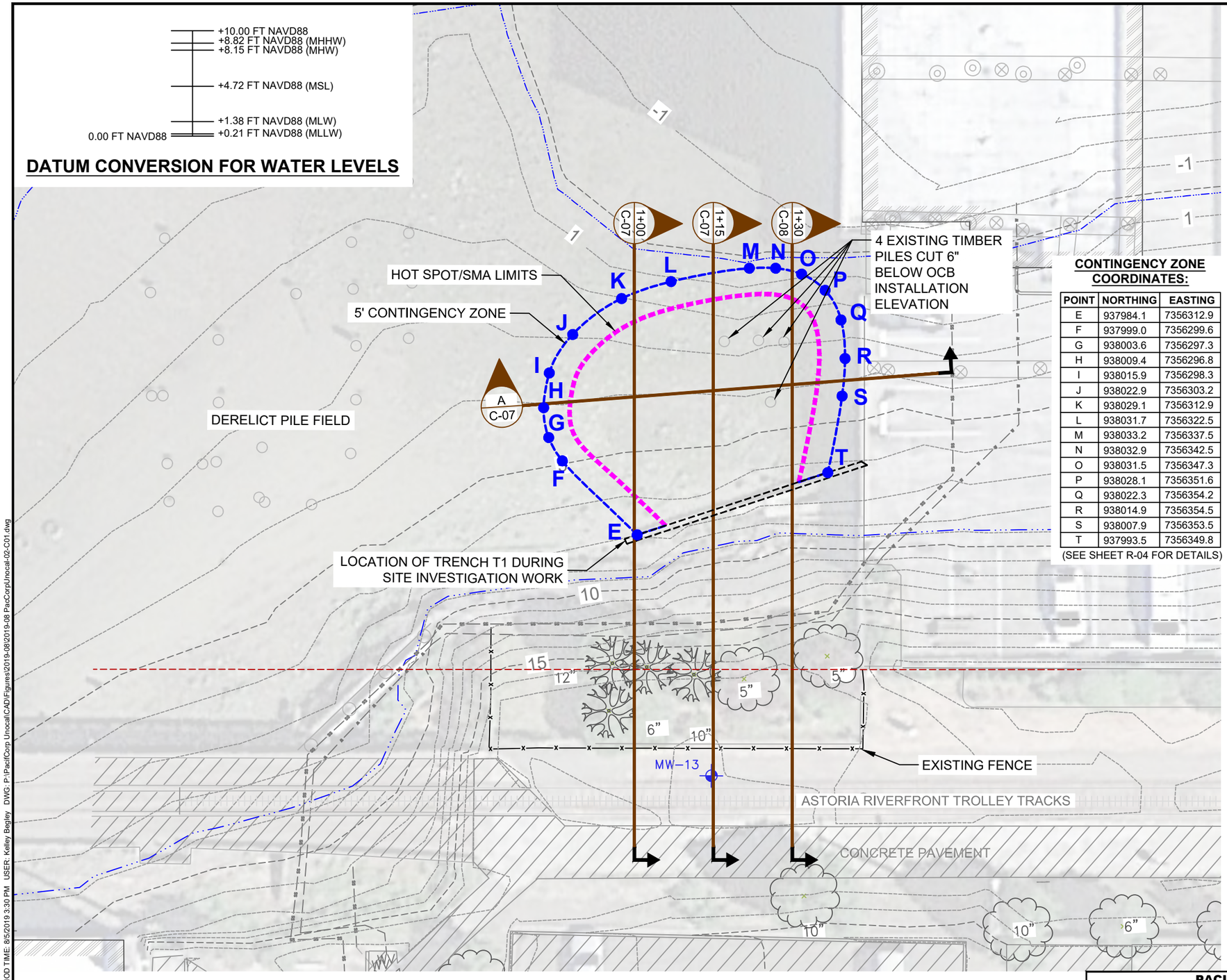
COVER SHEET,
VICINITY MAP AND SHEET INDEX

DALTON OLMSTED FUGLEVAND

FIGURE
1

August 5, 2019

PLOT TIME: 8/5/2019 11:50 AM MOD TIME: 8/5/2019 11:48 AM USER: Kelley Begley DWG: P:\PacifiCorp Unocal\CAD\Figures\2019-08\2019-08 PacCorpUnocal-01-G01 Cover.dwg



CONTINGENCY ZONE COORDINATES:

POINT	NORTHING	EASTING
E	937984.1	7356312.9
F	937999.0	7356299.6
G	938003.6	7356297.3
H	938009.4	7356296.8
I	938015.9	7356298.3
J	938022.9	7356303.2
K	938029.1	7356312.9
L	938031.7	7356322.5
M	938033.2	7356337.5
N	938032.9	7356342.5
O	938031.5	7356347.3
P	938028.1	7356351.6
Q	938022.3	7356354.2
R	938014.9	7356354.5
S	938007.9	7356353.5
T	937993.5	7356349.8

(SEE SHEET R-04 FOR DETAILS)

LEGEND:

- HOT SPOT/SMA AREA LIMITS
- 5' SMA CONTINGENCY AREA
- SMA CONTINGENCY AREA COORDINATE ID
- APPROXIMATE EXISTING CONCRETE RUBBLE LIMITS
- CONTROL POINT
- PROPERTY LINE
- WATER ELEVATION - MLLW (0.21 FT NAVD88)
- WATER ELEVATION - MHHW (8.82 FT NAVD88)
- EXISTING CONTOUR MAJOR
- EXISTING CONTOUR MINOR
- EXISTING CHAIN LINK FENCE
- EXISTING TIMBER PILE
- EXISTING TROLLEY TRACKS
- EXISTING MONITORING WELL
- EXISTING SEWER LINE
- EXISTING WATER LINE
- APPROXIMATE EDGE OF EXISTING VEGETATION
- APPROXIMATE EDGE OF EXISTING RIP-RAP
- EXISTING BUILDING
- CROSS SECTION LOCATION AND ID

