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12 January 2015

Mr. Stephen Posner
Energy Facility Site Evaluation Council
Washington Utilities and Transportation Commission
P.O. Box 43172
Olympia, WA 98504-3172

Subject: Vancouver Energy
EFSEC Application No. 2013-01, Docket No. EF131590
Response to EFSEC Draft EIS Data Request 1

Dear Mr. Posner:

On behalf of Tesoro Savage Petroleum Terminal LLC (the Applicant), BergerABAM is providing a response to the Energy Facility Site Evaluation Council's (EFSEC) Draft EIS Data Request 1, dated 16 December 2014.

Please feel free to contact me at 206/431-2373, or irina.makarow@abam.com, if you have any questions about this submittal. We look forward to further coordination with you, your staff, and EFSEC's consultants.

Sincerely,

Irina Makarow
Senior Environmental Project Manager

IM:keh
Attachments

cc w/attach: Kelly Flint, Savage Companies
Jay Derr, Van Ness Feldman

Code	Data Request Item	Applicant Response
Project Description		
PD-1	Provide a spill response plan that includes staff training to prevent spills, practice drills and a set of actions that would be followed in the event of a spill including agency notification.	The Applicant submitted a Preliminary Spill Prevention Control and Countermeasure Plan (SPCCP)(Appendix B.2 to the Application for Site Certification (ASC)) and a Preliminary Oil Spill Contingency Plan (Appendix B.3 to the ASC) on 14 January 2014. Both of these documents address spill response planning, including training, exercises, response actions to be followed and agency notification to be implemented at the Facility. They are available on EFSEC's website at http://www.efsec.wa.gov/Tesoro%20Savage/Application/Tesoro%20Savage%20Application%20Page.shtml On 18 November 2014, the Applicant received comments from EFSEC and their Ecology consultant requesting that the Applicant prepare an Oil Handling Operations Manual, a Training and Certification Program, and a Safe and Effective Threshold Report[1]. The Applicant will coordinate with EFSEC staff the future submittal of this additional documentation as part of an updated Oil Spill Contingency Plan.
PD-2	Provide an emergency action plan that includes staff training to prevent fires and explosions, the safe handling of hazardous materials, practice drills, and a set of actions that would be followed in emergencies.	The Applicant is preparing construction and operation health and safety plans, which will each include an emergency action plan addressing staff training to prevent fires and explosions, the safe handling of hazardous materials, practice drills, and a set of actions that would be followed in emergencies. The future submittal of these plans is being coordinated with EFSEC staff.

Code	Data Request Item	Applicant Response
Air Quality		
AQ-1	Provide the data source for information provided in PDEIS Section 4.2.1.3 Meteorological Conditions and Climate.	The general summary of climatological conditions in the project vicinity was assembled from various sources, such as regional clean air agency and university web sites (see for example: http://cses.washington.edu/cig/pnwc/pnwc.shtml). The cited annual average precipitation came from long-term measurements at the "Vancouver 4 NNE" agricultural meteorological station (see for example: http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?wavanc). Wind direction and wind speed data came from meteorological measurements data at the Vancouver Airport/Pearson Airfield.

[1] These plans were requested verbally by Ms. Bumpus.

Code	Data Request Item	Applicant Response
Air Quality		
AQ-2	Provide the data sources for information provided in PDEIS Section 4.2.2.2 General Air Quality Conformity Assessment.	The federal air-quality general conformity rules and statements regarding how these rules are applied derive from 40 CFR Part 93 Subpart B. The quantitative assessment of general-conformity-governed emissions from a larger marine terminal project used for comparison purposes were developed for a project in the Port of Tacoma and documented in ENVIRON, 2010, Puyallup Tribal Terminal, Air Quality Technical Report, prepared for: AMEC Earth and Environmental, on behalf of SSA Containers, Inc., Seattle, WA, March 26, 2010, ENVIRON Project Number: 03 21315A. This document was provided previously. See Attachment 1 for Air Quality Report. The comparison and conclusion that the Vancouver Energy facility represents a smaller construction emissions source than the Port of Tacoma Puyallup Tribal Terminal project was based on a qualitative comparison of the relative durations and expected efforts required for construction.

Code	Data Request Item	Applicant Response
Water Resources		
WR-1	Provide more detail on the entire stormwater collection, conveyance, and discharge system including details on the responsibilities of the Port and the Applicant to ensure facilities operate in compliance with all applicable permit requirements.	A draft Stormwater Engineering Report was submitted to EFSEC in April 2014. Details regarding stormwater collection, conveyance, and discharge system are identified in the report, and specifically in Sections 8, 9, 11, 16, and 17 of the report. Excerpts of these sections are attached (Attachment 2, NPDES Engineering Report). The Applicant will be responsible to ensure facility stormwater components operate in compliance with the stormwater permits issued by EFSEC relative to the Facility. The Port would continue to be in charge of compliance with permit requirements applicable to Port systems.
WR-2	Provide stormwater runoff directions in a figure or several figures for the project area, i.e. arrows and locations of new conveyances discussed in Section 2.2.5 (and runoff coefficients) including permit numbers added to the outfalls depicted in the figure(s).	A draft Stormwater Engineering Report was submitted to EFSEC in April 2014. Details regarding stormwater collection, conveyance, and discharge system are identified in the report, and specifically on pages 59, 65, and 69. Excerpts of these Sections are attached as Attachment 2.

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Vegetation		
VG-1	Clarify whether the inquiries to state and federal agencies regarding the presence of special status species included those that could occur in rail shipping corridors, in addition to those that could occur at the site.	Within Washington State, the USFWS Washington Species list and WDFW PHS databases were reviewed to determine special status plant species potentially occurring in the rail corridor. (Table 5.6-2 pages 5-103 to 5-104). See Attachment 3 (Vancouver Energy SEPA Draft EIS, Plant Species Tables). Outside of Washington State, the USFWS species lists for Idaho, Montana, and North Dakota were reviewed to determine if federally listed threatened or endangered species plants were present within the rail corridor. Listed species are shown in Table 5.6-4 on page 5-108. See Attachment 3.
VG-2	Provide a list of special status plant species that were targeted for assessment in Section 4.4.	Special status species targeted for assessment in Section 4.4 are listed in Appendix I of the PDEIS, Section 3.1 Special Status Species, pages I-2 to I-11. See Attachment 4 (Vancouver Energy SEPA Draft EIS, Special Status Species).
VG-3	Explain methods used to delineate the vegetation on the project site.	Vegetation on site was delineated through a combination of aerial photo review and field surveys. Vegetation polygons were delineated using the proposed project boundary and aerial photo. Pedestrian surveys were then conducted onsite to visually identify dominant vegetation types within each polygon.

Code	Data Request Item	Applicant Response
Energy and Natural Resources		
EN-1	Explain how the estimates for the amounts of natural resources that would be consumed by the project were derived (Sections 4.7.2.1 and 4.7.2.2.).	Construction material estimates listed in Section 4.7.2.1 were calculated from 30 percent design drawings using standard estimating techniques and CAD drawings. Operational material estimates were calculated using standard estimating techniques, with industry average gas/fuel/electricity use for the facility design. The excel spread sheets with these calculations are provided on the enclosed CD-ROM.
EN-1	Provide source documentation regarding "Northwest Natural's ability to provide service to the	The PDEIS states the Facility natural gas consumption at full capacity operations will be approximately 1,188,576 MMBTU, i.e. approximately 1.189 million MMBTU or 1.189 MMDT[2]. According to Northwest Natural Gas' 2014 Integrated Resource Plan (IRP)[3], Northwest Natural's annual base case firm load

[2] One MMBTU is equal to one dekatherm (DT); One MMDT is equal to one million dekatherms.
[3] Available at: https://www.nwnatural.com/uploadedFiles/NW_Natural_2014_IRP.pdf

	project" (Section 4.7.1.2 states: "NW Natural currently has the capacity to provide service to incremental additions of industrial customers such as the Proposed Action").	(including residential, commercial, and industrial users, but excluding firm transportation users) for the period 2013-2014 is estimated at 7,380.33 MMDT at the Vancouver hub, and 76.865.03 MMDT system-wide. Industrial usage for the same forecast period is 308.91 MMDT at the Vancouver hub and 3,282.86 system-wide. Thus the Facility usage would represent approximately 0.4 percent of Northwest Natural's industrial-based consumption at the Vancouver hub, 0.04 percent industrial-based, system-wide, and 0.0015 percent of all firm consumption (excluding transportation-related) system-wide. Northwest Natural's IRP identifies long term load and supply forecasts; the percentage use by the Facility is negligible in comparison with other areas of anticipated growth, including residential, commercial, industrial transportation and emerging markets. As a regulated utility in the state of Washington, Northwest Natural is required to provide cost-effective service, and would implement the necessary supply solutions to serve its customer base, including the Facility.
EN-2	Clarify the citation in Section 4.7.1.3 referring to the "available geologic data".	The PDEIS stated: "Clark County has 27,729 acres of identified gravel resources and 7,297 acres of bedrock resources (DNR 2005). While not all of these resources can necessarily be developed due to environmental and other constraints, available geologic data suggest rock aggregate resources are plentiful in the County." The statement refers to the language used in the reference provided, DNR 2005 (see below): *"The geology of Clark County is favorable for large sand and gravel resources and bedrock aggregate resources."* DNR. 2005. Rock aggregate resource lands inventory map for Clark County, Washington. Available at http://www.dnr.wa.gov/Publications/ger_rm1_aggregate_inventory_clark_co.pdf, accessed February 28, 2014. Washington Department of Natural Resources, Division of Geology and Earth Resources.
EN-3	Explain what types of materials are being referred to as "aggregates" in PDEIS Section 4.7.2.1.	As referred to in the text, aggregates are coarse materials, including sand, gravel, and crushed rock. Size classes are specified in detailed construction plans, which were not available at the time of the PDEIS as the design of the specific ground improvement program is still underway.
EN-4	Explain the statement in Section 4.7.2.3 that "It is anticipated the fuel supplied by the Facility would be available from other market sources,"	The statement in Section 4.7.2.3 is clarified as follows. Removal of infrastructure would require temporary energy consumption related to construction activity. Energy sources would be used to operate onsite construction equipment; for example, fuel for mobile equipment, electricity for lighting of workspaces and powering of construction equipment, and welding

	which refers to decommissioning. Identify the source of fuel and electricity (if applicable) for decommissioning.	gases for torch cutting employed for equipment disassembly. Because the amounts of energy used would be relatively small, decommissioning would not result in long-term impacts to energy consumption, supply, or availability. It is anticipated the fuels supplied to the Facility for decommissioning activities would be available from existing local and regional market sources, similar to those used for construction.
EN-5	Provide citations for information provided in Section 6.2.1.12, Energy and Natural Resources, Analysis of Alternatives.	The Applicant assumes that the reviewer meant "Provide citations for information provided in Section 6.2.1.~~12~~ 7, Energy and Natural Resources, Analysis of Alternatives." Section 6.2.1.12 is related to Public Services. The citations used in Chapter 6 were provided to EFSEC, including the citations specifically relative to Section 6.2.1.7 which are repeated below: Benton County. 2012. Comprehensive plan, 2006 update. Benton County, Kennewick, WA. Benton PUD (Benton Public Utility District). 2012a. Benton PUD fast facts webpage. Available at: http://www.bentonpud.org/images/site/2012%20Fast%20Facts(4).pdf, accessed May 12, 2014. Benton Public Utility District, Kennewick, WA. Benton PUD. 2012b. Update to 2010 integrated resource plan. Benton Public Utility District, Kennewick, WA. DNR (Washington State Department of Natural Resources). 2014. Available at: https://fortress.wa.gov/dnr/geology/?Theme=erpl DNR earth resources permit locations GIS map application.

Code	Data Request Item	Applicant Response
Noise		
NO-1	Clarify where the physical limits of the analysis area for "on site" rail begins and ends as	The physical limits for "on site" rail are the site boundaries displayed in light blue in Figure 4.8.2 of the PDEIS.

<table>
<tr><th>Code</th><th>Data Request Item</th><th>Applicant Response</th></tr>
<tr><td colspan="3">Noise</td></tr>
<tr><td></td><td>assumed for the CadnaA model.</td><td></td></tr>
<tr><td>NO-2</td><td>Under Impact Pile Driving Activities, the average sound level of pile driving is stated to come from "previous SLM data of impact pile driving activities taken by ENVIRON personnel indicate ...86 dBA". Provide reference and source documentation for this estimated sound level.</td><td>The measurement identified was taken by ENVIRON personnel who were working for a different company at the time. The included spreadsheet provides details of the measurement.

Pile Driving sound level measurements by MFG, Inc. 10/13/94
Measurements with Larson Davis 820 set for fast response:
<table>
<tr><th></th><th>Time</th><th>Duration</th><th></th><th>SEL</th><th>Leq</th><th>Min</th><th>Max</th><th>L2</th><th>L8</th><th>L10</th><th>L25</th><th>L50</th><th>L90</th></tr>
<tr><td>1</td><td>9:17</td><td>29 sec</td><td></td><td>103</td><td>88</td><td>69</td><td>97</td><td>96</td><td>94</td><td>94</td><td>89</td><td>80</td><td>72</td></tr>
<tr><td>2</td><td>9:18</td><td>28 sec</td><td></td><td>102</td><td>88</td><td>68</td><td>96</td><td>95</td><td>93</td><td>93</td><td>89</td><td>80</td><td>72</td></tr>
<tr><td>3</td><td>9:18</td><td>29 sec</td><td></td><td>102</td><td>87</td><td>68</td><td>95</td><td>94</td><td>93</td><td>93</td><td>88</td><td>80</td><td>71</td></tr>
<tr><td>4</td><td>9:19</td><td>27 sec</td><td></td><td>101</td><td>87</td><td>69</td><td>95</td><td>94</td><td>92</td><td>92</td><td>88</td><td>79</td><td>70</td></tr>
<tr><td>5</td><td>9:19</td><td>14.5 min</td><td></td><td>118</td><td>88</td><td>64</td><td>98</td><td>96</td><td>95</td><td>94</td><td>88</td><td>78</td><td>69</td></tr>
<tr><td>10</td><td>9:45</td><td>15 min</td><td></td><td>108</td><td>78</td><td>64</td><td>95</td><td>85</td><td>83</td><td>83</td><td>78</td><td>74</td><td>67</td></tr>
<tr><td>11</td><td></td><td>1 hour</td><td></td><td>121</td><td>86</td><td>62</td><td>98</td><td>95</td><td>92</td><td>91</td><td>82</td><td>74</td><td>66</td></tr>
</table>
1-4: 20 cycles of the pile driver at 100'
5: Entire pile driving episode at 100'
10: Crane picking up concrete piling @ approximately 15' at the nearest location
11: Total sound level over 1 hour. 2 piles driven in.

The 86 dBA level refers to an hour of pile driving activity assuming two piles were set and installed. The reference used read as Sound Level Measurements taken by MFG, Inc., 1994.</td></tr>
<tr><td>NO-3</td><td>Explain the reasoning for using dB and not dBA in Section 4.8.</td><td>The use of dB instead of dBA occurred in the discussion of the characteristics of noise, such as the effects of a doubling of power or the perception of increased levels of noise. These characteristics are not dependent on a particular frequency weighting system (e.g., A-weighting), and discussion of such</td></tr>
</table>

Code	Data Request Item	Applicant Response
Noise		
		characteristics in terms of dB instead of dBA is more globally inclusive. All discussion, measurements, and calculations of project-related noises and noise impacts were done using dBA.
NO-4	Provide reference for Estimated Sound Level Increase listed in Table 5.10-1.	The sound level increases were calculated using the following formula and rounding the results to the nearest whole decibel. $= 10 * \log(TotalTrains/BackgroundTrainVolumes)$
NO-5	Explain what model and data sources were used to support this statement in Section 7.2.8: "Considering all proposed onsite equipment from the Proposed Action plus 7 additional trains on the Port rail lines, modeled sound levels at the nearest residential properties indicate a potential increase over existing sound levels of 0 to 2 dBA (Ldn)".	The analysis that provided the basis of this statement used the same modeling results and general methodology as used for the noise impact assessment described in Section 4.8 (i.e., CadnaA noise modeling and subsequent calculations). As part of the cumulative noise impact assessment, the change in L_{dn} with seven additional trains (compared with current numbers of trains) was calculated assuming the trains could arrive and depart on Port rail lines any time during a 24-hour period. Thus, train arrivals and departures were assumed to occur evenly over 15 daytime (7 AM to 10 PM) and 9 nighttime (10 PM to 7 AM) hours. The facility impact noise modeling provided model-calculated sound levels for an hour <u>without</u> train arrivals or departures and for an hour <u>with</u> a single train arrival and departure. These model-calculated train noise levels were then used to compute the cumulative (24-hour) L_{dn} due strictly to the seven new trains. This was accomplished as follows: There are 15 daytime hours, so 15/24 * 7 = 4.375 daytime hours with trains, and 10.625 daytime hours without trains (based on 15 – 4.375) There are 9 nighttime hours, so 9/24 * 7 = 2.625 nighttime hours with trains, and 6.375 nighttime hours without trains (based on 9 – 2.625) The L_{dn} due to the seven new trains was then calculated assuming 4.375 daytime hours and 2.625 nighttime hours of "<u>with train</u>" noise levels in conjunction with 10.625 daytime hours and 6.375 nighttime hours of "<u>without train</u>" noise levels. Finally, the "new trains" L_{dn} was added to the existing measured L_{dn} to estimate potential overall cumulative sound levels and to calculate sound level increases due to seven new trains traveling on Port rail lines.