NOTES:

1. BASE MAP INFORMATION FROM OTAK, INC. DATED 4/24/2014, AT A SCALE OF 1" = 30'.
2. APPARENT HORIZONTAL COORDINATE SYSTEM IS NORTH AMERICAN DATUM OF 1983 (NAD83). APPARENT VERTICAL COORDINATE SYSTEM IS NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. TROLLEY TRACKS, UTILITIES, MONITORING WELLS, AND OTHER EXISTING STRUCTURES SHALL BE PROTECTED IN ACCORDANCE WITH SPECIFICATIONS.
4. WATER QUALITY CONTROLS SHALL BE INSTALLED IN ACCORDANCE WITH SPECIFICATIONS.
5. CRANE MATS OR SIMILAR MATERIAL SHALL BE PLACED OVER THE EXISTING SEDIMENT SURFACE TO PROVIDE STABLE SURFACE FOR CONSTRUCTION EQUIPMENT ACCESS AS NEEDED.
6. THE LOCATIONS OF UTILITIES SHOWN ARE APPROXIMATE. THE CONTRACTOR SHALL VERIFY THE LOCATIONS PRIOR TO WORK.
7. THE LOCATION OF PIER PILINGS ARE APPROXIMATE. A SURVEY OF THE PIER PILINGS WITH THE WORK AREA SHALL BE CONDUCTED PRIOR TO WORK.

10 0 10
Scale in Feet

PACIFICORP / UNOCAL SITE
ASTORIA, OREGON

IN-WATER (INTERTIDAL) OCB REMEDY

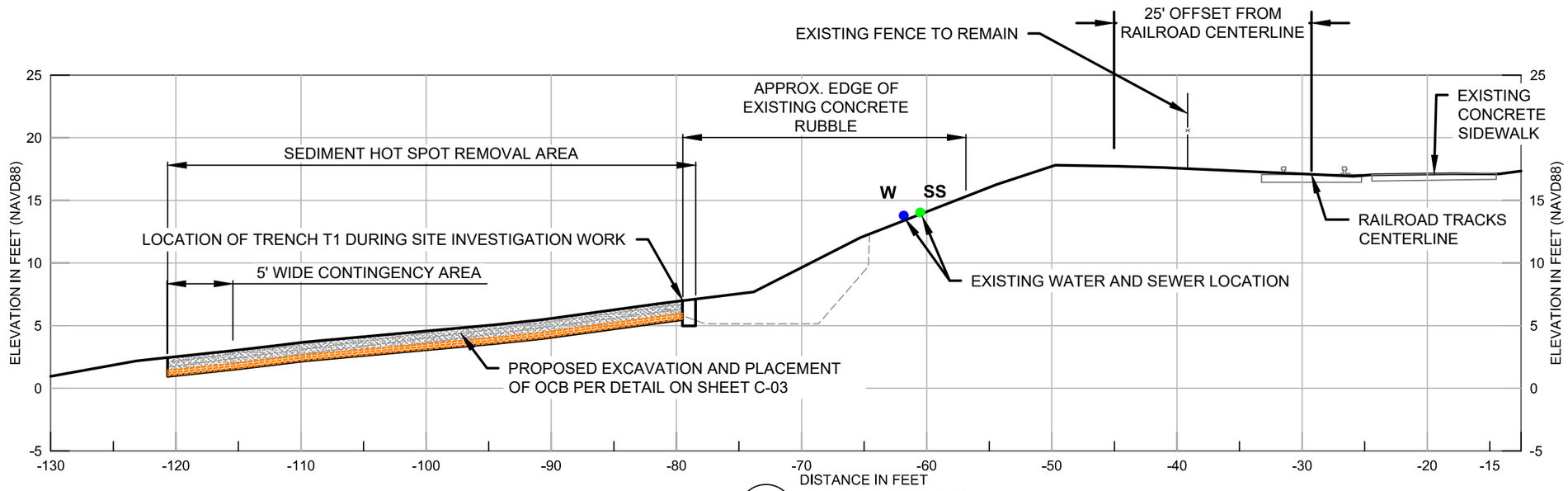
IN-WATER REMEDY PLAN

DALTON OLMSTED FUGLEVAND

FIGURE 2

August 5, 2019

PLOT TIME: 8/5/2019 3:32 PM MOD TIME: 8/5/2019 3:30 PM USER: Kelley Begley DWG: P:\Pacif\Corp Unocal\CAD\Figures\2019-08\2019-08 PacCorpUnocal-02.C01.dwg



1+00
C-02
CROSS SECTION

LEGEND:

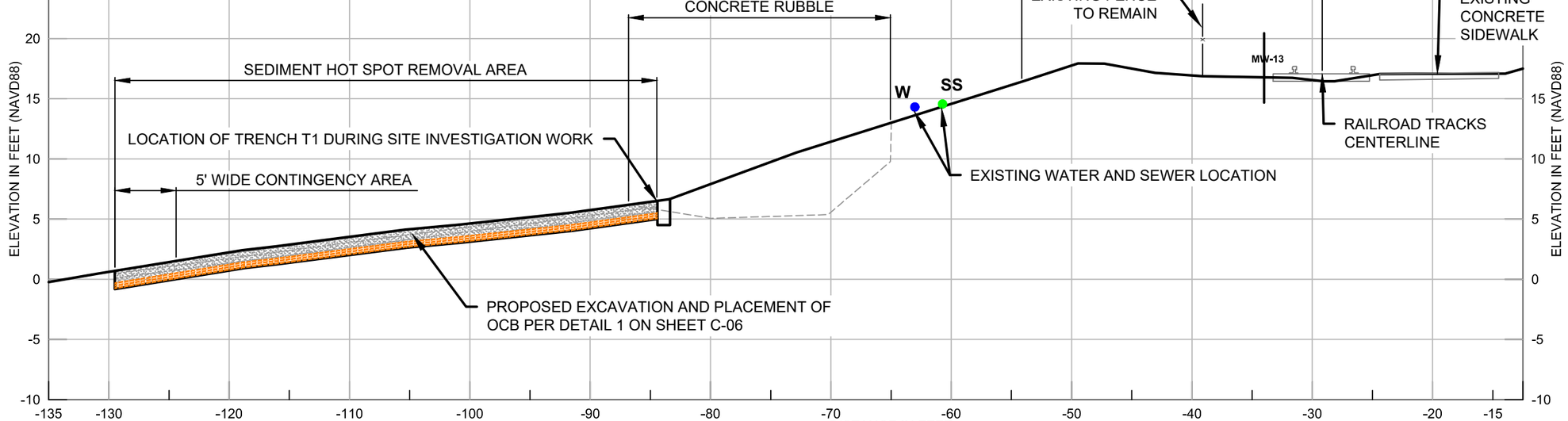
- ORGANOPHILIC CLAY BARRIER (OCB)
- EXISTING GRADE SURFACE
- EXISTING CONCRETE RUBBLE

ABBREVIATIONS:

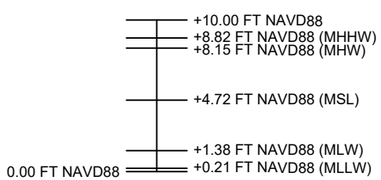
MHHW = MEAN HIGHER-HIGH WATER LEVEL
MLLW = MEAN LOWER-LOW WATER LEVEL

NOTE:

1. VERTICAL DATUM REFERNCED TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) iIN UNITS OF FEET.



1+15
C-05
CROSS SECTION



DATUM CONVERSION FOR WATER LEVELS

5 0 5
Scale in Feet

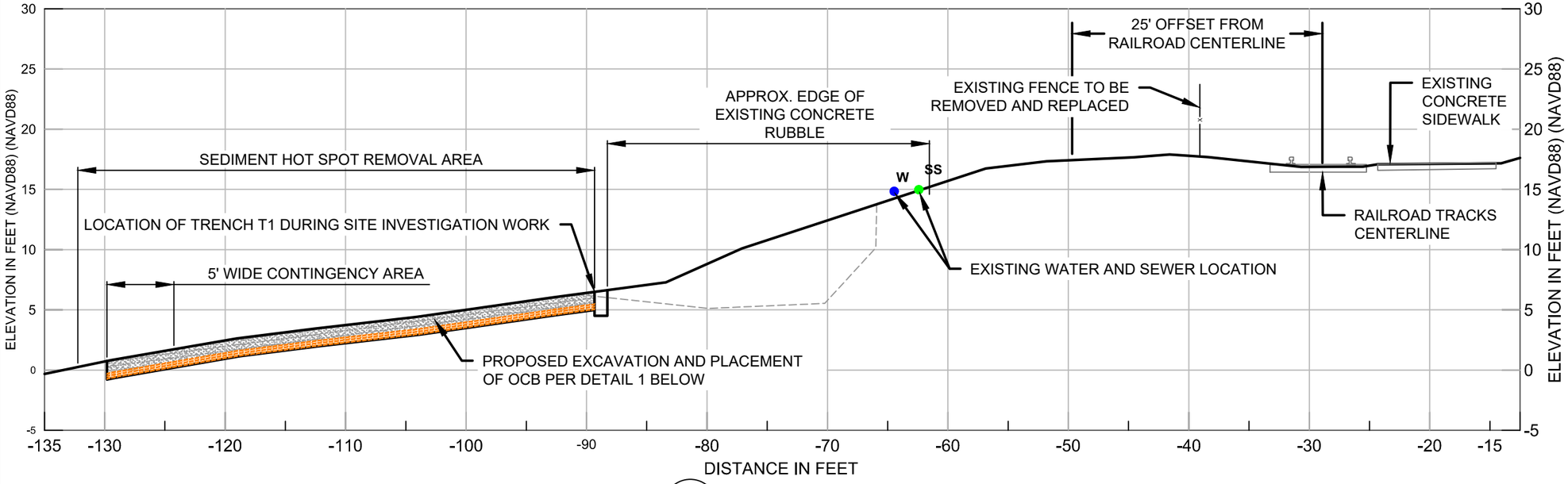
PACIFICORP / UNOCAL SITE
ASTORIA, OREGON
IN-WATER (INTERTIDAL) OCB REMEDY

IN-WATER REMEDY PLAN CROSS SECTIONS

DALTON OLMSTED FUGLEVAND

FIGURE 3

August 5, 2019



1+30 / C-05 CROSS SECTION

LEGEND:

- ORGANOPHILIC CLAY BARRIER (OCB)
- EXISTING GRADE SURFACE
- EXISTING CONCRETE RUBBLE

ABBREVIATIONS:

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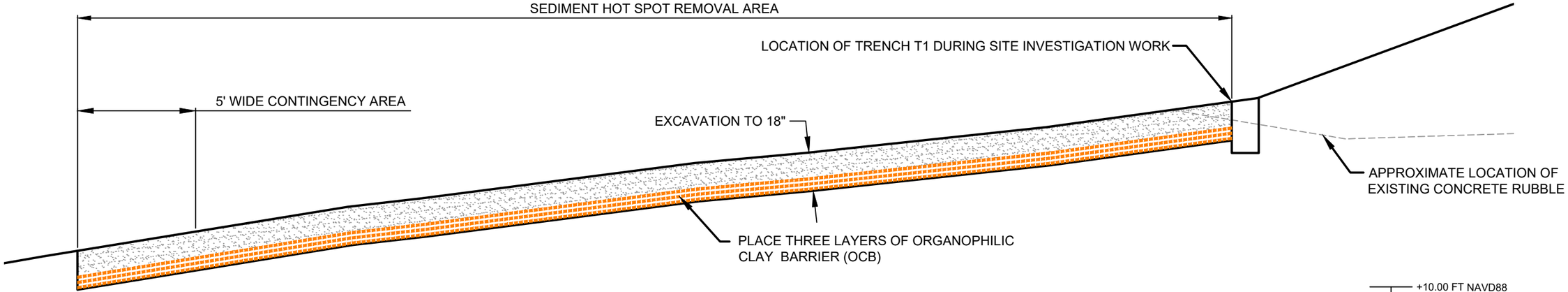
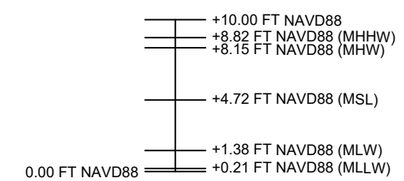


1 TYP HOT SPOT PRB AND OCB DETAIL
NTS



DATUM CONVERSION FOR WATER LEVELS

5 0 5
Scale in Feet

PACIFICORP / UNOCAL SITE
ASTORIA, OREGON
IN-WATER (INTERTIDAL) OCB REMEDY

IN-WATER REMEDY PLAN CROSS SECTIONS

DALTON OLMSTED FUGLEVAND

FIGURE 4

August 5, 2019

STATEWIDE LAND SURVEYING INC.

Mitigation Area Easement **12-30-18**

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43 NORTH W. AVA AVE. Gresham, Oregon 97030 www.statewidesurveying.com survey@statewidesurveying.com Phone 503 65.7777

STATEWIDE LAND SURVEYING INC.

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"G"	938003.64	7356297.35	PERIMETER POINT
"H"	938009.36	7356296.76	PERIMETER POINT
"I"	938015.87	7356298.27	PERIMETER POINT
"J"	938022.88	7356303.18	PERIMETER POINT
"K"	938029.08	7356312.90	PERIMETER POINT
"L"	938031.68	7356322.49	PERIMETER POINT
"M"	938033.23	7356337.49	PERIMETER POINT
"N"	938032.90	7356342.48	PERIMETER POINT
"O"	938031.46	7356347.33	PERIMETER POINT
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REGISTERED PROFESSIONAL LAND SURVEYOR
OREGON
JULY 29, 1988
GREGORY D. SPURLOCK
2370
EXPIRES: 06/30/20

43 NORTH W. AVA AVE. Gresham, Oregon 97030 www.statewidesurveying.com survey@sta

MAP TO ACCOMPANY EASEMENT DESCRIPTION

EASEMENT

EASEMENT SITUATED IN SOUTHEAST QUARTER OF SECTION 7, TOWNSHIP 8 NORTH, RANGE 9 WEST, WILLAMETTE MERIDIAN, CITY OF ASTORIA, COUNTY OF CLATSOP, STATE OF OREGON.

CONTROL, EASEMENT VERTICES

POINT	NORTHING	EASTING
A	937898.87	7356464.23
B	937704.23	7356451.39
C	937717.40	7356251.78
D	937912.00	7356264.61
E	937984.08	7356312.92
F	937999.04	7356299.65
G	938003.64	7356297.35
H	938009.36	7356296.76
I	938015.87	7356298.27
J	938022.88	7356303.18
K	938029.08	7356312.90
L	938031.68	7356322.49
M	938033.23	7356337.49
N	938032.90	7356342.48
O	938031.46	7356347.33
P	938028.10	7356351.59
Q	938022.28	7356354.23
R	938014.92	7356354.51
S	938007.85	7356353.48
T	937993.52	7356349.82

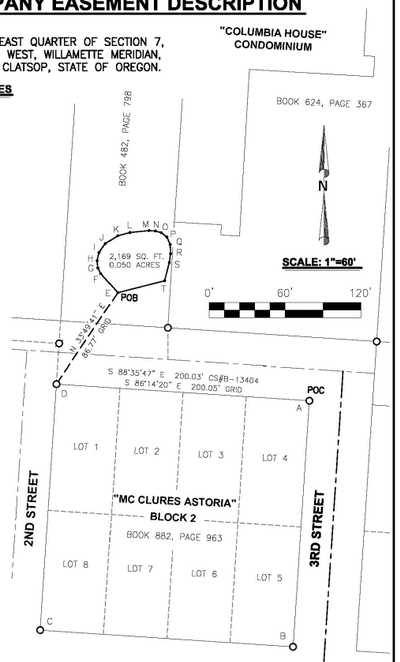
LEGEND

- 5/8" IRON ROD WITH YELLOW PLASTIC CAP MARKED "S.W.L.S. INC. 503-665-7777"
- 1.17" COPPER DISK MARKED "SWLS INC 6657777"
- EASEMENT

DATUM

NAD83/2011 EPOCH 2010.0000 OREGON STATE PLANE NORTH ZONE 3601, INTERNATIONAL FEET

REGISTERED PROFESSIONAL LAND SURVEYOR
OREGON
JULY 29, 1988
GREGORY D. SPURLOCK
2370
EXPIRES: 06/30/20



DRAWN DATE: **12/29/18**	DRAWN: **G.W.E.**	STATEWIDE LAND SURVEYING INC. 43 NW AVA AVE. GRESHAM, OR 97030 O: 503-665-7777 F: 503-665-7988	SWLS
REVIEW DATE: **12/29/18**	REVIEWED: **G.D.S.**		
SCALE: **1"=50'**	JOB NUMBER: **2016-052-2**		

PACIFICORP / UNOCAL SITE
ASTORIA, OREGON
IN-WATER (INTERTIDAL) OCB REMEDY

SMA CONTINGENCY BOUNDARY LEGAL

DALTON OLMSTED FUGLEVAND

FIGURE 5

August 5, 2019

PLOT TIME: 8/5/2019 11:52 AM MOD TIME: 8/5/2019 11:15 AM USER: Kelley Begley DWG: P:\PacifiCorp Unocal\CAD\Figures\2019-08\20190-04-12 05 PacCorpUnocal-04-R01.dwg

Appendix B

OMMP Inspection Form

SEDIMENT CAP INSPECTION REPORT FORMER UNOCAL/PACIFICORP ASTORIA SITE ASTORIA, OREGON		
Date:		
Time:		
Temperature and Weather:		
Tide Stage:		
24 hr Precip:		
Inspector:		
Company:		
Phone number:		
Signature:		

Background: Sediments along the shoreline slope in the intertidal area north of the Site were shown to contain residual petroleum hydrocarbon constituents (concentrations of TPH) in the form of light non-aqueous-phase liquid (LNAPL). The selected remedial action for the sediment management area (SMA) included installation of an organophilic clay barrier (OCB) over the SMA and "Contingency Zone" (an area extending 5 feet beyond the SMA, see attached Figure). The remedy is comprised of three layers of OCB overlain by 1.5 feet of protective armor (cobbles, gravel, and sand).

Photographic Requirements:

- Photo from the top of the SMA looking downslope (facing north)
- Photo from the bottom of the SMA looking upslope (facing south)
- Photo from the NE corner of the SMA looking upslope (facing south-west)
- Photo from the NW corner of the SMA looking upslope (facing south-east)
- Photo(s) of the SMA signage regarding the cap
- Photo(s) of any noted damage, erosion, debris, sedimentation, or other notable issue

Visual observation of the condition of the intertidal cap area (please note any problems such as rutting, erosion, cracking, exposure of OCB, or other damage to or loss of protective cap materials):

1. Sheen present on protective armor (cobbles, gravel, sand, etc.)? Yes/No, If Yes record locations and observations and take a photograph of the location:

   _____
   _____
   _____
   _____

2. Erosion? Yes/No, If Yes record locations and observations and take a photograph of the location:

   _____
   _____
   _____
   _____

3. Sedimentation? Yes/No, If Yes note locations and depth and take a photograph of the location:

4. Exposed OCB? Yes/No, If Yes record locations and observations and take a photograph of the location:

5. Debris observed on CAP? Yes/No, If Yes was CAP damaged and was debris removed? Yes/No, If Yes, How was debris removed, manual vs. equipment?

6. Note percentage of CAP area covered by water:

7. Condition of signage at site:

8. Identify any CAP maintenance required, or where evidence exists that maintenance has occurred since the last site inspection. Attach any documentation of "repairs made" for any work performed since the previous inspection. Note areas requiring follow-up for repairs or reevaluation in future inspections:

Appendix C

Investigation Report Figures

Location Map

Legend

Investigation Area

Background Image Source:
July 2014 Google Earth Pro

0 80
Scale in Feet

PacifiCorp Environmental Remediation Co.\Unocal
Astoria, Oregon

Former Petroleum Terminal #022 and Manufactured Gas Plant
Intertidal Remedial Investigation Sampling Summary

Vicinity Map

DALTON OLMSTED FUGLEVAND

Figure 1

October 5, 2016

Legend

- E6 — Proposed Sampling Grid 10'x10' Cell
- Proposed Sheen Sample (Observation) Location

Pre-Design Investigation Legend

- SED-4 — Sediment Sample
- Test Pit
- T5 — Trench
- No Observed Impact
- LNAPL
- Sheen
- Impacted Sediment
- LNAPL and Impacted Sediment
- Sheen and Impacted Sediment
- 10 — Trench Stationing, 10 Feet
- Organoclay Contained in Geotextile Fabric
- Reactive Core Mat
- Conceptual Sediment Management Area Extent as shown in FS

Previous Information shown based on Feasibility Study Report by Maul, Foster & Alonghi, March 12, 2010

N

0 10

Scale in Feet

PLOT TIME: 10/5/2016 10:37 AM MOD TIME: 10/5/2016 10:35 AM USER: Lee Barras DWG: D:\Projects\PacifiCorp Unocal\CAD\Figures\2016-10\Sampling\2016-10-05 Sampling Investigation Report Fig Set1.dwg

PacifiCorp Environmental Remediation Co.\Unocal
Astoria, Oregon

Former Petroleum Terminal #022 and Manufactured Gas Plant
Intertidal Remedial Investigation Sampling Summary

Proposed Sheen Observation Locations in Surface Sediment for SMA Refinement

DALTON OLMSTED FUGLEVAND

Figure 2

October 5, 2016

Legend

- Previously Mapped Hot Spot Extent
- Primary Hot Spot Investigation Point
- Secondary Hot Spot Investigation Point (Initial, conceptual locations shown. Locations may be adjusted and additional secondary points to be added as necessary as described in plan)
- Reactive Core Mat (location of previously installed Mat, no longer in place)