Code	Data Request Item	Applicant Response
Land Use and Recreation		
LU-1	Provide sources for information presented in PDEIS Tables 5.11-1, 5.11-2, 5.11-3, 5.11-4.	The data in these tables were all provided by LBG and are based on the maps included in the map book. Thedata sources are thus listed in the map books: Table 5.11-1 is from Mapbook K7A – Source: US Geological Survey Gap Analysis Program (GAP) National Land Cover Version 2 August 2011 Table 5.11-2 is from Mapbook K6A – Source: US Geological Survey Gap Analysis Program (GAP) National Land Cover Version 2 August 2011 Table 5.11-3 is from Mapbook K7B – Source: US Geological Survey Protected Areas Database V.1.3 (2012) Table 5.11-4 is form Mapbook K7C – Source: US Geological Survey Gap Analysis Program (GAP) National Land Cover Version 2 August 2011
LU-2	Clarify the geographic limits of the study area assumed for the analysis in Appendix M.	As noted in Section 2, the study area was generally limited to 1/2 mile from the rail line. For Emergency Services, the study included facilities up to 2 miles from the facility to recognize that emergency services are provided to larger areas, and limiting the distance to 1/2 mile would not reflect this.
LU-3	Provide a list of the plans that specifically identify and consider recreational resource management within the study area.	The Applicant requested clarification of the intent of this data request by email to Stephen Posner on December 29, 2014.

Code	Data Request Item	Applicant Response
Visual Resources		
VR-1	Provide a detailed description of the methodology used to characterize existing visual resources and assess visual impacts.	**Methodology** For the purposes of the visual resources assessment, methodologies used by federal resource managers were employed. The most widely known methodologies are those developed by the U.S. Department of Agriculture, Forest Service (*Landscape Aesthetics, A Handbook for Scenery Management*, USDA USFS, 1995) and the U.S. Department of Transportation, Federal Highways Administration (*Visual Impact Assessment for Highway Projects*, USDOT FHWA, 1981). While neither methodology applies directly to this

		project, conducting a visual inventory and identifying viewer sensitivity form a general framework for assessing the project's potential visual impacts. While both of these methodologies have been used in prior Northwest energy project assessments (most recently in analyzing visual impacts of wind energy facilities), the landscape and land use setting for this facility are considerably different, necessitating consideration of the industrial landscape as context, both in measuring impacts as well as the expectations and sensitivities of viewers. The visual resource methodology used to inventory and assess the potential impacts of this project includes the following steps: • Prepare an inventory existing visual quality. • Identify and evaluate potentially sensitive viewers and viewpoints within the landscape context of the development. • Use visual simulations to describe the visual changes introduced by the construction and operation of the Facility. • Assess the visual impacts from potentially sensitive viewpoints within the visual context of the project and an existing heavy industrial zone. • Recommend mitigation measures. **Inventory** The first step in assessing the projects visual impacts was defining current and past land uses. The long history of the industrial site was discussed to establish the visual context and aesthetic resources that are the baseline for measuring potential visual impacts. The discussion of the surrounding land uses and natural landscape setting also placed the proposed changes into a larger visual context from which viewers will experience the site.

		Visual Quality Based on the character and setting, three general descriptions were identified to categorize the visual quality of the project site. These visual quality categories were developed from land uses and the visual patterns created by the existing natural and manmade features. The descriptions follow. **Urban/Industrial -** This landscape is common to urban areas and urban/industrial fringes. Human elements are prevalent or landscape modifications exist that do not blend with the adjacent natural surroundings (low visual intactness and unity). The character and setting of the site, and its visibility from surrounding areas, will be that of a heavily industrialized landscape, dominated by rail infrastructure, commodity storage, processing and shipping, with or without the project. **Rural** - The landscape exhibits reasonably attractive natural and human-made features/patterns, although these are not visually distinctive or unusual within the region. The area provides some positive visual experiences such as natural open space with some existing agricultural areas (farm fields, etc.) or well-maintained and landscaped urban areas. **Unique/Distinctive** - This landscape exhibits distinctive and memorable visual features (landforms, lakes and rivers, etc.) and patterns (vegetation/open space) that are largely undisturbed—usually in a rural or open space setting. **Viewer Sensitivity** Within each visual quality category, potential viewer sensitivity depended on viewer type and exposure (number of viewers and view frequency), view orientation and duration, viewer frame of reference and expectation, and viewer awareness/sensitivity to visual changes. For the purposes of this report, levels of viewer sensitivity were evaluated using the following criteria: **Low** – Viewer types representing low visual sensitivity include industrial/warehouse, utility, and shipping and transportation workers. Compared with other viewer types, the number of viewers is generally considered small and the duration of their view is short. The activities of these viewers typically focus their attention and limit their awareness/sensitivity to the visual setting immediately beyond the workplace. **Moderate** – Viewer types representing moderate visual sensitivity consist of highway and local travelers. The awareness and sensitivity of this set of viewers are considered moderate because destination travelers often have a focused orientation. The level of sensitivity is influenced by the rate and frequency of travel. Delivery drivers who often travel a particular route will have less sensitivity than pedestrians who move slowly through an area.

		High – Residential and recreational viewers and viewers accessing public places (parks, beaches, etc.) are considered to have comparatively high visual sensitivity. Their views may be of longer duration and higher frequency. **Viewpoints** In order to determine the areas from which aesthetic changes on the project site may be experienced, City and County maps, U.S. Geological Survey quadrangle maps, project maps, and aerial and site photographs were consulted to determine potentially sensitive viewpoints (e.g., residences, travel routes, public parks, or other sensitive viewpoints) within the project area that influence views of the project site and define the visual environment. A field reconnaissance was conducted to verify the general visibility and determined the existing visual quality of the proposed Facility site from the potentially sensitive viewpoints. Photographs were taken with a digital SLR camera from various focal lengths from 27 mm to 105 mm. Photographs were taken of the existing topographic and vegetative features showing both close-in and distant views of the affected adjacent developed, recreation, residential, neighborhood, roadway and river areas. To assess the potential visual impacts resulting from this project, a visual assessment was performed from each viewpoint to identify visual changes to the site from proposed facilities and operations. **Visual Assessment** The visual assessments were based on simulations that illustrate potential impacts caused by the construction and operation of the proposed facilities. Simulated views of the proposed Facility and surrounding landscapes and were developed using the visual inventory photos and 3-D models of the proposed structures. 3-D models were created using a combination of AutoCAD, Google Sketchup Pro, and Adobe Photoshop and were geo-referenced and placed in Google Earth Pro. Perspective views of the 3-D models were generated for each structure using the camera locations used for the inventory photographs. Images exported from the 3-D model were then superimposed over the high-resolution digital photographs to simulate the constructed condition of the built structures and proposed landscape improvements within the existing landscape setting. The digital photographs and the simulations represent before and after images and help describe the visual change associated with this project. No other photo editing or touchup work was done to the simulations. **Visual Impacts** Impacts to visual quality and sensitive viewers were assessed on the changes shown in the visual simulations. Viewer sensitivity was considered within the context of reasonable expectations of those experiencing views of a heavily industrialized area. The assessment of impacts was based on the visual

		simulations of the changes portrayed in each image. The levels of impacts are identified as high, moderate, and low: **High Level of Impact (H) –** assigned in situations in which the facility or operations would be highly visible to a high number of sensitive viewers and would impact the visual quality of the landscape setting negatively. Mitigation measures may or may not provide benefit to this level of impact. **Moderate Level of Impact (M) –** assigned in situations in which the facilities or operations would be visible to a moderate number of sensitive viewers. Moderate impacts may be generally consistent with adjacent land uses and some mitigation may be required to minimize impacts to sensitive viewers. **Low Level of Impact (L) –** assigned in situations in which the facilities or operations would be minimally visible or visual impacts would be difficult to perceive because of distance, compatibility with other existing land uses, or screening or buffering. A project that affects a low number of viewers may be a low level of impact. **Mitigation** Mitigation for the proposed project were developed based on visual assessments and impacts to viewers. Specific measures were developed to minimize visual impacts and standard City of Vancouver development mitigation requirements were included.
VR-2	Provide sources for information on lighting levels provided in Section 4.10.1.4, and clarify how the lighting levels were identified.	The qualitative assessment of the existing lighting levels is based on the author's personal observations and familiarity with the Port and the surrounding land uses. Existing lighting levels observed at the site are the result of the industrial, manufacturing, utility, and transportation land uses listed in Section 4.10.1.4.
VR-3	Provide sources for information on planning lighting and footcandles for proposed fixtures if available.	The American Petroleum Institute (API) 540 – Electrical Installations in Petroleum Process Plants, Section 7 – Lighting, and Illuminating Engineering Society (IES) codes and standards will be used for the basis of design for Facility lighting. Light fixtures will be selected during final project design to achieve the levels of illuminance established by the above listed standards.

Code	Data Request Item	Applicant Response
Socioeconomics		
SE-1	Clarify assumptions used for determining the proportion of expenditures anticipated to occur within the region of analysis.	Within the socioeconomic analysis, the region of analysis is the 10-county region that includes counties with areas that are within a one-hour commute of the Vancouver Energy facility. During the construction phases, labor expenditures are assumed to be made to workers that reside within the 10-county study area. Non-labor expenditures include a mix of spending within and outside the 10-county study area. The geographic pattern of spending is based on the pattern of spending for the new non-residential construction sector that is imbedded within the IMPLAN model. This geographic pattern reflects actual historical spending patterns from non-residential construction in the region based on data collected by the Bureau of Economic Analysis. These past expenditures include a mix of spending within the 10-county region and outside this region. For the operations phases, labor expenditures (reflecting positions listed in Table 3 of the Analysis Group report) are assumed to be made to workers that reside within the 10-county study area. General operating expenditures, local taxes and payments to the Port of Vancouver (as listed in Table 2 of the Analysis Group report) were assumed to be made within the 10-County study area.[4] The geographic pattern of expenditures associated with each of these spending categories reflects the spending patterns for the specific sectors identified in Table 2 of the Analysis Group report. The analysis also assumes that certain expenditures are made to businesses that are outside the study area, including electric utility sales and insurance payments. Detail on these expenditures is not reported in the Analysis Group report.
SE-2	Clarify the proportion of total wages expected to be paid by the Applicant during construction assumed to accrue to workers within the region of analysis.	During the construction phases, all wages paid to workers identified in Table 1 of the Analysis Group report were assumed to occur within the region of analysis. The positions identified in Table 1 include all positions that would be paid directly by the Applicant. During construction, the Applicant would also make expenditures for goods and services that would result in additional employment, which would occur both within and outside the 10-county study area, consistent with embedded assumptions within IMPLAN, as discussed in Response SE-1.

[4] Schatzki, Todd and Bruce Strombom, "Assessment of Vancouver Energy Socioeconomic Impacts: Primary Economic Impacts", July 2014.

Code	Data Request Item	Applicant Response
Cultural Resources		
CR-1	Provide site numbers for sites and isolated finds included in Mapbook K13A Archaeological Resources Oregon Rail Corridor Sheets 5 to 9 and Mapbook K13B Archaeological Resources Oregon Marine Corridor.	The site numbers for sites as shown in Mapbooks K13A and K13B are listed in the following Table. Isolated finds are shown as symbols in Mapbooks K13A and K13B and are included in the following Table from Oregon Archaeology. The following are notes about the Table listing resources shown on Mapbooks K13A and K13B: • Oregon SHPO does not assign trinomials or numbers to isolates. • SHPO does not assign numbers to isolates; they are shown as symbols (dots or polygons). • AINW has an "Other" category listed in the Table to distinguish and separate the sites and isolates from types of resources that are neither sites nor isolates but are notes within the SHPO database (see Table for clarification). • Three Cultural Period categories and a descriptive site type are listed in the Table for each site. • Three Cultural Period categories and a description of the isolate are listed in the Table for each isolate.
CR-2	Provide a table of all sites and isolated finds in the project area and the survey corridor, their description, and their NRHP eligibility status (recommended and determined by SHPO/lead agency).	The descriptions and NRHP eligibility status are included in the following Oregon Archaeology Table.
CR-3	Clarify if the Applicant intends to develop an Unanticipated Discovery Plan and Mitigation Plan to include in the EIS, or if this should these plans should be developed under EFSEC direction.	The Applicant intends to prepare an Inadvertent Discovery Plan and Mitigation Plan. The future submittal of this plan will be coordinated with EFSEC staff.

Oregon Archaeological Resources			Site - Cultural Period			Isolate -Cultural Period			Site Record - Admin Data	Other Admin Data	Burials Associated with Sites	National Register Eligibility	MapBook		Oregon County
Site (Trinomial)	Other	Isolate	Prehistoric	Historic	Multicomponent	Prehistoric	Historic	Multicomponent	Site Type	Description			Book	Sheet	Name
35CLT48			X						Midden			Unevaluated	K13B	7	CLATSOP
35CLT22			X						Midden			Unevaluated	K13B	7	CLATSOP
35CLT34			X						Midden			Listed NRHP	K13B	7	CLATSOP
35CLT33			X						Midden			Unevaluated	K13B	7	CLATSOP
35CLT93				X					Historic Structures			Unevaluated	K13B	7	CLATSOP
35CLT37			X						Village			Listed NRHP	K13B	7	CLATSOP
35CLT95				X					Historic Features			Not Eligible	K13B	7	CLATSOP
35CLT89				X					Historic Features and Debris Scatter			Not Eligible	K13B	7	CLATSOP
35CLT54			X						Midden			Unevaluated	K13B	7	CLATSOP
35CLT2			X						Midden			Unevaluated	K13B	7	CLATSOP
35CLT88				X					Habitation			Unevaluated	K13B	7	CLATSOP
35CLT110				X					Homestead			Not Eligible	K13B	7	CLATSOP
35CLT109				X					Historic Structure			Not Eligible	K13B	7	CLATSOP
35CLT108				X					Homestead			Not Eligible	K13B	7	CLATSOP
35CLT32			X						Campsite			Unevaluated	K13B	7	CLATSOP
35CLT85				X					Military Fort			Listed NRHP	K13B	7	CLATSOP
35CLY106				X					Observation Towers			Not Eligible	K13B	7	CLATSOP
35CLT104				X					Historic Structure			Eligible	K13B	7	CLATSOP
35CLT35			X						Midden			Unevaluated	K13B	7	CLATSOP
	X									Culvert		Unevaluated	K13B	7	CLATSOP
	X									Site reported in this area		Unevaluated	K13B	6	CLATSOP
	X									isolated springboard stump		Unevaluated	K13B	6	CLATSOP
	X									Shipwreck, MASSACHUSETTS 1849		Unevaluated	K13B	7	CLATSOP
	X									Shipwreck, CASTLE 1856		Unevaluated	K13B	7	CLATSOP
	X									Racquette 1953: shipwreck		Unevaluated	K13B	7	CLATSOP
	X									ERRIA 1951: shipwreck		Unevaluated	K13B	7	CLATSOP
	X									STATE OF WASHINGTON 1920: shipwreck		Unevaluated	K13B	7	CLATSOP
	X									Shipwreck: Gleaner 1888		Unevaluated	K13B	7	CLATSOP
	X									possible location of ship timbers		Unevaluated	K13B	7	CLATSOP
	X									possible location of ship timbers		Unevaluated	K13B	7	CLATSOP
	X									Shipwreck, TELEPHONE 1887		Unevaluated	K13B	7	CLATSOP
	X									Shipwreck, Henriette 1901		Unevaluated	K13B	7	CLATSOP
	X									Shipwreck, ARROW 1949		Unevaluated	K13B	7	CLATSOP
	X									Shipwreck, Olento 1949		Unevaluated	K13B	7	CLATSOP
	X									LIGHTSHIP COLOMBIA		Unevaluated	K13B	7	CLATSOP
	X									Shipwreck, MICHIGAN 1890		Unevaluated	K13B	7	CLATSOP
	X									SILVIE DE GRACE 1849 - shipwreck		Unevaluated	K13B	7	CLATSOP
	X									FORT ASTORIA LANDMARK		Unevaluated	K13B	7	CLATSOP
	X									Reported location of Fort George (1813-1818)		Unevaluated	K13B	7	CLATSOP
	X									Santa Adgla 1855 shipwreck		Unevaluated	K13B	7	CLATSOP
	X									Shipwreck, GENERAL MUIL 1955		Unevaluated	K13B	7	CLATSOP
	X									Shipwreck, EVA 1951		Unevaluated	K13B	7	CLATSOP
	X									Shipwreck, Firefly 1854		Unevaluated	K13B	7	CLATSOP
	X									Possible site as per Le Gisen's map		Unevaluated	K13B	7	CLATSOP
	X									Shipwreck - Wellesley 1926		Unevaluated	K13B	7	CLATSOP
	X									Shipwreck, DESOEMONA 1847		Unevaluated	K13B	7	CLATSOP
	X									Shipwreck, WAVERTREE 1904		Unevaluated	K13B	7	CLATSOP
	X									Shipwreck; MULTNOMAH 1929		Unevaluated	K13B	7	CLATSOP
	X									Check with staff to get report. Shipwreck: C Trader sank 1964		Unevaluated	K13B	7	CLATSOP
	X									Shipwreck; HENRIETTA 1860		Unevaluated	K13B	7	CLATSOP
	X									Shipwreck; Electra: 1944		Unevaluated	K13B	7	CLATSOP
	X									Shipwreck, WILLIAM & ANN: 1829		Unevaluated	K13B	7	CLATSOP
	X									Shipwreck, VANCOUVER 1848		Unevaluated	K13B	7	CLATSOP
	X									Shipwreck; SHARK 1846		Unevaluated	K13B	7	CLATSOP
	X									Shipwreck, Isabella: 1830		Unevaluated	K13B	7	CLATSOP
35CO43			X						Village			Unevaluated	K13B	5	COLUMBIA
35CO72			X						Lithic Scatter			Unevaluated	K13B	5	COLUMBIA
35CO66				X					Historic Structures and Debris			Not Eligible	K13B	6	COLUMBIA
35CO18			X						Lithic Scatter			Unevaluated	K13B	6	COLUMBIA
35CO26			X						Village			Unevaluated	K13B	6	COLUMBIA

Site (Trinomial)	Other	Isolate	Prehistoric	Historic	Multicomponent	Prehistoric	Historic	Multicomponent	Site Type	Description			Book	Sheet	Name
35CO27			X						Lithic Scatter			Unevaluated	K13B	6	COLUMBIA
35CO1			X						Village			Unevaluated	K13B	6	COLUMBIA
35CO28			X						Lithic Scatter			Unevaluated	K13B	6	COLUMBIA
35CO67				X					Historic Structures			Not Eligible	K13B	6	COLUMBIA
35CO65				X					Historic Structures			Not Eligible	K13B	6	COLUMBIA
35CO11			X						Campsite			Unevaluated	K13B	6	COLUMBIA
35CO12				X					Habitation			Unevaluated	K13B	6	COLUMBIA
35CO13			X						Lithic Scatter			Unevaluated	K13B	6	COLUMBIA
35CO16			X						Campsite			Unevaluated	K13B	6	COLUMBIA
	X									shipwreck location 175' long w/V shaped bow & oak timbered hull GPS45 43.665		Unevaluated	K13B	5	COLUMBIA
	X									site owned by ODF&W (Alex Beaordeaux 6-24-03)		Unevaluated	K13B	5	COLUMBIA
	X									feature added per Dennis's map of St.Helens		Unevaluated	K13B	5	COLUMBIA
	X									SITE REPORTED THIS AREA		Unevaluated	K13B	5	COLUMBIA
						X				concave base unfluted yet Clovis like spear point recovered in dredge deposits at this location.		Unevaluated	K13B	6	COLUMBIA
	X									LEVEE &DREDGE SAND ALONG SHORE COX & WENGER 1919 COLOMBIA CO. SURVEY		Unevaluated	K13B	6	COLUMBIA
	X									MARCH 27, 1806; possible Lewis & Clark campsite		Unevaluated	K13B	6	COLUMBIA
	X									MARKER (GREEN)		Unevaluated	K13B	6	COLUMBIA
	X									NOVEMBER 5, 1805		Unevaluated	K13B	6	COLUMBIA
	X									wreck on the Columbia		Unevaluated	K13B	6	COLUMBIA
	X									cliffs & bluffs, railroad construction impacts, as per notation on original SHPO map		Unevaluated	K13B	6	COLUMBIA
	X									wreck on the Columbia		Unevaluated	K13B	6	COLUMBIA
	X									MCECK HOUSE		Unevaluated	K13B	6	COLUMBIA
	X									DIKE 10, COVERED WITH SAND		Unevaluated	K13B	6	COLUMBIA
	X									MUSTOLA HOUSE SITE		Unevaluated	K13B	6	COLUMBIA
	X									APRIL 26, 1806, Possible location of Lewis and Clark Camp		Unevaluated	K13B	6	COLUMBIA
	X									904		Unevaluated	K13B	6	COLUMBIA
	X									MARCH 25, 1806; Lewis & Clark Camp location estimate		Unevaluated	K13B	6	COLUMBIA
35GM125									Rock Feature	Unknown cultural period		Unevaluated	K13B	2	GILLIAM
35GM231			X						Rock Feature			Unevaluated	K13B	2	GILLIAM
35GM229			X						Rock Feature			Unevaluated	K13B	2	GILLIAM
35GM10			X						Campsite			Unevaluated	K13B	2	GILLIAM
35GM9			X						Village		X	Unevaluated	K13B	2	GILLIAM
35GM8			X						campsite			Unevaluated	K13B	3	GILLIAM
35GM21			X						Campsite			Unevaluated	K13B	2	GILLIAM
35GM365			X						Rock Feature			Unevaluated	K13B	2	GILLIAM
35GM366			X						Rock Feature			Unevaluated	K13B	2	GILLIAM
35GM351									Rock Feature			Unevaluated	K13B	2	GILLIAM
35GM20			X						Campsite			Unevaluated	K13B	2	GILLIAM
35GM7			X						Campsite			Unevaluated	K13B	3	GILLIAM
35GM352			X						Rock Feature			Unevaluated	K13B	2	GILLIAM
35GM337					X				Rock Feature			Unevaluated	K13B	2	GILLIAM
35GM342			X						Rock Feature			Unevaluated	K13B	2	GILLIAM
35GM340			X						Rock Feature			Unevaluated	K13B	2	GILLIAM
35GM349				X					Quarry			Unevaluated	K13B	2	GILLIAM
35GM6			X						Habitation			Unevaluated	K13B	3	GILLIAM
35GM5			X						Habitation			Unevaluated	K13B	3	GILLIAM
35GM4			X						Lithic Scatter			Unevaluated	K13B	3	GILLIAM
35GM341			X						Rock Feature			Unevaluated	K13B	2	GILLIAM
35GM336			X						Rock Feature			Unevaluated	K13B	2	GILLIAM
35GM344			X						Rock Feature			Unevaluated	K13B	2	GILLIAM
35GM343			X						Rock Feature			Unevaluated	K13B	2	GILLIAM
35GM11			X						Habitation			Unevaluated	K13B	2	GILLIAM
35GM339			X						Rock Feature			Unevaluated	K13B	2	GILLIAM
35GM338			X						Rock Feature			Unevaluated	K13B	2	GILLIAM
35GM355			X						Rock Feature			Unevaluated	K13B	2	GILLIAM
35GM354			X						Rock Feature			Unevaluated	K13B	2	GILLIAM
35GM353			X						Rock Feature			Unevaluated	K13B	2	GILLIAM
35GM350			X						Rock Feature			Unevaluated	K13B	2	GILLIAM
35GM359				X					Road			Unevaluated	K13B	2	GILLIAM
35GM24			X						Rock Shelter			Unevaluated	K13B	3	GILLIAM
35GM12			X						Campsite			Unevaluated	K13B	2	GILLIAM

Site (Trinomial)	Other	Isolate	Prehistoric	Historic	Multicomponent	Prehistoric	Historic	Multicomponent	Site Type	Description			Book	Sheet	Name
35GM1			X						Cemetery		X	Unevaluated	K13B	3	GILLIAM
35GM95					X				Lithic Scatter			Unevaluated	K13B	3	GILLIAM
35GM17			X						Habitation			Unevaluated	K13B	3	GILLIAM
35GM2			X						Campsite			Unevaluated	K13B	3	GILLIAM
35GM74			X						Lithic Scatter			Unevaluated	K13B	3	GILLIAM
35GM73			X						Lithic Scatter			Unevaluated	K13B	3	GILLIAM
35GM23			X						Rock Shelter			Unevaluated	K13B	3	GILLIAM
35GM3			X						Lithic Scatter			Unevaluated	K13B	3	GILLIAM
35GM16			X						Habitation			Unevaluated	K13B	2	GILLIAM
35GM15			X						Habitation			Unevaluated	K13B	2	GILLIAM
35GM360				X					Road			Unevaluated	K13B	2	GILLIAM
35GM14			X						Campsite			Unevaluated	K13B	2	GILLIAM
35GM13			X						Lithic Scatter			Unevaluated	K13B	2	GILLIAM
35GM141				X					Debris Scatter			Unevaluated	K13B	2	GILLIAM
35GM18									Unknown			Unevaluated	K13B	2	GILLIAM
35GM359				X					Road			Unevaluated	K13B	2	GILLIAM
35GM345				X					Debris Scatter			Unevaluated	K13B	2	GILLIAM
35GM364				X					Road			Unevaluated	K13B	2	GILLIAM
		X				X				Two CCS flakes		Not Eligible	K13B	2	GILLIAM
		X			X					Rock Cairn		Not Eligible	K13B	2	GILLIAM
35HR121			X						Lithic Scatter			Unevaluated	K13B	4	HOOD RIVER
35HR23					X				Lithic and Debris Scatter			Unevaluated	K13B	4	HOOD RIVER
35HR74				X					Historic Features and Debris Scatter			Unevaluated	K13B	4	HOOD RIVER
35HR22			X						Lithic Scatter			Unevaluated	K13B	4	HOOD RIVER
35HR4			X						Campsite			Unevaluated	K13B	4	HOOD RIVER
35HR97					X				Habitation		X	Unevaluated	K13B	4	HOOD RIVER
35HR123				X					Historic Features and Debris Scatter			Unevaluated	K13B	4	HOOD RIVER
35HR76				X					Debris Scatter			Unevaluated	K13B	4	HOOD RIVER
35HR75				X					Debris Scatter			Unevaluated	K13B	4	HOOD RIVER
35HR14			X						Campsite			Unevaluated	K13B	4	HOOD RIVER
35HR131				X					Debris Scatter			Unevaluated	K13B	4	HOOD RIVER
35HR21			X						Quarry			Unevaluated	K13B	4	HOOD RIVER
35HR142				X					Homestead			Not Eligible	K13B	4	HOOD RIVER
35HR132				X					Campsite/Historic Features			Unevaluated	K13B	4	HOOD RIVER
35HR129				X					Debris Scatter			Unevaluated	K13B	4	HOOD RIVER
35HR128				X					Wagon Road			Eligible	K13B	4	HOOD RIVER
35HR86				X					Historic Features and Debris Scatter			Unevaluated	K13B	4	HOOD RIVER
35HR130				X					Historic Features and Debris Scatter			Unevaluated	K13B	4	HOOD RIVER
35HR118				X					Transportation			Unevaluated	K13B	4	HOOD RIVER
35HR127				X					Homestead			Unevaluated	K13B	4	HOOD RIVER
35HR141				X					Debris Scatter			Not Eligible	K13B	4	HOOD RIVER
35HR124				X					Road			Not Eligible	K13B	4	HOOD RIVER
35HR126				X					Road			Unevaluated	K13B	4	HOOD RIVER
35HR150				X					Debris Scatter			Unevaluated	K13B	4	HOOD RIVER
35HR125				X					Homestead			Unevaluated	K13B	4	HOOD RIVER
35HR65				X					Historic Features and Debris Scatter			Not Eligible	K13B	4	HOOD RIVER
35HR98				X					Debris Scatter			Unevaluated	K13B	4	HOOD RIVER
35HR92				X					Debris Scatter			Not Eligible	K13B	4	HOOD RIVER
35HR66				X					Habitation			Unevaluated	K13B	4	HOOD RIVER
35HR133				X					Historic Structure			Unevaluated	K13B	4	HOOD RIVER
35HR95				X					Homestead			Unevaluated	K13B	4	HOOD RIVER
35HR117				X					Transmission Line			Not Eligible	K13B	4	HOOD RIVER
35HR134				X					Historic Structures			Unevaluated	K13B	4	HOOD RIVER
35HR96				X					Historic Structures			Unevaluated	K13B	4	HOOD RIVER
35HR94				X					Debris Scatter			Not Eligible	K13B	4	HOOD RIVER
35HR135				X					Rock Features			Unevaluated	K13B	4	HOOD RIVER
35HR140				X					Homestead			Unevaluated	K13B	4	HOOD RIVER
35HR85					X				Lithic and Debris Scatter			Unevaluated	K13B	4	HOOD RIVER
	X									Car Dump Site		Not Eligible	K13B	4	HOOD RIVER
		X					X			5 metal cans		Not Eligible	K13B	4	HOOD RIVER
	X									UNKNOWN		Not Eligible	K13B	4	HOOD RIVER

Site (Trinomial)	Other	Isolate	Prehistoric	Historic	Multicomponent	Prehistoric	Historic	Multicomponent	Site Type	Description			Book	Sheet	Name
	X									Wells Island Historic Site		Unevaluated	K13B	4	HOOD RIVER
	X									Reported village site (Marge Dryden 1-27-2014)		Unevaluated	K13B	4	HOOD RIVER
	X									Reported Native American village site (Lewis & Clark) [Marge Dryden 1-27-2014]		Unevaluated	K13B	4	HOOD RIVER
	X						X			Automobile fender		Not Eligible	K13B	4	HOOD RIVER
	X									UNKNOWN SEE REPORT		Unevaluated	K13B	4	HOOD RIVER
		X					X			Rail tie		Unevaluated	K13B	4	HOOD RIVER
		X					X			oil can		Not Eligible	K13B	4	HOOD RIVER
		X					X			ceramic chamber pot, oil can		Unevaluated	K13B	4	HOOD RIVER
	X									Structure from 1934 USGS map and 1939 photo		Unevaluated	K13B	4	HOOD RIVER
	X									4 historic graves; relatives of Virginia Emerson. Note in OPRD files		Unevaluated	K13B	4	HOOD RIVER
		X					X			horse or mule shoe and canning far lid		Not Eligible	K13B	4	HOOD RIVER
		X					X			Model T fender		Not Eligible	K13B	4	HOOD RIVER
		X					X			porcelain fragment		Not Eligible	K13B	4	HOOD RIVER
		X					X			5 cut nails		Not Eligible	K13B	4	HOOD RIVER
		X								porcelain fragment		Not Eligible	K13B	4	HOOD RIVER
		X					X			automobile dashboard/firewall with Stewart-Warner fuel pump		Not Eligible	K13B	4	HOOD RIVER
		X				X				flake, ccs		Unevaluated	K13B	4	HOOD RIVER
		X					X			cut nail fragment		Not Eligible	K13B	4	HOOD RIVER
35MW4			X						Lithic Scatter			Unevaluated	K13B	2	MORROW
35MW236			X						Lithic Scatter			Unevaluated	K13B	2	MORROW
35MW238			X						Rock Feature			Unevaluated	K13B	2	MORROW
35MW237				X					Road			Unevaluated	K13B	2	MORROW
35MW5			X						Campsite			Unevaluated	K13B	2	MORROW
35MW6			X						Campsite			Unevaluated	K13B	2	MORROW
35MW8			X						Campsite			Unevaluated	K13B	2	MORROW
35MW7			X						Rock Art			Unevaluated	K13B	2	MORROW
35MW9			X						Campsite			Unevaluated	K13B	2	MORROW
35MW218				X					Townsite			Unevaluated	K13B	2	MORROW
35MW219				X					Road			Unevaluated	K13B	2	MORROW
35MW10			X						Midden			Unevaluated	K13B	2	MORROW
35MW205			X						Lithic Scatter			Unevaluated	K13B	2	MORROW
35MW244				X					Homestead			Unevaluated	K13B	2	MORROW
35MW243				X					Cemetery		X	Unevaluated	K13B	2	MORROW
35MW214				X					Transportation			Unevaluated	K13B	1	MORROW
35MW3			X						Lithic Scatter			Unevaluated	K13B	1	MORROW
35MW13			X						Campsite/Lithic Scatter			Unevaluated	K13B	1	MORROW
35MW47			X						Campsite/Lithic Scatter			Not Eligible	K13B	1	MORROW
35MW48			X						Campsite/Lithic Scatter			Unevaluated	K13B	1	MORROW
35MW2			X						Campsite			Unevaluated	K13B	1	MORROW
35MW1			X						Campsite/Midden			Unevaluated	K13B	1	MORROW
35MW44			X						Campsite/Lithic Scatter			Unevaluated	K13B	1	MORROW
35MW35			X						Lithic Scatter			Unevaluated	K13B	1	MORROW
35MW34			X						Lithic Scatter			Unevaluated	K13B	1	MORROW
35MW33			X						Lithic Scatter			Unevaluated	K13B	1	MORROW
35MW36			X						Lithic Scatter			Unevaluated	K13B	1	MORROW
35MW212			X						Lithic Scatter			Unevaluated	K13B	1	MORROW
35MW37			X						Lithic Scatter			Unevaluated	K13B	1	MORROW
35MW41			X						Lithic Scatter			Unevaluated	K13B	1	MORROW
35MW181			X						Lithic Scatter			Unevaluated	K13B	1	MORROW
35MW11			X						Campsite/Midden			Unevaluated	K13B	1	MORROW
35MW42			X						Lithic Scatter			Unevaluated	K13B	1	MORROW
35MW182			X						Rock Feature			Unevaluated	K13B	1	MORROW
35MW12			X						Lithic Scatter			Unevaluated	K13B	1	MORROW
35MW40			X						Lithic Scatter			Unevaluated	K13B	1	MORROW
35MW39			X						Lithic Scatter			Unevaluated	K13B	1	MORROW
		X					X			2 glass insulators & 1 bottle base		Not Eligible	K13B	1	MORROW
	X									Human remains found in 1997 (Umatilla Tribe has details)		Unevaluated	K13B	1	MORROW
		X				X				flake, obs.		Not Eligible	K13B	1	MORROW
	X									Human jaw found in 1997 associated with NRCS project. (Umatilla Tribe shared info on 8-20-2014)		Unevaluated	K13B	1	MORROW
	X									OCTOBER 19, 1805; Lewis & Clark campsite		Unevaluated	K13B	1	MORROW
	X									20th century farmstead w/irrigation system		Unevaluated	K13B	1	MORROW