Previous Information shown based on Feasibility Study Report by Maul, Foster & Alonghi, March 12, 2010

N

0 10

Scale in Feet

Background Image Source: July 2014 Google Earth Pro

PacifiCorp Environmental Remediation Co.\Unocal
Astoria, Oregon

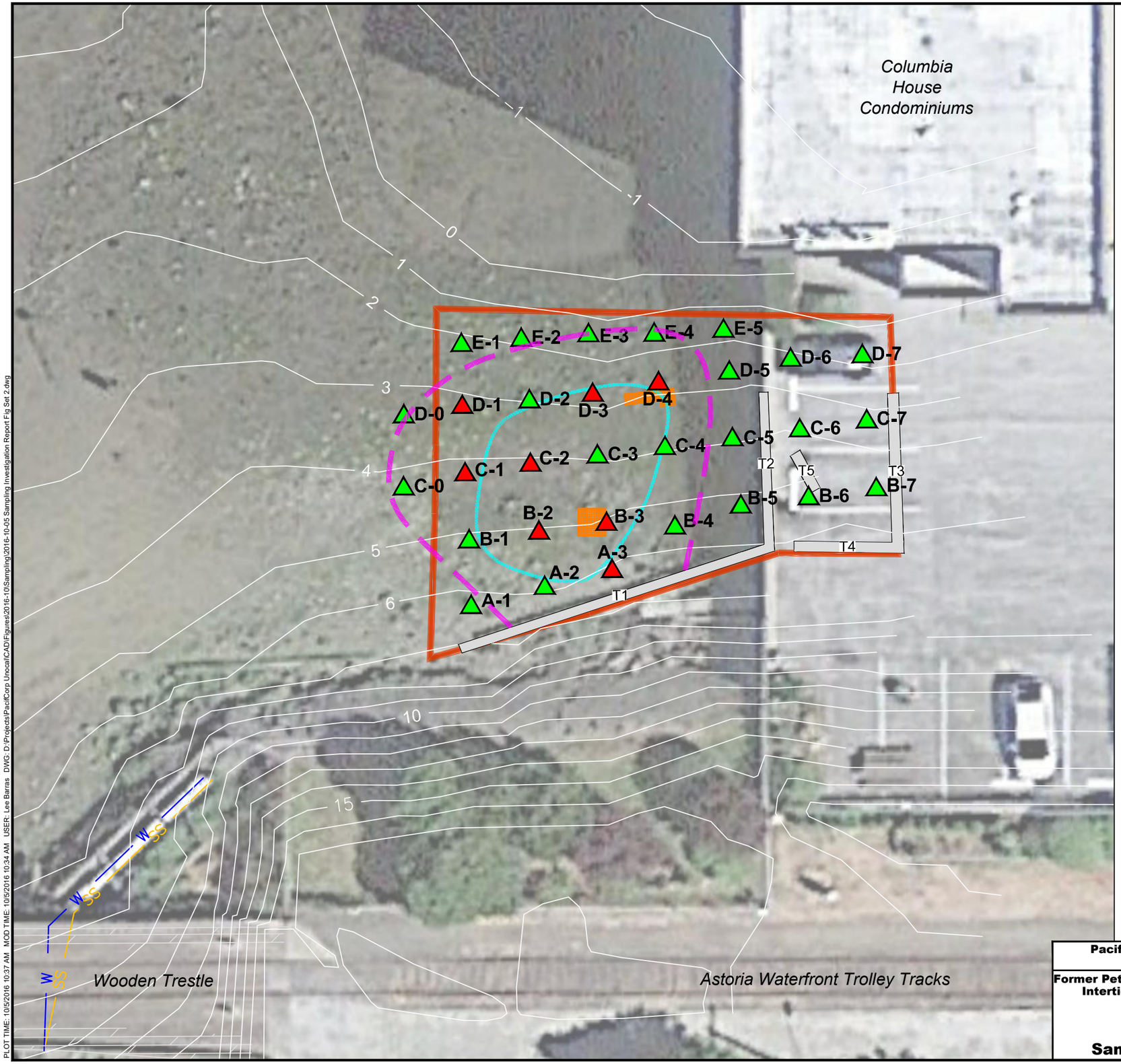
Former Petroleum Terminal #022 and Manufactured Gas Plant
Intertidal Remedial Investigation Sampling Summary

Proposed Hot Spot Refinement Boring Locations

DOF DALTON OLMSTED FUGLEVAND

Figure 3

October 5, 2016



Legend

- Hydrocarbon Sheen or LNAPL Detected
- No Hydrocarbon Sheen or LNAPL Detected

*(LNAPL = Light Non Aqueous Phase Liquid)

- Estimated August 2016 Hot Spot and SMA Extent
- T4 — Trench Sample Location
- Previously Mapped Hot Spot Extent (Previously performed by others)
- Conceptual Sediment Management Area Extent as shown in FS
- Reactive Core Mat (Previous Information shown based on Feasibility Study Report by Maul, Foster & Alonghi, March 12, 2010) (no longer in place)
- Contour (April 2016) (NAVD88 Feet)

N

0 5 10 15

Scale in Feet

Notes

1. Surface sampling and subsurface borings collected during two field events: Field Event 1 performed by both DOF and Parsons Environmental on August 17-19, 2016 and Field Event 2 performed by DOF on August 30-31, 2016.
2. Background Image Source: July 2014 Google Earth Pro.