Site (Trinomial)	Other	Isolate	Prehistoric	Historic	Multicomponent	Prehistoric	Historic	Multicomponent	Site Type	Description			Book	Sheet	Name
		X				X				1 CCS flake fragment, collected		Not Eligible	K13B	1	MORROW
		X				X				isolate flake		Not Eligible	K13B	2	MORROW
	X									townsite of Castle Rock, Oregon, is inundated by Lake Umatilla		Unevaluated	K13B	2	MORROW
35MU124				X					Historic Feature			Unevaluated	K13B	5	MULTNOMAH
35MU165					X				Historic Features and Debris Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU166				X					Fishwheel			Unevaluated	K13B	5	MULTNOMAH
35MU187				X					Historic Features and Debris Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU188				X					Historic Features and Debris Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU219			X						Burial		X	Unevaluated	K13B	5	MULTNOMAH
35MU89					X				Campsite and Historic Features			Unevaluated	K13B	5	MULTNOMAH
35MU157				X					Historic Features			Unevaluated	K13B	5	MULTNOMAH
35MU76			X						Campsite		X	Unevaluated	K13B	5	MULTNOMAH
35MU106			X						Lithic Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU70			X						Campsite/Village			Unevaluated	K13B	5	MULTNOMAH
35MU37			X						Campsite			Unevaluated	K13B	5	MULTNOMAH
35MU24			X						Village		X	Eligible	K13B	5	MULTNOMAH
35MU27			X						Burial		X	Unevaluated	K13B	5	MULTNOMAH
35MU159				X					Debris Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU107				X					Hearth and Debris Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU132					X				Campsite and Lithic Scatter		X	Unevaluated	K13B	5	MULTNOMAH
35MU131				X					Historic Features and Debris Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU30			X						Habitation			Unevaluated	K13B	5	MULTNOMAH
35MU130					X				Lithic and Debris Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU108			X						Lithic Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU78			X						Habitation			Unevaluated	K13B	5	MULTNOMAH
35MU161				X					Homestead			Unevaluated	K13B	5	MULTNOMAH
35MU158				X					Habitation			Unevaluated	K13B	5	MULTNOMAH
35MU167				X					Historic Features and Debris Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU185				X					Homestead			Unevaluated	K13B	5	MULTNOMAH
35MU87					X				Lithic and Debris Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU86					X				Features; Lithic and Debris Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU174				X					Historic Features and Debris Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU141				X					Historic Features and Debris Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU245				X					Historic Features			Unevaluated	K13B	5	MULTNOMAH
35MU176				X					Historic Camp			Unevaluated	K13B	5	MULTNOMAH
35MU96					X				Lithic and Debris Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU92					X				Lithic and Debris Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU175				X					Debris Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU221									Historic Feature			Unevaluated	K13B	5	MULTNOMAH
35MU160									Historic Features and Debris Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU88			X						Lithic Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU94					X				Lithic and Debris Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU164				X					Debris Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU163				X					Debris Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU55			X						Lithic Scatter			Unevaluated	K13B	4	MULTNOMAH
35MU177				X					Historic Features and Debris Scatter			Unevaluated	K13B	4	MULTNOMAH
35MU178					X				Lithic and Debris Scatter			Unevaluated	K13B	4	MULTNOMAH
35MU75					X				Lithic and Historic Debris			Unevaluated	K13B	4	MULTNOMAH
35MU91			X						Lithic Scatter			Unevaluated	K13B	4	MULTNOMAH
35MU95					X				Lithic and Debris Scatter			Unevaluated	K13B	4	MULTNOMAH
35MU90					X				Lithics and Historic Features/Debris			Unevaluated	K13B	4	MULTNOMAH
35MU179				X					Debris Scatter			Unevaluated	K13B	4	MULTNOMAH
35MU156					X				Lithics and Historic Features/Debris			Unevaluated	K13B	4	MULTNOMAH
35MU180				X					Debris Scatter			Unevaluated	K13B	4	MULTNOMAH
35MU155				X					Historic Features and Debris Scatter			Unevaluated	K13B	4	MULTNOMAH
35MU181				X					Historic Features			Unevaluated	K13B	4	MULTNOMAH
35MU184				X					Historic Features			Unevaluated	K13B	4	MULTNOMAH
35MU182				X					Historic Features			Unevaluated	K13B	4	MULTNOMAH
35MU16			X						Campsite/Village			Unevaluated	K13B	5	MULTNOMAH

Site (Trinomial)	Other	Isolate	Prehistoric	Historic	Multicomponent	Prehistoric	Historic	Multicomponent	Site Type	Description			Book	Sheet	Name
35MU74					X				Lithics and Historic Features/Debris			Unevaluated	K13B	4	MULTNOMAH
35MU186				X					Debris Scatter			Unevaluated	K13B	4	MULTNOMAH
35MU183				X					Fishwheel			Unevaluated	K13B	4	MULTNOMAH
35MU154					X				Lithic and Debris Scatter; Historic Features			Unevaluated	K13B	4	MULTNOMAH
35MU53					X				Lithics and Historic Features/Debris			Unevaluated	K13B	4	MULTNOMAH
35MU153				X					Historic Features			Unevaluated	K13B	4	MULTNOMAH
35MU151					X				Lithics and Historic Features/Debris			Unevaluated	K13B	4	MULTNOMAH
35MU152					X				Lithics and Historic Features/Debris			Unevaluated	K13B	4	MULTNOMAH
35MU150					X				Lithics and Historic Features/Debris			Unevaluated	K13B	4	MULTNOMAH
35MU149				X					Historic Feature			Unevaluated	K13B	4	MULTNOMAH
35MU138					X				Lithic and Debris Scatter			Unevaluated	K13B	4	MULTNOMAH
35MU143				X					Historic Features			Unevaluated	K13B	4	MULTNOMAH
35MU142					X				Historic Features and Lithic Scatter			Unevaluated	K13B	4	MULTNOMAH
35MU93					X				Lithic and Debris Scatter			Unevaluated	K13B	4	MULTNOMAH
35MU144				X					Historic Features			Unevaluated	K13B	4	MULTNOMAH
35MU145				X					Historic Features			Unevaluated	K13B	4	MULTNOMAH
35MU73			X						Lithic Scatter			Unevaluated	K13B	4	MULTNOMAH
35MU146				X					Historic Features			Unevaluated	K13B	4	MULTNOMAH
35MU148				X					Historic Features			Unevaluated	K13B	4	MULTNOMAH
35MU147				X					Historic Features			Unevaluated	K13B	4	MULTNOMAH
35MU139				X					Fishwheel			Unevaluated	K13B	4	MULTNOMAH
35MU140				X					Fishwheel			Unevaluated	K13B	4	MULTNOMAH
35MU125					X				Historic Features			Unevaluated	K13B	4	MULTNOMAH
35MU198				X					Guard Station			Unevaluated	K13B	4	MULTNOMAH
35MU14			X						Lithic Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU13			X						Lithic Scatter			Unevaluated	K13B	5	MULTNOMAH
35MU2				X					Village			Unevaluated	K13B	5	MULTNOMAH
	X									Possible campsite of Lewis and Clark, NOVEMBER 2, 1805		Unevaluated	K13B	5	MULTNOMAH
	X									Possible camp of Lewis and Clark, APRIL 19 1806		Unevaluated	K13B	4	MULTNOMAH
		X				X				1 quartzite flake; isolate form not included in the report		Not Eligible	K13B	4	MULTNOMAH
	X									Possible Lewis and Clark Camp APRIL 7-8, 1806		Unevaluated	K13B	5	MULTNOMAH
	X									Human remains found 5-18-2007; Marge Dryden CRGNSA	X	Unevaluated	K13B	5	MULTNOMAH
	X									Human remains from Section 8 5/18/2007 discovery reinterred here on 6-1	X	Unevaluated	K13B	5	MULTNOMAH
		X				X				banded net weight, cobble choppe; isolate form not included in the report		Not Eligible	K13B	5	MULTNOMAH
	X									Mist Creek Cabin		Unevaluated	K13B	5	MULTNOMAH
		X				X				1 flaked jasper core; isolate form not included in the report		Not Eligible	K13B	5	MULTNOMAH
		X				X				4 flaked pebbles, collected; isolate form not included in the report		Not Eligible	K13B	5	MULTNOMAH
		X					X			twisted cable; site form not included in the report		Unevaluated	K13B	5	MULTNOMAH
	X						X			Two pieces of riveted metal pipe		Not Eligible	K13B	5	MULTNOMAH
	X						X			Two portions of large metal pipes		Not Eligible	K13B	5	MULTNOMAH
		X					X			Three ceramic fragments and milk glass fragment		Not Eligible	K13B	5	MULTNOMAH
	X									Structures indicated in 1939 and 1955 Aerial photos		Unevaluated	K13B	5	MULTNOMAH
	X									Former structures and cleared areas 1939 Aerial photo		Unevaluated	K13B	5	MULTNOMAH
	X									Former structures and cleared areas 1939 Aerial photo		Unevaluated	K13B	5	MULTNOMAH
	X									Possible floating dock 1939 aerial photo		Unevaluated	K13B	5	MULTNOMAH
		X								Area of structures and orchards in 1939 photo		Unevaluated	K13B	5	MULTNOMAH
		X					X			glass canning jar, collected		Not Eligible	K13B	5	MULTNOMAH
		X				X				Side notched P/P		Unevaluated	K13B	5	MULTNOMAH
	X									Possible Lewis & Clark Camp November 3, 1805		Unevaluated	K13B	5	MULTNOMAH
		X				X				FCR, broken P/P preform, historic ceramics		Not Eligible	K13B	5	MULTNOMAH
		X					X			White ceramics and cut nails		Not Eligible	K13B	5	MULTNOMAH
	X									NOVENMBER 3, 1805		Unevaluated	K13B	5	MULTNOMAH
							X			insulator- telephone style		Not Eligible	K13B	5	MULTNOMAH
		X				X				3 flakes; 2 ccs, 1 basalt		Not Eligible	K13B	5	MULTNOMAH
	X									Lemon Homestead		Unevaluated	K13B	5	MULTNOMAH
	X									wreck on the Columbia		Unevaluated	K13B	5	MULTNOMAH
	X									wreck on the Columbia		Unevaluated	K13B	5	MULTNOMAH
	X									wreck on the Columbia		Unevaluated	K13B	5	MULTNOMAH
	X									wreck on the Columbia		Unevaluated	K13B	5	MULTNOMAH
35SH105			X						Lithic Scatter			Unevaluated	K13B	3	SHERMAN
35SH120			X						Lithic Scatter			Unevaluated	K13B	3	SHERMAN
35SH167			X						Quarry			Unevaluated	K13B	3	SHERMAN

Site (Trinomial)	Other	Isolate	Prehistoric	Historic	Multicomponent	Prehistoric	Historic	Multicomponent	Site Type	Description			Book	Sheet	Name
35SH121			X						Quarry			Unevaluated	K13B	3	SHERMAN
35SH123			X						Rock Shelter			Unevaluated	K13B	3	SHERMAN
35SH122			X						Lithic Cache			Unevaluated	K13B	3	SHERMAN
35SH168					X				Lithic & Debris Scatter			Unevaluated	K13A & K13B	7 & 3	SHERMAN
35SH119			X						Quarry			Unevaluated	K13B	3	SHERMAN
35SH154			X						Camp Site			Not Eligible	K13B	3	SHERMAN
35SH152			X						Village			Eligible	K13B	3	SHERMAN
35SH111			X						Rock Art			Unevaluated	K13B	3	SHERMAN
35SH6			X						SHPO notes no artifacts			Unevaluated	K13B	3	SHERMAN
35SH2			X						Habitation			Unevaluated	K13B	3	SHERMAN
35SH1			X						Village		X	Unevaluated	K13B	3	SHERMAN
	X									Reported lithic material found on 2-6-2010 by Officer Christine Tegner CRITFE		Unevaluated	K13B	3	SHERMAN
	X									5 hunting blinds; flakes		Unevaluated	K13B	3	SHERMAN
		X				X				2 CCS Flakes		Not Eligible	K13B	3	SHERMAN
		X				X				One obsidian flake		Not Eligible	K13B	3	SHERMAN
35UM68			X						Lithic Scatter			Unevaluated	K13B	1	UMATILLA
35UM69					X				Camp Site		X	Unevaluated	K13B	1	UMATILLA
35UM14					X				Village		X	Unevaluated	K13B	1	UMATILLA
35UM1					X				Village		X	Listed NRHP	K13B	1	UMATILLA
35UM6			X						Rock Shelter			Unevaluated	K13B	1	UMATILLA
35UM5			X						Camp Site			Unevaluated	K13B	1	UMATILLA
35UM4			X						Habitation/Midden			Unevaluated	K13B	1	UMATILLA
35UM424				X					Debris Scatter			Not Eligible	K13B	1	UMATILLA
35UM358				X								Debris Scatter	K13B	1	UMATILLA
35UM451				X					Other			Unevaluated	K13B	1	UMATILLA
35UM64			X						Lithic Scatter			Unevaluated	K13B	1	UMATILLA
35UM58			X						Habitation		X	Eligible		1	UMATILLA
35UM425				X					Debris Scatter			Not Eligible	K13B	1	UMATILLA
35UM13			X						Village		X	Unevaluated	K13B	1	UMATILLA
35UM450				X					Other			Unevaluated	K13B	1	UMATILLA
35UM18			X						Burial		X	Unevaluated	K13B	1	UMATILLA
35UM8			X						Camp Site			Unevaluated	K13B	1	UMATILLA
35UM9			X						Camp Site			Unevaluated	K13B	1	UMATILLA
35UM10			X						Habitation/Midden			Unevaluated	K13B	1	UMATILLA
35UM7			X						Habitation/Pithouses			Unevaluated	K13B	1	UMATILLA
35UM3			X						Camp Site			Unevaluated	K13B	1	UMATILLA
35UM2			X						Camp Site			Unevaluated	K13B	1	UMATILLA
35UM17			X						Village		X	Unevaluated	K13B	1	UMATILLA
35UM20			X						Camp Site		X	Unevaluated	K13B	1	UMATILLA
35UM21					X				Camp Site			Unevaluated	K13B	1	UMATILLA
35UM19			X						Camp Site			Unevaluated	K13B	1	UMATILLA
35UM16			X						Camp Site			Unevaluated	K13B	1	UMATILLA
35UM12			X						Camp Site			Unevaluated	K13B	1	UMATILLA
35UM15			X						Habitation			Unevaluated	K13B	1	UMATILLA
		X					X			2 iron bars, possible drill bits associated w/corner markers		Not Eligible	K13B	1	UMATILLA
		X					X			Schlitz beer can circa 1951		Not Eligible	K13B	1	UMATILLA
		X					X			machine cut 10d square-headed nail		Not Eligible	K13B	1	UMATILLA
		X				X				2 - 9 basalt broken flakes		Not Eligible	K13B	1	UMATILLA
		X					X			Parker Ink Bottle		Not Eligible	K13B	1	UMATILLA
		X				X				primary basalt broken flake		Not Eligible	K13B	1	UMATILLA
		X				X				primary basalt broken flake		Not Eligible	K13B	1	UMATILLA
		X					X			colorless bottle base with Owens Illinois mark dating prior to 1954		Not Eligible	K13B	1	UMATILLA
		X					X			brown bottle base with Anchor Hocking mark manufactured in 1942		Not Eligible	K13B	1	UMATILLA
	X						X			Oregon Railway and Navigation Company		Unevaluated	K13B	1	UMATILLA
	X									ERODING SKELETAL REMAINS 7/24/97		Unevaluated	K13B	1	UMATILLA
		X				X				Isolated find: flakes & bone fragments		Not Eligible	K13B	1	UMATILLA
		X				X				Isolated find: 3 flakes		Not Eligible	K13B	1	UMATILLA
	X									Inadvertent Discovery of Human Remains (left female humorus) 1 mile east of sand station park, across fro		Unevaluated	K13B	1	UMATILLA
		X		X						3 brown glazed stoneware fragments, 1 amber glass fragment		Not Eligible	K13B	1	UMATILLA
35WS573					X				Lithic and Debris Scatter			Unevaluated	K13B	3	WASCO
35WS389					X				Lithic and Debris Scatter			Unevaluated	K13B	3	WASCO

Site (Trinomial)	Other	Isolate	Prehistoric	Historic	Multicomponent	Prehistoric	Historic	Multicomponent	Site Type	Description			Book	Sheet	Name
35WS520									Historic Structure Remains			Not Eligible	K13B	4	WASCO
35WS453				X					Debris Scatter & Historic Remains			Eligible	K13B	4	WASCO
35WS620				X					Debris Scatter & Historic Remains			Unevaluated	K13B	4	WASCO
35WS591			X						Lithic Scatter			Unevaluated	K13A & K13B	7 & 4	WASCO
35WS572			X						Lithic Scatter			Unevaluated	K13B	3	WASCO
35WS429					X				Lithic and Debris Scatter			Unevaluated	K13B	3	WASCO
35WS428			X						Lithic Scatter			Unevaluated	K13B	3	WASCO
35WS351					X				Lithic and Debris Scatter		X	Eligible	K13B	3	WASCO
35WS354					X				Lithic and Debris Scatter			Unevaluated	K13B	3	WASCO
35WS606				X					Homestead & Shaker Church			Unevaluated	K13B	3	WASCO
35WS441									Fishwheel			Unevaluated	K13B	3	WASCO
35WS247					X				Village			Eligible	K13B	3	WASCO
35WS388				X					Debris Scatter			Unevaluated	K13B	3	WASCO
35WS141			X						Rock Art			Unevaluated	K13B	3	WASCO
35WS138			X						Lithic Scatter			Unevaluated	K13B	3	WASCO
35WS137				X					Fishwheel			Unevaluated	K13B	3	WASCO
35WS355					X				Lithic Scatter and Historic Features			Eligible	K13B	3	WASCO
35WS1			X						Village			Unevaluated	K13A & K13B	7 & 3	WASCO
35WS5			X						Burial		X	Unevaluated	K13B	3	WASCO
35WS420			X						Lithic Scatter			Unevaluated	K13B	3	WASCO
35WS421			X						Lithic Scatter			Unevaluated	K13B	3	WASCO
35WS360					X				Lithic Scatter and Historic Features			Unevaluated	K13B	3	WASCO
35WS15			X						Lithic Scatter			Not Eligible	K13A & K13B	7 & 4	WASCO
35WS357			X						Lithic Scatter			Unevaluated	K13B	3	WASCO
35WS139			X						Lithic Scatter			Unevaluated	K13A & K13B	7 & 3	WASCO
35WS358			X						Lithic Scatter			Unevaluated	K13B	3	WASCO
35WS8			X						Village			Listed NRHP	K13B	3	WASCO
35WS143					X				Lithic and Debris Scatter			Unevaluated	K13B	3	WASCO
35WS222			X						Rock Art			Unevaluated	K13B	3	WASCO
35WS140			X						Lithic Scatter			Unevaluated	K13B	3	WASCO
35WS532				X					Debris Scatter			Unevaluated	K13A & K13B	7 & 4	WASCO
35WS136			X						Lithic Scatter			Unevaluated	K13B	3	WASCO
35WS14			X						Village			Eligible	K13A & K13B	7 & 4	WASCO
35WS531				X					Historic Features			Unevaluated	K13B	4	WASCO
35WS218			X						Village		X	Unevaluated	K13A & K13B	7 & 4	WASCO
35WS242			X						Lithic Scatter			Not Eligible	K13B	4	WASCO
35WS361					X				Village			Unevaluated	K13B	3	WASCO
35WS390			X						Rock Art			Unevaluated	K13B	4	WASCO
35WS439				X					Homestead			Eligible	K13B	4	WASCO
35WS387				X					Historic Features and Debris Scatter			Unevaluated	K13B	4	WASCO
35WS503				X					Historic Structure			Unevaluated	K13B	4	WASCO
35WS219			X						Lithic Scatter			Unevaluated	K13B	4	WASCO
35WS221			X						Burial		X	Eligible	K13B	4	WASCO
35WS353			X						Sacred Site		X	Unevaluated	K13B	3	WASCO
35WS135			X						Lithic Scatter			Unevaluated	K13B	3	WASCO
35WS136			X						Lithic Scatter			Unevaluated	K13B	3	WASCO
35WS359				X					Debis Scatter			Unevaluated	K13B	3	WASCO
35WS356				X					Fish Drying		X	Unevaluated	K13B	3	WASCO
35WS384				X					Homestead			Unevaluated	K13B	4	WASCO
35WS142					X				Lithic and Debris Scatter			Unevaluated	K13B	3	WASCO
35WS440				X					Debris Scatter			Unevaluated	K13B	4	WASCO
35WS241			X						Lithic Scatter			Unevaluated	K13B	4	WASCO
35WS220					X				Lithic and Debris Scatter			Eligible	K13B	4	WASCO
35WS274			X						Rock Features		X	Listed NRHP	K13B	4	WASCO
35WS581				X					Historic Habitation/Compound			Unevaluated	K13B	4	WASCO
35WS444				X					Debris Scatter			Unevaluated	K13B	4	WASCO
35WS256					X				Lithic Scatter			Unevaluated	K13B	4	WASCO
35WS217					X				Burial		X	Unevaluated	K13B	4	WASCO
35WS13			X						Lithic Scatter			Unevaluated	K13B	4	WASCO
	X									Refer to report for details on feature: Cultural Resource Overview and Survey of Select Parcels in The Dalles		Unevaluated	K13B	3	WASCO

Site (Trinomial)	Other	Isolate	Prehistoric	Historic	Multicomponent	Prehistoric	Historic	Multicomponent	Site Type	Description			Book	Sheet	Name
	X									Refer to report for details on feature: Cultural Resource Overview and Survey of Select Parcels in The Dalles		Unevaluated	K13B	3	WASCO
	X									Refer to report for details on feature: Cultural Resource Overview and Survey of Select Parcels in The Dalles		Unevaluated	K13B	3	WASCO
	X									Refer to report for details on feature: Cultural Resource Overview and Survey of Select Parcels in The Dalles		Unevaluated	K13B	3	WASCO
	X									Refer to report for details on feature: Cultural Resource Overview and Survey of Select Parcels in The Dalles		Unevaluated	K13B	3	WASCO
	X									Refer to report for details on feature: Cultural Resource Overview and Survey of Select Parcels in The Dalles		Unevaluated	K13B	3	WASCO
	X									Refer to report for details on feature: Cultural Resource Overview and Survey of Select Parcels in The Dalles		Unevaluated	K13B	4	WASCO
	X							X		5 beer cans, 1 lithic flake		Not Eligible	K13B	4	WASCO
		X				X				Isolate; 1 CCS uniface, 2 CCS flakes		Unevaluated	K13B	4	WASCO
		X						X		Isolate; 5 flakes & 2 unknown metal fragments		Unevaluated	K13B	4	WASCO
		X				X				Isolate: 4 flakes		Unevaluated	K13B	4	WASCO
	X									displaced historic refuse scatter on fill		Not Eligible	K13B	4	WASCO
	X									Possible Lewis and Clark Camp, OCTOBER 25-29, 1805		Unevaluated	K13B	4	WASCO
		X				X				Isolate: 2 ccs flakes and one basalt hammerstone		Unevaluated	K13B	4	WASCO
	X									Burned bone fragments & deer tooth		Unevaluated	K13B	4	WASCO
	X									MARKER, October 28, 1825, Possible location of Lewis & Clark camp		Unevaluated	K13B	4	WASCO
	X									Possible burials as per Le Gislen's map	X	Unevaluated	K13B	4	WASCO
		X					X			Isolate; old apple trees; washing machine		Not Eligible	K13B	4	WASCO
		X				X				chert core		Not Eligible	K13B	4	WASCO
		X				X				Isolate; flake, chert		Not Eligible	K13B	4	WASCO
	X									Historic apple tree and concrete foundation; refuse		Unevaluated	K13B	4	WASCO
	X									gec+gec-av:ethnographic village opposite Klickitat		Unevaluated	K13B	4	WASCO
		X					X			Boiler		Not Eligible	K13B	4	WASCO
	X									basalt hammerstone & Concrete footpath, concrete box, clay tile fragments and historic refuse		Unevaluated	K13B	4	WASCO
		X					X			Pipes		Unevaluated	K13B	4	WASCO
	X									Rowena Dell Rock Wall site; historic rock wall		Unevaluated	K13B	4	WASCO
	X									Rim Rock Wall		Unevaluated	K13B	4	WASCO
	X									Serpentine Rock Wall Site; Rock wall		Unevaluated	K13B	4	WASCO
	X									Ditto-Rock Wall Site; Rock Wall		Unevaluated	K13B	4	WASCO
	X									Old Car Site; Car and parts and historic refuse		Unevaluated	K13B	4	WASCO
	X									Universal Breadmaker Site; Rock wall and historic refuse scatter		Unevaluated	K13B	4	WASCO
	X									Rowena Lithic Scatter		Unevaluated	K13B	4	WASCO
	X									Bread Pan Rock Wall		Unevaluated	K13B	4	WASCO
	X									011 Rock Wall-poison oak Site		Unevaluated	K13B	4	WASCO
	X									Hollow Cairn Site		Unevaluated	K13B	4	WASCO
	X									Gate Rock Wall		Unevaluated	K13B	4	WASCO
	X									Bearing Tree Site; PLSS witness trees		Unevaluated	K13B	4	WASCO
	X									Historic Rock Walls and Road		Unevaluated	K13B	4	WASCO
	X									Rock Walls		Unevaluated	K13B	4	WASCO
	X									Rock Walls		Unevaluated	K13B	4	WASCO
	X									Burnt Wood and metal rods		Unevaluated	K13B	4	WASCO
	X									Union Pacific Railroad Grade Site		Unevaluated	K13B	4	WASCO
	X									tickler; no site form comp.		Unevaluated	K13B	4	WASCO
	X									Large site submerged on east side of Creek, ground stone		Unevaluated	K13B	4	WASCO
	X									Posssible location of Lewis & Clark campsite: OCTOBER 29, 1805		Unevaluated	K13B	4	WASCO
	X									STRONG SKHENK STEWARD 1930 INDIAN VILLAGE as per Le Gilsen's map		Unevaluated	K13B	4	WASCO
	X									Bridge footings		Unevaluated	K13B	4	WASCO

Response to EFSEC Draft
EIS Data Request
Vancouver Energy, Vancouver, Washington

Attachment 1
Air Quality Report

Vancouver Energy
Air Quality Technical Report

Prepared for:
BergerABAM
Vancouver, WA

On behalf of:
Tesoro Savage Petroleum Terminal LLC
Vancouver, Washington

Prepared by:
ENVIRON International Corporation
Lynnwood, WA

Date:
August 2014

Project Number:
29-33275A

ENVIRON

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Acronyms, Abbreviations, and Definitions

Note that in this section and throughout the rest of this report there are active hyperlinks that will jump to the referenced material or section. General hyperlinks are formatted like this. Hyperlinks for tables and figures are highlighted like **this**.

AERMOD ..... Air quality dispersion modeling system used in this analysis. The AERMOD modeling system consists of two pre-processors and a dispersion model. The meteorological preprocessor (AERMET) provides meteorological information, and a terrain pre-processor (AERMAP) characterizes terrain, and generates receptor grids for the dispersion model (AERMOD).

AESS ..... Automatic Engine Shutoff System, used by train locomotives to shutdown unneeded units when idling occurs for more than about 10 minutes, and when ambient temperatures exceed 40°F.

Air quality standard ..... Health-based standard representing a pollutant concentration in the ambient air usually over some averaging period like 1-hour, intended to protect the health and welfare of people with a margin of safety.

Ambient air..... the air in outdoor locations to which the public has access, e.g., outside the property boundary of the emissions source

Area source ..... an emission source type defined in AERMOD. Area source emissions are released from a two-dimensional rectangular area and typically used to represent fugitive emission sources.

ASIL ..... Acceptable Source Impact Level – a *screening* level (as opposed to a *standard*) used to evaluate the potential impact of **TAP**s based on the estimated risk of a lifetime of exposure

Attainment/Nonattainment ..... a determination and classification made by EPA indicating whether ambient air quality in an area complies with (i.e., attains) or fails to meet (i.e., nonattainment) the requirements of one or more **NAAQS**

Averaging time..... a specific length of time (e.g., 1 hour, 24-hours, 1 year) over which measured or model-calculated concentrations of an air pollutant are averaged for comparison with the **NAAQS** based on the same averaging period. Note that some NAAQSs are also based on multi-*year averages of certain percentiles of measured or calculated concentrations.

BACT ..... Best Available Control Technology

BNSF ..... BNSF Railroad Company

cf ..... cubic foot, a measure of volume

cfm ..... cubic feet per minute, a measure of air flow

CO ..... carbon monoxide, a criteria air pollutant

CO_2 ..... carbon dioxide, a greenhouse gas

CO_2e ..... Greenhouse gas equivalents (emissions of all GHGs expressed in terms of their "global warning potential")

Criteria air pollutant ..... an air pollutant specifically governed by the Federal Clean Air Act for which ambient air quality standards have been set. Criteria air pollutants include carbon monoxide, particulate matter, sulfur dioxide, nitrogen dioxide, ozone, and lead

Dispersion model..... A computerized calculation tool used to estimate pollutant concentrations in the ambient air based on numeric simulations that consider the locations and rates of pollutant emissions and the effects of meteorological conditions, usually over specific averaging times (e.g., 8-hours)