PacifiCorp Environmental Remediation Co.\Unocal
Astoria, Oregon

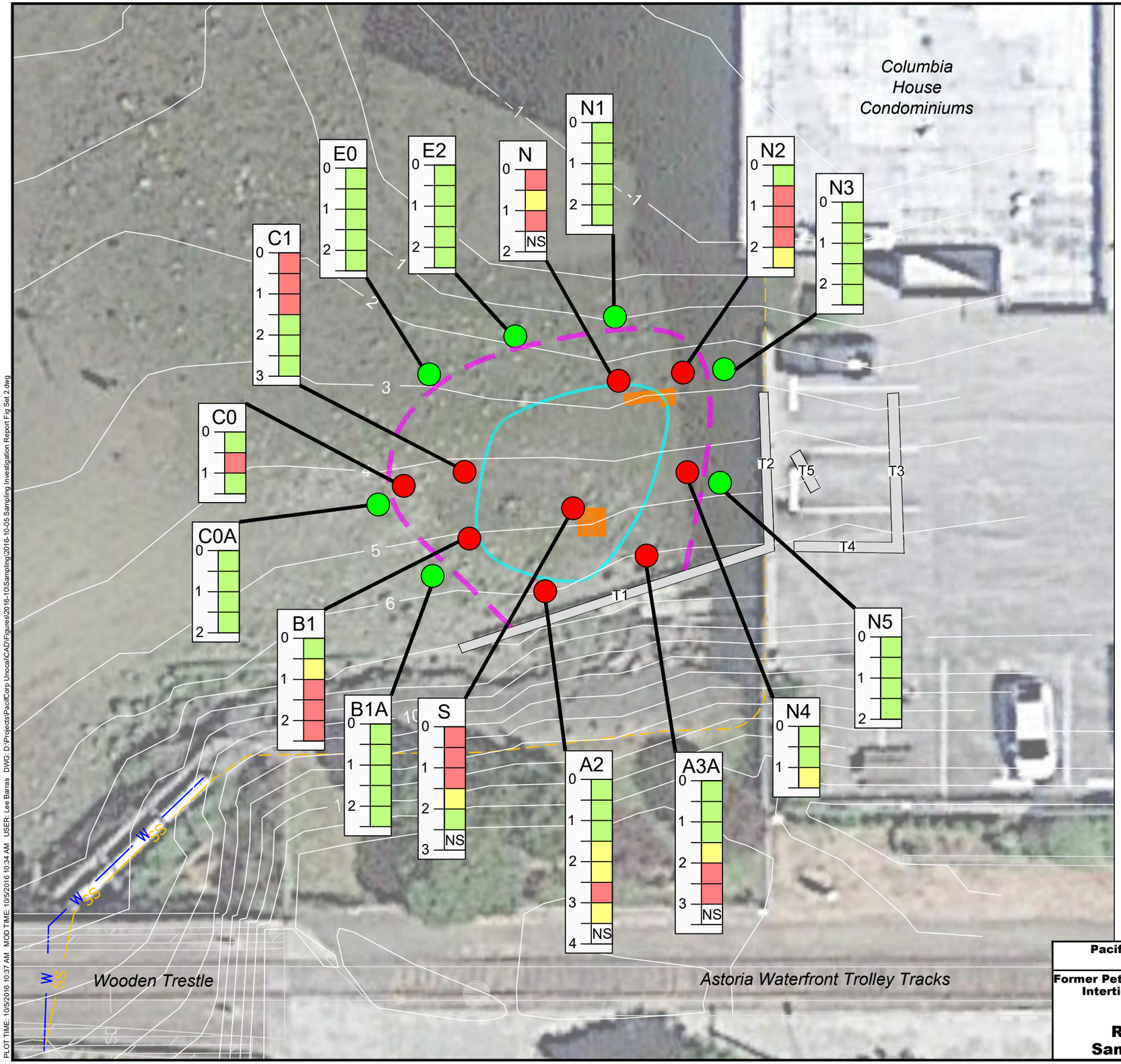
Former Petroleum Terminal #022 and Manufactured Gas Plant
Intertidal Remedial Investigation Sampling Summary

SMA Refinement Results
Reported Surface Locations
Sampling Dates: August 17-31, 2016

DOF DALTON OLMSTED FUGLEVAND

Figure 4

October 5, 2016



Legend

- Subsurface - Hydrocarbon Sheen or LNAPL Detected
- Subsurface - No Hydrocarbon Sheen or LNAPL Detected

*(LNAPL = Light Non Aqueous Phase Liquid)

Sheen Rating

- Heavy Sheen
- Moderate Sheen
- No Sheen
- NS No sample due to lack of finer matrix

- Estimated August 2016 Hot Spot and SMA Extent
- T4 Trench Sample Location
- Previously Mapped Hot Spot Extent (Previously performed by others)
- Reactive Core Mat (Previous Information shown based on Feasibility Study Report by Maul, Foster & Alonghi, March 12, 2010) (no longer in place)
- Contour (April 2016) (NAVD88 Feet)

N

0 5 10 15

Scale in Feet

Notes

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2. Background Image Source: July 2014 Google Earth Pro.