DPM ..... Diesel engine exhaust particulate matter

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Ecology	Washington State Department of Ecology
EFSEC Application	A document prepared to allow EFSEC to consider an application for site certification for a proposed facility.
EFSEC	Energy Facility Site Evaluation Council
EPA	US Environmental Protection Agency
Facility	Vancouver Energy Facility proposal
Fugitive dust	Potential air pollutant in the form of dust (or other pollutant) emitted from a non-point or non-mobile source such as dust from a road or from a coal pile caused by wind
GHG	Greenhouse gas (e.g., carbon dioxide or methane) that contributes to the process of a gradual warming of the atmosphere that can result in global climate change
Global warming potential	a measure of the potential of a gas to have an effect in the atmosphere that could lead to climate change based on the potential of the gas to cause global warming. This is a standard measure, typically based on a 100-year time horizon, used to compare each GHG with the global warming potential of carbon dioxide (CO_2), the most abundant GHG.
hp	horsepower
Knot	a unit of speed equal to one nautical mile per hour, or approximately 1.151 mph; abbreviated kt
Long ton	also called imperial ton and equal to 2,240 pounds (1,016 kg)
Maintenance area	An area that was once designated as nonattainment that has since come into compliance with the ambient air quality standard but where air quality control measures may remain in effect (in perpetuity).
Meteorological data set	a compilation of meteorological data representing conditions over some period of time and including such things as wind speed and wind direction, and formatted as required by the dispersion model being used. This analysis used a meteorological data set covering 5 years.
Metric ton	1,000 kilograms (kg) = 2,204.6 pounds = tonne (see also short ton)
Micrometer/Micron	one millionth of a meter; typically used to distinguish particle size; typical human hair is 100 about microns in diameter
mmtpy	million metric tons per year
Modeling domain	the area included in the **dispersion-modeling** analysis, such as in this case, which used a larger than 10 kilometer by 10 kilometer domain. Modeling receptors are distributed within this domain, usually over a standard grid pattern with receptors every 100 to 500 meters.
Modeling receptor	a theoretical (i.e., often non-specific) location used in computer modeling at which air pollutant concentrations are calculated. Modeling may also use site-specific receptors representing individual locations.
Monte Carlo simulation	a mathematical procedure using repeated random sampling methods to develop sufficient test results to reach statistically valid conclusions; often applied in situations in which uncertainty or intermittent/ unpredictable occurrences prevent more specific examination of possible outcomes. Additional discussion **here** (pg. 14)
mtyp	metric tons per year
NAAQS	National Ambient Air Quality Standard
Nautical mile (nm; kt)	The nautical mile is a unit of length that is about one minute of arc of latitude measured along any meridian, or about one minute of arc of longitude at the equator. By international agreement it is exactly 1,852 meters (approximately 6,076 feet).
NO_2	nitrogen dioxide, a **criteria** air pollutant
Nonattainment area	an area delineated by regulatory agencies including US EPA and the Washington Department of Ecology in which an ambient air quality

	standards have been violated and where there is a program in place designed to reduce air pollution so that the standard attained.
NOx	oxide of nitrogen, a general class of air pollutant without a specific air quality standard but used in monitoring air quality
NSPS	New Source Performance Standard; rules that pertain to air pollution emission sources subject to air quality permits and newly manufactured equipment
Particulate matter (PM)	air pollutant comprised of solid or liquid particles; PM is usually characterized based on the particle size. See also PM_{10} and $PM_{2.5}$.
PM_{10}	"Coarse" inhalable particulate matter with an aerodynamic size less than or equal to 10 micrometers (**microns**)
$PM_{2.5}$	"Fine" inhalable particulate matter with an aerodynamic size less than or equal to 2.5 micrometers (**microns**)
Point source	an emission source type defined in AERMOD. Point source emissions are released from a single location.
ppm	parts per million (a metric used in quantifying concentrations of air pollutants)
PSD	Prevention of Significant Deterioration – an air quality assessment program intended to prevent air quality degradation from major sources (i.e., those sources exceeding specific annual emission thresholds
Receptor	See modeling receptor
Release height	an AERMOD term defining the height above ground at which source emissions are released
Short ton	2,000 pounds (see also **metric ton** and long ton)
SO_2	Sulfur dioxide, a **criteria air pollutant**
Soiling	A non-health-related effect of air pollution such as staining or deposition of a fine film typically on exterior surfaces
Stationary source	an air pollutant emissions source at a fixed location; typically subject to air quality review and possible permitting by local, state, or federal agencies
SWCAA	Southwest Clean Air Agency; the designated local air quality control agency in the project area
TAP	Toxic air pollutant
tonne	**metric ton**
tpy	tons per year, an estimate of annual emissions
$\mu g/m^3$	micrograms per cubic meter (a metric used in quantifying concentrations of air pollutants)
Volume source	an emission source type defined in AERMOD. Volume sources emit diffuse air pollutants from a three-dimensional area. Line sources, such as emissions from transiting trains, can be simulated using multiple, adjacent volume sources.
Wind rose	a quantitative graphical summary of wind direction and speed information for a given time span. The wind rose arms represent 24 directional points of the compass. The length of the arms represent the period of time the wind blew *from* a given direction, and the colors of the arms represent wind speed categories.

1 Introduction

Tesoro Savage Petroleum Terminal LLC, is proposing to develop the Tesoro Savage Vancouver Energy Facility (Facility), a petroleum transloading terminal, at the Port of Vancouver in Clark County, Washington.

This report documents the technical analyses of the air quality impact and mitigation assessments performed by ENVIRON International Corporation (ENVIRON) in support of the environmental review for the Facility. This report is summarized in the Draft Environmental Impact Statement for this proposal.

2 Project Description

Tesoro Savage Petroleum Terminal LLC is proposing to develop the Vancouver Energy Facility at the Port of Vancouver in Clark County, Washington (Figure 1, page 27). The proposed Facility would receive crude oil by rail, store it on site, and load it onto marine vessels for shipment to various consumers and end users located primarily on the west coast of the US. A depiction of the various components of the proposed Facility is presented in Figure 2. Unit trains would arrive at the project site and be stationed on the rail loops. At full build-out, the Facility would have the capability of loading up to 360,000 barrels/day of crude oil to marine vessels.

2.1 Terminal Design Elements

In addition to the primary components described above, the Facility would include ancillary elements to support the offloading, storage, and loading operations. The primary and ancillary elements are described in detail below. Table 1 summarizes the primary and ancillary project elements by area.

2.2 Construction/Operations Stages

In a first stage, Tesoro-Savage expects to construct the following facilities:

- Two rail loops to receive unit trains
- The unloading building
- Administrative and support buildings
- Storage area including
- Transfer pipelines serving the concurrent unloading of unit trains staged at the 2 unloading tracks described above, and the conveyance to the marine terminal
- Transfer pipelines serving the conveyance of crude oil from the storage area to the marine terminal
- Marine terminal facilities designed to handle the conveyance of crude oil to a marine vessel at full build out
- All of the berth improvements necessary to support vessel berthing at full build-out
- Marine Vapor Combustion Units (MVCUs)
- Fire-suppression facilities

Table 1. Summary of Primary and Ancillary Project Elements

Facility Area	Primary and Ancillary Project Elements
Rail Infrastructure	Rail facility loops
200 – Unloading and Office	Rail unloading area Control rooms/E-houses Fire Pump and Foam Building Administrative and Support Buildings
300 – Storage	Crude Oil Storage Tanks Secondary Containment Berm Pump Basin Control Room/E-House Fire Pump and Foam Building
400 – Marine Terminal	Marine Vessel Loading Hoses and Equipment Control Room/E-House Crane Control Room Dock Safety Unit MVCU Vapor Blower Skid Spill Prevention, Response and Containment Equipment Dock Improvements
500 – Transfer Pipelines	Transfer Piping from Area 200 to Area 300 Transfer Piping to/from Area 300 to Area 400 Piping from vessel loading to MVCU
600 - Unloading Boilers	Boiler Building Piping to carry steam to Area 200
Source: Flint 2014	

Contingent on evolving market conditions, Tesoro-Savage would construct the following additional elements in a subsequent stage:

- The second of the support buildings
- Storage area including
- Transfer pipelines serving the concurrent unloading of unit trains staged at the 3rd unloading track
- The Unloading Boiler Building
- Additional fire-suppression facilities sufficient to meet the suppression needs of the additional facilities

In the future, the Facility would incorporate a third rail loop to be constructed by the Port for the Facility's exclusive use, serving the third unloading track. This third track would be built prior to, concurrently with, or after the construction of the Facility. Until the Facility capacity exceeds 120,000 barrels per day, this third loop track will be owned and operated by the Port for general use. Once the Facility capacity exceeds 120,000 barrels per day, use of the third rail loop would be transferred to the exclusive use of the Facility, at which time Facility would undertake maintenance of this rail third loop.

Tesoro-Savage expects a 20-year lifetime for the Facility. Such timeline could be extended if market conditions warrant. Maintenance dredging at berths 13 and 14 are part of the Marine

Terminal (Area 400). Dredging operations would continue to be conducted by the Port of Vancouver under its existing and future approvals granted by local, state and federal agencies to which such dredging is subject.

2.3 Concurrent Air Quality Permitting Assessment

The Facility would emit air pollutants and therefore must obtain certain air quality permits before construction of the Facility can commence. Air permits are required for construction and operation of the emissions units associated with the stationary sources. Emissions from mobile sources, including ships, trains, and vehicles, are regulated under other federal mobile source emission standards, and although such sources are not addressed as part of the stationary source air permitting process, they were considered as part of the more comprehensive environmental review documented in this report and summarized in the EIS.

Stationary emission sources at the Facility were considered as part of a detailed air quality modeling analyses that was conducted as part of the permit application process for this project. [1,2] Emissions from the on-site sources subject to the Washington State Energy Facility Site Evaluation Council (EFSEC) application for site certification (ASC) process also were considered in the environmental review reported here, and results of the analyses conducted for the ASC are summarized below. Note that the Facility emission units would include emission controls achieved by virtue of the application of Best Available Control Technology.

- Emissions units at the Facility would employ Best Available Control Technology to ensure emissions of all regulated pollutants are less than major source thresholds. Consequently, all Facility emissions are addressed in a minor source Notice of Construction application.
- The Facility would comply with all federal and state emissions standards, including New Source Performance Standards and National Emissions Standards for Hazardous Air Pollutants.
- Predicted total concentrations of the criteria air pollutants emitted from the Facility are less than the National and Washington Ambient Air Quality Standards (NAAQS and WAAQS) established to protect human health and welfare. The maximum predicted concentrations attributable to the Facility were added to the existing background concentrations to ensure a conservative analysis.
- Estimated emissions or predicted concentrations of toxic air pollutants released from the Facility operation are less than the Washington Department of Ecology's Small Quantity Emissions Rates (SQER) or Ecology's Acceptable Source Impact Levels (ASIL) for all toxic air pollutants (TAPs), demonstrating that all permitted sources of the Facility emissions would be in compliance with Washington's toxic air pollutant regulations.

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(1) EFSEC Application for Site Certification, BergerABAM, 2014

(2) Vancouver Energy Air Permit Application Revisions, Flint 2014

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3 Analytical Methods

The air quality impact analysis included two basic steps: (1) emission inventory development to estimate emissions related to operation of the terminal facilities in 2016 with full capacity operations, and (2) dispersion modeling to estimate resulting air contaminant concentrations in the ambient air associated with full capacity operation of the Facility. The following sections discuss the methods employed and the critical assumptions involved in each portion of the analysis.

Note that portions of the air quality analysis were developed as part of an evaluation prepared for the EFSEC application for the Facility that considered project-related air pollutant emission sources subject to permitting. That analysis included detailed emission inventory development and dispersion modeling for the following stationary combustion sources:

- Natural gas-fired boilers (3) used as part of product unloading
- Eight (8) Marine Vapor Combustion Units (MVCU) used to combust vapors displaced during vessel loading
- Product-handling components (e.g., valve seals and pressure relief valves) fugitive emissions
- Crude oil storage tanks fugitive emissions
- Emergency diesel-powered fire water pump engines

The methods and findings of this previous analysis are documented in detail in the EFSEC application. Those findings are summarized but not fully duplicated in this document. [3] Instead, the analysis reported here focused on the train and vessel mobile sources not considered in the permit review combined with the stationary sources subject to air quality permitting.

3.1 Emission Inventory Methods

The proposed Facility would result in emissions from mobile sources including vessels and trains (i.e., fuel combustion sources) and from the stationary and fugitive source listed above. The stationary source emissions subject to permitting were compiled and considered in the air quality analysis conducted as part of the EFSEC permit application. The train and vessel mobile source emissions were considered in the broader analysis documented here.

3.1.1 Emission Factor Tools and Sources

The emissions estimates for project-related sources employed several standard computer tools as well as emission rate calculations using formulas published by EPA. Important assumptions employed in this portion of the assessment are summarized in **Table 2**.

[3] EFSEC Application and Revised Application (see Footnotes 1 and 2, page 3)

Table 2. Emission Factors: Tools, Sources, and Critical Assumptions

Equipment Type	Tool/Method Source and Critical Assumptions
Facility Operational Phase – GHG and Criteria Pollutant Emissions	
Oil Tanker Vessels	• Emission factors based on 1,000 ppm (0.1%) S distillate fuel (the 2015 goal for vessels in IMO ECAs) [(a)] • Oil tanker vessel average propulsion engine 8,680 kW, w/ 3 auxiliary engines at 800 kW each → 8,680 kW for mains (Savage 2013) • Load factors for engines and boilers as derived from propeller law and EPA, 2009: → Main @ cruise - 0.83 → Main maneuvering - 0.0456 → Aux @ cruise - 0.24 → Aux Maneuvering - 0.33 → Aux Hotelling - 0.26 • 2016 NOx emission factors (EFs) conservatively **not** adjusted for Tier 3 NOx • Transit speed 14 knots, 6-10 knots within Columbia River, and <5 knots during maneuvering as provided to ENVIRON through a data request
Tugs	• Tugs use ULSD • Propulsion assumed as two 710 kW engines and two auxiliary engines at 55 kW (Savage 2013) • Load factors from EPA methods (EPA, 2009) • Assumed Tier 2 engines • 2016 NOx emission factors (EFs) **not** adjusted for Tier 3 requirements • Assume 2 tugs for each tanker vessel
Locomotives	• Line-haul Locomotives → Conservatively assumed U.S. fleet average emission rates for class-I line-haul engines (typically C44s or SD70s [Savage 2013]) that reflect fuel quality requirements (EPA, 2009) → Assumed line-haul locomotives operate at idle or notch 3 (Savage 2013) → Per engine fuel consumption – 3.3 gal/hr at idle – 47 gal/hr at notch 3 → Conservatively assumed no AESS (automatic engine stop during idling) • Switch Engines → Conservatively assumed U.S. fleet average emission rates for switch engines (typically SW1500 [Savage 2013]) that reflect fuel quality requirements (EPA, 2009) → Assumed switch engines operate at notch 2
Facility Boilers, MVCU, Process Fugitives	• These sources were considered as part of the air quality review prepared for the EFSEC application for the proposed Facility. The specifics of that review are documented in the EFSEC application.

[(a)] The International Maritime Organization (IMO) has established a program to create and administer Emission Control Areas (ECA) intended to result in lower emissions within specially designated areas.

3.1.2 Facility Operational Emissions

ENVIRON estimated combustion source (i.e., vessels and trains) emissions associated with full capacity operation of the terminal in 2016 based on the maximum expected commodity throughput at the Facility. The combustion source emissions assessment used detailed operational scenarios of both peak day and annual levels of activities developed in discussions with Tesoro Savage Petroleum Terminal LLC. Emission estimates considered the following sources: oil tanker vessels in transit over about one nautical mile down river from the Facility, vessels hotelling while at berth; tugs assisting tankers during docking and undocking; incoming loaded and outgoing empty trains traveling in the vicinity of the Facility; and trains traveling through the terminal while waiting to unload, during unloading, and while leaving. **Table 3** lists critical assumptions regarding Facility operations and basic dispersion modeling characteristics associated with project-related combustion sources.

Table 3. Facility Operations and Dispersion Modeling Critical Assumptions – Mobile Sources

Equipment Type	Source and Critical Assumptions
Oil Tankers and Tugs	**Operations** • Transit speed at 10 knots • Emissions during transit to/from dock based on travel distance of about 1 nautical mile (nm) from dock, west to common route point • Assumed 2 tugs for each tanker • Tugs escort inbound vessels starting 1 nm from dock • Maneuvering occurs with tugs assisting within 1,500 feet of dock and for one hour of activity to and from the dock • Time at berth (i.e., hotelling emissions) based on average time required for loading (17 hours) → This includes 1 hour before and 1 hour after unloading → Vessels per year: 365 **Modeling** • Transiting vessels considered series of point sources along a 400-foot wide route • Annual modeling considered total annual emissions related to transiting, maneuvering, and hotelling vessels – distributed evenly in time and space along the 1-nm transiting and maneuvering route [(a)] • Short-term modeling included a single vessel and two tugs maneuvering to dock [(b)]
Locomotives	**Operations** • 7,800-foot trains in 2016 for daily and annual emissions **Modeling** • Annual modeling based on total annual emissions from 4 trains/day evenly distributed in time and space across the entire year as emission sources located along the off and on-site rail as appropriate [(a)] • Annual modeling considered trains along all on-site rail routes and approximately two miles east to the Vancouver Rail Yard, south of Mill Plain Boulevard / State Route 501. • Short-term modeling considered reasonable worst-case conditions during periods up to 24-hours long (because this is the longest "short-term" ambient standard) [(b)] • Short-term (i.e., 1-hour) modeling considered worst-case conditions by assuming 3 trains on site during any (and every) 24-hour period as follows: → 2 trains idling during "indexed" unloading → 1 train moving into position and then idling during unloading **Train Modeling – All** • Train movements were treated as a series of volume sources, using an initial plume rise calculated with SCREEN3; see discussion here (page 13) • Idling locomotives were treated as point sources

(a) "Annual" modeling refers to the process of assessing pollutant emissions and concentrations based on expected emissions over an entire year. Calculated concentrations are compared with ambient standards based on annual statistics and/or with annual average health risk estimate criteria.
(b) "Short-term" modeling refers to assessments considering emissions and concentrations to be compared with short-term ambient standards such as 1-hour and 24-hour averages.

The combustion source emission factors applied in the analysis are listed in Table 4.

Table 4. Facility Project Mobile Source Emission Factors

Train Locomotive Emission Factors (g/gal)									
Type	**NOx**	**NO_2**	**PM10**	**PM2.5**	**HC**	**VOCs [a]**	**CO**	**SO_2**	**CO_2**
Line-haul	121.00		3.10	3.01	5.10	5.37	26.6	0.09	10,217
Switcher	82.08		1.22	1.18	3.95	2.63	26.6	0.09	10,217
Vessel Emission Factors (g/kW-hr) [b]									
Engine Type	**NOx**	**NO_2**	**PM10**	**PM2.5**	**HC**	**CH_4**	**CO**	**SO_2**	**CO_2**
Tug Mains	9.8	6.2	0.72	0.70	0.48	0.09	5.00	1.3	690
Tug Aux	6.8	6.2	0.3	0.29	0.26	0.09	5.00	1.3	690
Vessel Mains	17		0.19	0.17	0.60	0.084	1.4	0.4	589
Vessel Mains (low load)	37.5		0.6	0.5	4.63	21.8	6.8	0.7	3.28
Vessel Aux	13.9	9.61	0.18	0.17	0.4	0.084	1.1	0.42	691
Vessel Boiler [c]	13.9	9.61	0.18	0.17	0.4	0.084	1.1	0.42	691

[a] Emission factors for VOCs calculated as %HC

[b] Emissions factors for vessel engines used in this assessment did not vary by year because no credit was taken for future improvements in vessel emission controls. Specific emission rates varied as a function of fuel quality.

[c] Boiler emission factors conservatively assumed to be equivalent to auxiliary emission factors.

Sources:
Locomotive Emission Rates from USEPA Emission Factors for Locomotives, April 2009
Vessel Emission Factors from USEPA Current Methodologies in Preparing Mobile Source Port-related Emission Inventories, April 2009

3.1.3 Emission Controls included in Project Design

Air quality permitting rules governing stationary sources at the proposed Facility require the use of Best Available Control Technology (BACT) for those sources subject to an air quality permit. [4] A BACT review includes consideration of all reasonably available means to reduce or control emissions, and the evaluation of both feasibility (i.e., whether such controls can be physically implemented and their potential effectiveness) and cost (i.e., based on expenditures per ton of emissions avoided). A BACT submittal is prepared as part of a permit application, and ENVIRON prepared a BACT analysis as part of the EFSEC Application for Site Certification (BergerABAM 2014, Flint 2014). This analysis identified BACT for the proposed Facility sources.

In addition to the implementation of BACT for stationary emission sources, the proposed Facility would include emission controls for on-site locomotives in the form of Automatic Engine Shutoff Systems (AESS) that would sometimes shut off unneeded locomotives. When trains are on-site

[4] WAC 173-400-110 identifies potential emissions of criteria air pollutants and requires BACT for proposed units exceeding certain emission thresholds.

waiting to unload and while they are in the process of unloading and when temperature are greater than 40°F, the AESS would shut down all three locomotives associated with each train. Note that, in order to be conservative, the use of the AESS was *not* considered in the air quality impact analysis even though temperatures in the project area are less than 40°F less than 15% of the time, so factoring in AESS operations would result in emission reductions. [5]

3.1.4 Greenhouse Gas (GHG) Emissions

ENVIRON estimated long-term GHG emissions associated with the proposed Facility at full capacity operation beginning in 2016. This is a conservative approach because full capacity operation will not actually occur until some years later when a third rail line has been constructed. No specific schedule has been established for this construction.

The GHG emissions estimates considered stationary source emissions directly related to the operation of the Facility and indirect emissions due to mobile sources associated with the operational activities of the Facility. Indirect emissions from purchased energy were not considered, but would be minimal due to the natural gas-fired nature of most of the Facility.

Emissions related to operation of the Facility were tabulated as part of preparation of the EFSEC application. Indirect emissions from project-related mobile sources included locomotive emissions within Washington State associated with product delivery by rail and emissions from tanker vessels transiting to and from the Facility while operating in Washington State waters.

ENVIRON calculated GHG emissions using standard protocols and inventory methods published by the EPA, California Air Resources Board, the Intergovernmental Panel on Climate Change, and the Washington Department of Ecology. The emissions are estimated using the base equation:

$$CO_2e \text{ emissions} = \text{activity rate-duration X intensity X emission factor}$$

The emission factors used in this analysis and the critical assumptions employed in both the development of emissions and in estimating levels of construction equipment activities for the emission inventory tabulation are presented in **Attachment A**.

3.2 Dispersion Modeling

ENVIRON used air quality dispersion modeling simulations to estimate air pollutant concentrations due to emissions from ships, trains, and on-site emission sources associated with the operations at the Facility. This section discusses the methods used to develop these simulations to assess potential future pollutant concentrations in the area surrounding the Facility.

3.2.1 Model Used

ENVIRON reviewed regulatory modeling techniques to select the most appropriate air quality model to simulate dispersion of air pollutants emitted by sources associated with the proposed

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[5] Data from the National Weather Service TD-3505 at Portland International Airport (45.591N & 122.600W) from January 1, 1973 through July 20, 2014 indicated hourly temperatures were less than 4.4445°C (40°F), 14.2% of the 363,518 valid hours (99.8%) during the time period.

project to estimate air pollutant concentrations. ENVIRON selected AERMOD to perform this modeling analysis because this tool is approved for air quality permitting purposes and it is capable of handling the potential for exhaust plume downwash. The modeling considered emissions downwash related to the permanent physical structures on the site (i.e., not the vessels or the trains).

The U.S. EPA has designated AERMOD as the preferred guideline air dispersion model for air dispersion modeling (EPA "Guideline on Air Quality Models," codified as Appendix W to 40 CFR Part 51) for complex source configurations and for sources subject to exhaust plume down-wash. AERMOD incorporates numerical plume rise algorithms (the PRIME algorithms) that implicitly include the downwash effects a structure may have on an exhaust plume rather than using the wind tunnel based empirical algorithms of ISCST3. The PRIME algorithm also treats the geometry of upwind and downwind structures and their relationship to the emission point.

3.2.2 Mobile Source Modeling Procedures and Parameters

ENVIRON applied AERMOD to consider criteria pollutants using the regulatory defaults in addition to the options and data discussed in this section.

Model Setup and Application

ENVIRON employed the most recent version of AERMOD (Version 14134) with the default options for dispersion that depend on local meteorological data, regional upper air data, and the local physical characteristics of land use surrounding the Facility. The Facility site is located within an existing industrial area with nearby industrial and commercial activities but limited residential uses in the vicinity.

Elevation Data and Receptor Network

Terrain elevations for receptors and emission sources were prepared using digital elevation models developed by the United States Geological Survey (USGS) and available on the USGS Seamless Server system. These data have a horizontal spatial resolution of approximately 10 meters (m). The base elevation and hill height scale for each receptor were determined using the EPA terrain processor AERMAP (Version 11103). AERMAP generates a receptor output file that is read by AERMOD.

The dispersion modeling analyses used modeling receptors spaced 500 meters apart covering the 10 kilometer (km) by 10 km simulation domain, with a 5-km by 5-km nested receptor grid at 200-m spacing, a 4-km by 4-km nested receptor grid at 50-m spacing, and a 3-km by 3-km nested receptor grid at 25-m spacing. All five receptor grids were centered on the Facility site. The modeling receptor locations are depicted in **Figure 3**. All modeling receptors were located at and beyond the boundaries of Port of Vancouver property.

Meteorological Data

ENVIRON constructed a 5-year meteorological data set for use in the AERMOD dispersion model using surface and upper air data for the period of 2008 through 2012 after conducting a survey of available and complete meteorological data for use in the modeling simulations. For surface meteorological data, the closest and most representative National Weather Service (NWS) station was Pearson Field, located in Vancouver, Washington. A wind rose presenting wind speed and wind direction data for the five year period is shown in **Figure 6**. The wind rose indicates that the winds are predominantly from the northwest and east-southeast directions.

The average wind speed during the 5-year meteorological period was 2.3 meters per second (m/s; 5.1 mph), and calm conditions occurred less than 2 percent of the time.

Upper air data from McNary Field Airport, in Salem Oregon were also used for the 5-year meteorology data set. The McNary upper air data were compiled from the National Oceanic and Atmospheric Administration (NOAA) Forecast Systems Laboratory Radiosonde Database. [6]

EPA guidance indicates that surface parameters (albedo, Bowen ratio, and surface roughness) surrounding the primary meteorological site should be used in AERMET to construct the meteorological profiles used by AERMOD. Seasonal surface parameters were determined for the Pearson Field meteorological site using the AERMET preprocessor, AERSURFACE (Version 13016).

Daily versus Annual Operations

Operations of the proposed terminal are generally expected to occur over 24-hours per day, 365 days per year. The air quality modeling scenarios used to simulate daily and annual levels of operations are described further below.

ENVIRON developed modeling scenarios for the Facility to reflect both maximum daily through-put and maximum annual throughput in 2016 with complete buildout and full operation. The short-term (1-hour) scenario was used to estimate 1-hour concentrations, and this profile was considered with modeling simulation using every day in the 5-year meteorological database.

The daily and annual operations scenarios for stationary and mobile emission sources used a profile of hourly emissions throughout the year, reflecting a realistic operational schedule for full capacity operations. Note again that full capacity operations are not actually expected to occur until the development of a third rail line, so the modeling scenarios reflect a conservative (i.e., over-protective) approach to the impact analysis.

Averaging Periods

Pollutant concentrations predicted by the model were averaged over annual and short-term (1, 3, 8, and 24-hour) periods, as appropriate for a given pollutant's ambient standards or screening level. The modeling assessments for the CO standards and the short-term SO_2, $PM_{2.5}$, and NO_2 standards were based on the peak-day modeling described above. The assessments for comparison with the ambient standards for PM_{10}, $PM_{2.5}$, and the annual SO_2 and NO_2 concentrations were all based on the annual operations modeling scenarios due to the statistical techniques required for assessing compliance. [7]

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[6] http://esrl.noaa.gov/raobs/

[7] For example, the $PM_{2.5}$ 24-hour standard is based on the 3-year average of the 98th percentile of daily concentrations, which eliminates one or more of the highest concentrations each year and requires averaging the results. These calculations can be completed with the AERMOD model based on the realistic annual operations scenario, and cannot be based on the worst-case day modeling process used to evaluate not-to-exceed short-term standards. Thus, the annual operations modeling scenario was used to consider $PM_{2.5}$ and PM_{10} which are subject to statistical ambient standards.

NO_2 Modeling – PVMRM

In accord with EPA guidance, ENVIRON applied the Plume Volume Molar Ratio Method (PVMRM) within AERMOD to allow the model to consider factors that affect both NO_2 emission rates and resulting concentrations in the ambient air. The PVMRM method accounts for both direct NO_2 emissions from stacks (e.g., locomotive exhausts) as well as atmospheric transformations that create NO_2 in the presence of estimated concentrations of ozone. Atmospheric formation of NO_2 from NOx sources in the project study area is almost certainly limited due to the lack of ozone. For this portion of the analysis ENVIRON assumed 10% of exhaust emissions from mobile sources were NO_2 and up to 80% of NOx could be converted to NO_2 in the atmosphere. [8] For stationary sources including the unload boilers, marine vapor combustion units, and emergency fire water pumps, ENVIRON conservatively assumed the default 50% of exhaust emissions were NO_2 (EPA 2011).

Hourly ozone monitoring data from the entire modeling period (2008-2012) from Vancouver, Washington's ozone monitor (ID 530-11-0011) were considered in the modeling. For periods when hourly ozone data were missing, the highest annual average ozone value throughout the 5 year period (i.e., 25 ppb) was used instead.

Emission Source Locations, Characterization, and Release Parameters

Ship stack emissions from vessels in transit and hotelling at the dock were represented in the model as a series of **point sources**. Emissions from trains transiting on and near the site were represented by series of **volume sources**, while stationary idling trains were considered as **point sources**. Additional discussion of these sources follows.

Vessels in transit, harbor assist vessels (i.e., tugs), and vessels hotelling at the wharf during loading were considered as point sources in the AERMOD analysis. For point sources, AERMOD calculates thermal buoyancy and downwash effects on source emissions. Thermal buoyancy causes warmer plumes to rise and downwash effects push plumes downward as wind travels over buildings. **Table 5** (page 13) provides specific information regarding the modeling parameters for these sources. See also **Table 3** (page 7) for additional information regarding the assumptions and methods employed in the dispersion modeling.

Trains traveling on and near the site were considered as a series of equally spaced volume sources that represented the variable emission conditions along these curvilinear paths of travel. In AERMOD, volume sources are represented as a 3-dimensional Gaussian distribution of emissions. The model disperses the starting distribution of pollutant according to the meteorological conditions occurring in a given hour. Parameters describing the location and initial horizontal distribution of each volume source were determined using a series of equally spaced volumes that followed the rail alignment onto and around the Facility site. Unlike point sources, AERMOD does not consider the effects of thermal buoyancy or downwash on volume source emissions, and this approach is not entirely appropriate for representing the heated

[8] In-stack NO_2 to NOx emission ratio from P G Boulter, I S McCrae, and J Green, Transportation Research Laboratory, *Primary NO_2 Emissions From Road Vehicles in the Hatfield and Bell Commons Tunnels*, July 2007 as reported in the San Joaquin Valley Air Pollution Control District Air Modeling Guidance for NO_2.

emissions from a locomotive stack. ENVIRON therefore employed an additional adjustment to compensate for this limitation in the AERMOD model.

In 2004, as part of the Roseville Rail Yard Study, the California Air Resources Board (CARB) developed a method to estimate initial locomotive plume rise adjustments from buoyancy and downwash effects using the EPA SCREEN3 model. [9] Consistent with the ARB's adjustment calculations, ENVIRON estimated initial plume height using SCREEN3 based on typical in-stack temperature and flow rates based on average notch settings and approximate speed of the trains during transit. [10] Thus, the release height and vertical dimension of emissions from transiting trains take into account not only the height of the locomotive emission sources, but the buoyancy of the emission gasses and downwash effects generated by the train's movement. ENVIRON used the resulting estimated stack and release heights (Table 5) in the AERMOD assessment.

Idling locomotives were considered in the dispersion modeling as point sources with stack exhaust temperature, flow rate, and diameter based on stack testing for an idling GE ES44DC model locomotive engine. The ES44DC is a reasonable representation of the C44 locomotives expected to service the proposed Facility. Stack testing data provided by the Southwest Research Institute's Locomotive Technology Center did not include typical stack heights for locomotives with an ES44DC engine. Therefore, stack heights used for idling locomotives were estimated using the Roseville Rail Yard Study.

Table 5. Combustion Source Modeling Parameters

POINT Sources	Stack Height (m)	Stack Temp. (K)	Exit Velocity (m/s)	Exit Diam. (m)
Vessels	30	673.15	20	0.5
Idling Locomotives	4.52	374.15	1.85	0.6
VOLUME Sources				
VOLUME Sources	**Release Height (m)**	**Initial Lateral Dimension (m)**	**Initial Vertical Dimension (m)**	
Transiting Trains	5.5	7.1	2.1	

3.2.3 Permitted Emissions Sources

All on-site project-related stationary emission sources subject to air quality permitting under EFSEC rules were considered in a separate air quality modeling assessment conducted during preparation of the permit application. The emissions and dispersion modeling parameters

[9] State of California Air Resources Board, 2004, *Roseville Rail Yard Study*; this method does not consider variability in ambient meteorological conditions and wind speeds because as a screening-level model, SCREEN3 assumes fairly basic, static conditions in estimating dispersion. This technique represents a reasonable and previously applied method for representing plume rise associated with locomotive emissions.

[10] ENVIRON received notch-specific temperature and flow rates from Steve Fritz of the Southwest Research Institute's Locomotive Technology Center.

applied in that analysis are explained in detail in the EFSEC application materials. [11] Identical modeling parameters were assumed in the combined stationary source/mobile source modeling conducted for the air quality impact assessment described here.

3.3 Modeling Post-Processing: Transiting Trains Monte Carlo Simulations

The AERMOD assessment of 1-hour NO_2 concentrations from trains traveling on the project site were based on worst-case operations when locomotives would be idling in close proximity to one another and to the property boundaries. While such circumstances could occur once in a while, the worst-case conditions assumed in the modeling would be rare, and would at most be expected to occur more or less randomly over about one hour a day.

To address this issue, the analysis used a two-step process that began by performing AERMOD modeling that applied worst-case conditions in every hours of every day of the entire 5-year meteorological data set. The second step involved randomly selecting output from the first-step modeling results in a Monte Carlo probability analysis to allow worst-case conditions to occur only one hour each day.

The Monte Carlo simulations involved post-processing the hourly modeling results for each day of the 5 years analyzed to randomly select hours during which the locomotives would be idling in close proximity to one another during product unloading. Data from the hours selected for each day were considered for each modeling receptor. This process was repeated 1,000 times for each year. Results of this selection process were then used to compute the median hourly NO_2 concentrations for comparison with the 1-hour ambient air quality standard. This analysis process was consistent with the approach developed by Clint Bowman of the Washington State Department of Ecology for addressing compliance assessments of intermittent (or randomly occurring) emission sources (Ecology 2011b).