PacifiCorp Environmental Remediation Co.\Unocal
Astoria, Oregon

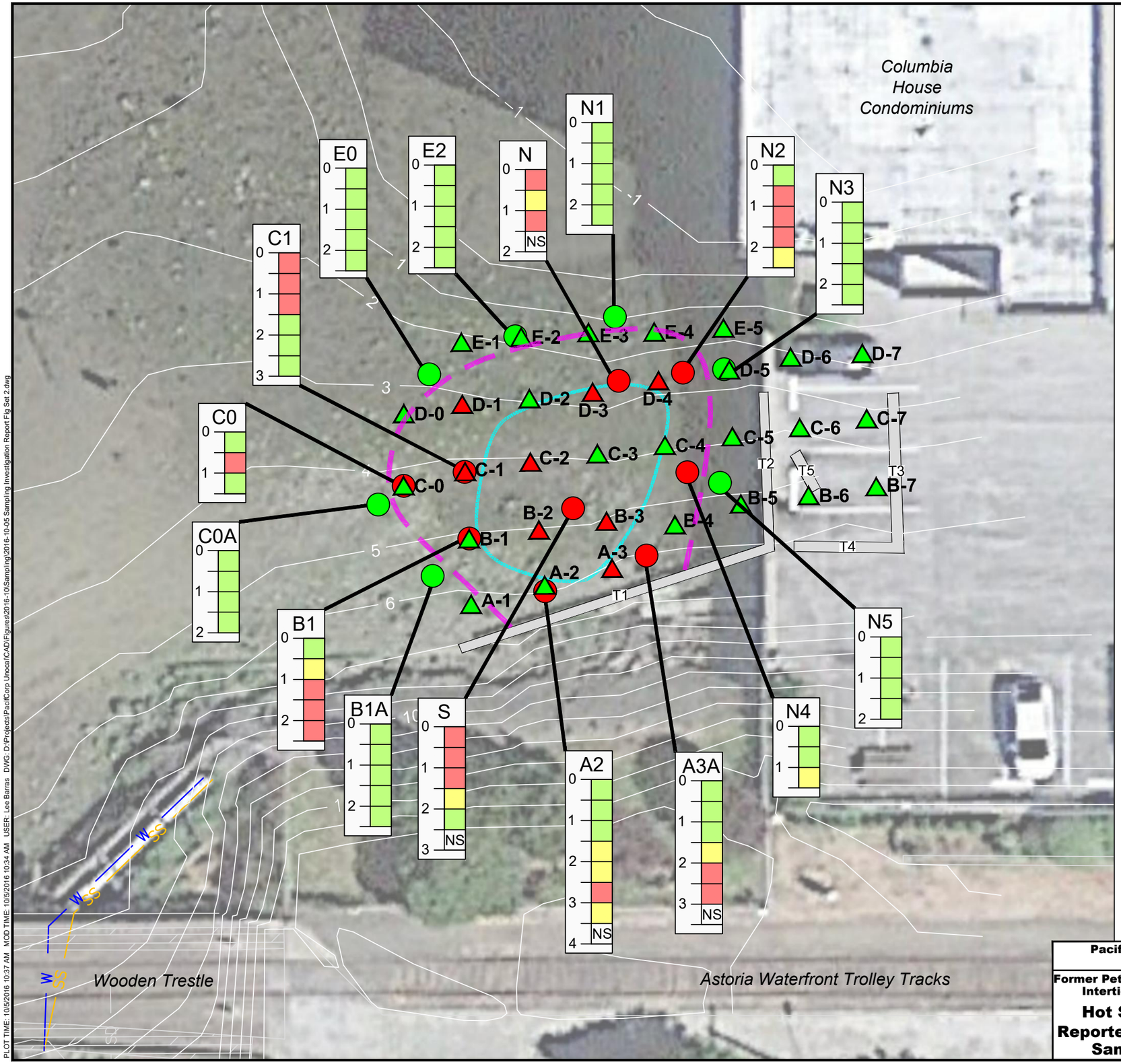
Former Petroleum Terminal #022 and Manufactured Gas Plant
Intertidal Remedial Investigation Sampling Summary

Hot Spot Refinement Results
Reported Subsurface Locations
Sampling Dates: August 17-19, 2016

DOF DALTON OLMSTED FUGLEVAND

Figure 5

October 5, 2016



Legend

- Surface - Hydrocarbon Sheen or LNAPL Detected
- Surface - No Hydrocarbon Sheen or LNAPL Detected
- Subsurface - Hydrocarbon Sheen or LNAPL Detected
- Subsurface - No Hydrocarbon Sheen or LNAPL Detected

*(LNAPL = Light Non Aqueous Phase Liquid)

Sheen Rating

- Heavy Sheen
- Moderate Sheen
- No Sheen
- NS — No sample due to lack of finer matrix

- Estimated August 2016 Hot Spot and SMA Extent
- T4 — Trench Sample Location
- Previously Mapped Hot Spot Extent (Previously performed by others)
- Reactive Core Mat (Previous Information shown based on Feasibility Study Report by Maul, Foster & Alonghi, March 12, 2010) (no longer in place)
- Contour (April 2016) (NAVD88 Feet)

N

0 5 10 15

Scale in Feet

Notes

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2. Background Image Source: July 2014 Google Earth Pro.

PacifiCorp Environmental Remediation Co.\Unocal
Astoria, Oregon

Former Petroleum Terminal #022 and Manufactured Gas Plant
Intertidal Remedial Investigation Sampling Summary

Hot Spot and SMA Refinement Results
Reported Surface and Subsurface Locations
Sampling Dates: August 17-31, 2016

DOF DALTON OLMSTED FUGLEVAND

Figure 6

October 5, 2016

PLOT TIME: 10/5/2016 10:37 AM MOD TIME: 10/5/2016 10:34 AM USER: Lee Barras DWG: D:\Projects\PacifiCorp Unocal\CAD\Figures\2016-10\Sampling\2016-10-05 Sampling Investigation Report Fig Set 2.dwg

Appendix D

Division 145 Lease

(To be included once issued)