3.4 Off-Site Traffic Impact Assessment

The analysis of potential air quality impacts of off-site project-related traffic operating near signalized intersections was conducted in accord with EPA guidance (EPA 1992b). The analysis was based on a qualitative review of intersection operation information compiled in the traffic impact assessment report for the project (Kittelson 2013).

[11] EFSEC Application for Site Certification and Revised Application (Footnotes 1 and 2, page 3)

4 Potential Impacts of the Proposed Project

4.1 General Air Quality Conformity Review

The federal General Conformity rules (40 CFR Part 93, Subpart B) require actions within air quality nonattainment or maintenance area that are taken or approved by federal agencies not cause new violations of the NAAQSs or prolong the time required to attain these standards. The Facility project site is within CO and ozone air quality maintenance areas, and the project requires approvals by the Army Corps of Engineers (USACE) and the US Coast Guard (USCG). As a result, the project is subject to consideration under the federal General Conformity rules.

The General Conformity review process is a stepped process beginning with consideration of project-related air pollutant emissions and comparison of those emissions with *de minimis* levels defined in the federal rule. Emissions subject to inclusion in this review are those directly and indirectly related to the action approved by a federal agency for which the agency has both jurisdiction *and* the ability to control emissions from the subject sources. For example, the USACE controls in-water activities and can impose requirements such as using clean fuels to reduce emissions. But the USACE has no jurisdiction to control emissions from any related land-side emission sources (e.g., trucks) because these sources are not subject to permit conditions, and in the case of trucks, are subject to emission limits adopted by US EPA. As a result, in-water work emission sources are subject to consideration under the General Conformity rules but related land operations emission sources are not. Similarly, although vessel operations are subject to USGC safety regulations, USGC has no jurisdiction to control vessel engine emissions, so vessel emissions are not subject to consideration as part of the General Conformity review. In addition, operational emission sources subject to other federal permits need not be considered as part of the General Conformity review because these sources are evaluated in other ways (e.g., via an EFSEC application review).

Facility-related in-water work subject to requirements of the USACE permit would be limited both in terms of the types of equipment involved and in the duration of use. It is therefore possible to assess General Conformity by qualitatively comparing project-related emissions with previously conducted emissions tabulations. Such a comparison reveals that construction of the proposed Facility would comply with General Conformity requirements.

ENVIRON prepared a detailed emissions inventory for equipment and activities associated with the construction of a 4-berth container terminal within the Port of Tacoma, Washington. That project, the Puyallup Tribal Terminal will involve multiple years of construction including in-water work such as dredging, excavation to reshape the shoreline, and both sheet pile and straight pile driving. ENVIRON quantified emissions associated with the single highest year of construction-related emissions due to sources subject to permitting by the USACE. As shown in **Table 6**, construction-related emissions associated with this larger project are much lower than the General Conformity *de minimis* levels. Because this larger project would involve much more in-water work than would be required for the Facility, this comparative analysis indicates the Facility project will comply with federal General Conformity requirements.

Table 6. Puyallup Tribal Terminal 3-Berth Construction Emissions in 2012 Subject to General Conformity Review – For Comparison Purposes

Emissions Category	Emissions (tons/year)				
	$PM_{2.5}$	NOx	SO_2	VOC	CO
Total In-Water Related Construction Emissions	1.14	23.44	0.18	1.50	5.92
General Conformity *de minimis* levels for $PM_{2.5}$, CO, and Ozone Maintenance Areas (CFR 40 § 93.153)	100	100	100	100	100
Source: ENVIRON 2010					

4.2 Operational Air Quality Impacts

4.2.1 Projected Annual Emissions

The estimated annual emissions of criteria air pollutants from full capacity operation of the Facility in 2016 are presented in the next two tables. Table 7 lists the emissions from permitted stationary sources at the Facility as they were considered in the EFSEC application analyses. Table 8 shows the emissions associated with mobile sources associated with transport of crude oil to the Facility on trains and transported away from the Facility on vessels. Note that the emissions listed were distributed both spatially across the Facility and temporally across each day of an entire year to provide the basis of the air quality dispersion modeling.

Table 7. Estimated Annual Operational Emissions (Permitted Stationary Sources)

Pollutant	Emission Rate (tons/year)					
	Unload Boilers	MVCUs	Component Fugitives	Tanks Fugitives	Fire-Water Pumps	Total
NO_X	5.95	8.04	--	--	0.00632	14.0
CO	19.5	3.49	--	--	0.0302	23.0
SO_2	1.99	6.59	--	--	0.000130	8.57
PM	4.06	2.62	--	--	0.00321	6.68
VOC	2.70	8.64	0.822	23.6	0.00689	35.7
GHG (CO_2e)	44,170	50,530	11.9	261	13.5	94,980
Source: Flint 2014						

Table 8. Estimated Annual Operational Emissions (Mobile Sources)

Criteria Air Pollutant	Operational Sources	Operational Emissions (tons/year)
Inhalable Coarse Particulate Matter (PM_{10})	Vessels	1.36
	Trains	0.03
Inhalable Fine Particulate Matter ($PM_{2.5}$)	Vessels	1.29
	Trains	0.02
Sulfur Dioxide (SO_2)	Vessels	3.11
	Trains	0.0008
Carbon Monoxide (CO)	Vessels	8.54
	Trains	0.21
Nitrogen Dioxide (NO_2)	Vessels	98.70
	Trains	0.99
Total Annual Emissions		
Inhalable Coarse Particulate Matter (PM_{10})		1.39
Inhalable Fine Particulate Matter ($PM_{2.5}$)		1.31
Sulfur Dioxide (SO_2)		3.11
Carbon Monoxide (CO)		8.76
Nitrogen Dioxide (NO_2)		99.68
Assumes 100% of NOx emissions are NO_2 Vessels in Transit include tug assists during maneuvering Train emissions without AESS; produces conservative results; including AESS would reduce emissions – see **Table 2**		

4.2.2 Projected Off-Site Air Pollutant Concentrations

The results of the air quality dispersion modeling analysis of Facility sources are summarized in Table 9, which presents the model-calculated future concentrations for criteria pollutants at the maximum impact locations affected by Facility emissions. As shown, model-predicted project-related criteria air pollutant concentrations at the maximum impact locations with full capacity operations are all less than the levels allowed by all the short and long-term ambient air quality standards.

Table 9. Modeling Results: Criteria Pollutant Maximum Concentrations (μg/m^3)

Criteria Air Pollutant	Averaging Time	B/G Conc. [a]	Project-Related Concentration [b], [c]	Project Plus B/G	Ambient Standard [d]
CO	1-hour	3,550	348.1	3,898	40,000
	8-hour	2,519	69.0	2,588	10,000
NO_2	1-hour	Varies [e]	Based on Monte Carlo Simulations	175	188
	Annual	16.9	29.6	46	100
$PM_{2.5}$	24-hour	20.5	5.4	26	35
	Annual	7 [f]	0.7	8	12
PM_{10}	24-hour	34	10.5	45	150
	Annual	13 [f]	0.7	14	50 [g]
SO_2	1-hour	12.8	43.8	57	196
	3-hour	7.1	16.0	23	1,310
	24-hour	4.5	12.6	17	365 [h]
	Annual	3.9 [f]	0.3	4	52 [h]

[a] Background concentrations (expressed as μg/m^3) based on measured levels.

[b] Reported pollutant concentrations are those occurring at the maximum impact location for each pollutant. Concentrations at all other locations are less than those reported here.

[c] Except as noted below, all short-term concentrations are based on modeling that considered maximum hourly activity during every hour of the 5-year meteorological data set, which is not a possible actual level of activity. These results therefore represent intentionally conservative conditions. Note that consistent with USEPA guidance, the annual modeling results are based on 5-year averages from the 5-year meteorological data set instead of 3-year as per the NAAQSs.

[d] All ambient concentrations are expressed in terms of micrograms per cubic meter (μg/m^3); sometimes the ambient air quality standards, includes some concentrations reported in parts per million (ppm).

[e] Variations hourly by season were considered in the dispersion modeling as explained in Seasonal/ Hourly Background Concentrations. Thus the modeling included background concentrations. Refer to Monte Carlo Post-Processing Simulations discussion for additional information.

[f] Value represents maximum measured concentrations; do not reflect statistical treatment, therefore conservative

[g] Denote SWCAA ambient air quality standard (only, i.e., no federal or Washington State standard)

[h] Denote Washington State ambient air quality standard (only, i.e., no federal standard)

4.3 Off-Site Traffic Air Quality Impacts

4.3.1 Surface Street Intersections

EPA guidance regarding potential traffic-related air quality impacts suggests considering the most congested signalized intersection(s) that would be affected by a project's traffic, and recommends possibly conducting dispersion modeling of the most adversely affected intersections. In this context, "adversely affected" refers to projected deterioration in an intersection's level of service (LOS) to a degree that might impact air quality nearby. [12]

EPA suggests modeling the most congested intersections that would be directly affected by traffic to the degree that LOS would be degraded to a LOS "D" or worse due to a project. [12] Consistent with EPA guidance, signalized intersections that would be affected by the proposed Facility project were screened for possible modeling analysis by reviewing the intersection LOS data provided by Kittelson (2013). Based on these traffic data, none of the signalized intersections in the project study area would be adversely affected by project-related vehicle traffic to the extent that the LOS would degrade to LOS D or worse. These data are summarized in Table 10. As a result of the traffic projections, because no intersections fall to an LOS of D or worse due to the project, no additional analysis is required to conclude that project-related operational vehicle traffic would not result in air quality impacts due to increased congestion near off-site intersections.

Table 10. Facility Forecast 2025 Total Traffic Conditions Summary

Intersection	Peak Commute Period	Level of Service	Volume to Capacity Ratio
Old Lower River Rd/ Lower River Rd (SR 501)	AM	B	0.10
	PM	A	0.13
Gateway Ave/Lower River Rd (SR 501)	AM	A	0.08
	PM	A	0.07
Fourth Plain Blvd/Mill Plain Blvd (SR 501)	AM	B	0.75
	PM	B	0.38
Old Lower River Rd/Old Alcoa Facility Access Rd	AM	B	NA
	PM	A	NA
Source: Kittelson and Associates, Inc. 2013			

4.3.2 Traffic Delays Caused by Project/Related Trains

ENVIRON also considered the potential for air quality impacts due to increases in vehicle delays near railroad/street crossings that occasionally would be obstructed by project-related trains.

[12] Level of service (LOS) is a measure of the relative efficiency of the operation of an intersection based on the amount of congestion that occurs, usually during a peak commute hour. The LOS for signalized intersections is the weighted average vehicle delay represented by a scale from A to F, with "A" representing little if any delay, and "F" representing congestion due to an intersection being over capacity. LOS "D," which is used as a threshold of *potential* for air quality impacts, results in delays of between 35 and 55 seconds per vehicle.

This review was based on a qualitative comparison of potential traffic delays with findings from a previous quantitative analysis.

At full capacity operation the proposed project would result in an average of four train trips to and from the Facility each day. The inbound transit trips within Washington State are expected to be via the "southern" route (i.e., Spokane-Pasco-Vancouver). The outbound "return" trips are expected to be via the "central" route (i.e., Tacoma-Pasco-Spokane). Inbound loaded trains trips are expected to cause up to about 10-minute delays at roadway crossings; outbound empty trains are expected to cause up to about 5-minute delays. For the anticipated 7,800-foot trains, this is equivalent to an inbound travel speed through rail crossings of about 9 mph and outbound speeds of about 18 mph. Trains traveling through controlled crossings in uncongested areas are likely to have higher travel speeds and cause less delay.

ENVIRON recently conducted a detailed air quality analysis of a very congested (i.e., peak-hour LOS = F) 4-way signalized intersection in Tukwila, Washington. This analysis used dispersion modeling (with EPA CAL3QHC model) based on emission rates calculated using the latest EPA emissions calculator tool (MOVES2010). Based on comparison with this previous quantitative analysis it is possible to assess the relative air quality implications of the train-related traffic delays due to Facility trains.

Review of the railroad alignment for inbound trains suggests that at highways and large roads the rail line is grade separated so there are no major rail/road crossings that would be delayed by train traffic. Consideration of the outbound return routes first reviewed the northern route then the central route (see **Figure 7**). Along the northern route, the largest single rail/road crossing for which there are reasonably available traffic volume estimates is the crossing of SR-516 in Kent. There is no similarly large rail/road crossing along the central route. So to provide a conservative assessment of potential impacts, the rail/road crossing of SR-516 in Kent was considered more closely.

The estimated daily traffic volume through the SR-516 crossing in Kent is 21,500 vehicles). [13] This compares with a daily volume through the Tukwila intersection of South 180th Street with the West Valley Highway of 25,000 vehicles. Assuming the same ratio of daily to afternoon peak-hour volumes applies, the respective intersection volumes are about 5,400 in Tukwila and 4,600 in Kent. The cumulative intersection delay at the Tukwila intersection (based on projections for 2030) was 455 hours). [14] In comparison, a 5-minute train-crossing delay of SR-516 would cause a cumulative delay of 386 hours, or about 85% of the cumulative delay found at the Tukwila intersection, conservatively assuming the delay occurs during the p.m. peak hour (i.e., when there would be maximum hourly volumes).

A detailed air quality modeling analysis of the Tukwila intersection indicated that carbon monoxide (CO) concentrations near this very congested intersection would be about 15% of the level allowed by the 1-hour CO standard and about 42% of the level allowed by the 8-hour CO

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[13] Based on the average of count location to the west (28k) and the one to the east (15k) from WSDOT website http://www.wsdot.wa.gov/mapsdata/tools/traffictrends/.

[14] Cumulative peak-hour delay is the average per vehicle delay times the total peak-hour volume.

standard (including background concentrations); (ENVIRON 2013). Using these results as an indicator and CO as a representative pollutant for vehicle sources it is clear that the occasional 5 to 10-minute delays caused by project-related trains would not comprise a significant threat to air quality in the vicinity of rail/road crossings due to vehicle emissions.

4.4 GHG Emissions

Long term (operational) GHG emissions were estimated to provide an indication of the potential for significant emissions as defined in SEPA. The sources and the extent of the area considered operational emissions plus vessel and rail emissions within Washington State.

The rail routes for which emissions were tabulated were as follow (see **Figure 7** regarding rail routes):

- Beginning at the state line east of Spokane, follow Columbia River Route south to Pasco and on to Vancouver on the incoming trip, then
- Starting in Vancouver, travel north through Tacoma and Auburn, then follow the Central Stampede alignment return route back to Pasco and then back to Spokane

GHG emissions from vessels were estimated based on docking, hotelling, and departure activities occurring near the Facility (see **Table 3**, page 7), along with emissions during inbound and outbound vessel transits within the waters of Washington State.

Details of the GHG calculations are included in **Attachment A**.

As shown in **Table 11**, total estimated annual Facility GHG emissions exceed the 10,000 metric ton CO_2e value Ecology suggests as an indicator of the need to quantify project-related GHG emissions during SEPA review, including "new" direct and "proximate" direct and indirect emissions (Ecology 2011a). This guidance also indicates projects with annual emissions of more than 25,000 metric tons CO_2e should provide a quantitative assessment of GHG emissions and an evaluation of the potential for impacts of changing climate on the project's new infrastructure. Note that at this time, the extent to which transportation-related GHG emissions should be included in such an analysis is "an unsettled question under SEPA case law" (Ecology 2011a). Facility-related GHG emissions are dominated by those from transportation sources.

Table 11. Summary of GHG Emissions

Operational Emissions	Annual Emissions CO_2e (metric tons)
Rail product delivery [a]	
Transiting within Washington [b]	156,684
On-site [c]	3,257
Vessel product export [d]	
Transiting within Washington [e]	17,232
On-site [f]	6,829
Total product transport emissions	184,002
Facility operations stationary sources [g]	86,184
Total annual Facility-related greenhouse gas emissions	**270,186**

[a] GHG emission factors taken or calculated from the 2009 USEPA "Emission Factors for Locomotives" and 2008 USEPA "Greenhouse Gas Inventory Protocol Core Module Guidance - Direct Emissions from Mobile Combustion Sources," USEPA Climate Leaders, Table A-6.

[b] Transiting emissions assume route along the Columbia River while loaded and along US-2 when empty

[c] On-site activity data provided by Savage (2013)

[d] GHG emission factors taken or calculated from the 2009 USEPA "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories" and 2204 IVL "Methodology for calculating emissions from ships. 1. Update of emission factors."

[e] Vessel transit operations assumed to occur between the Facility and the mouth of the Columbia River

[f] On-site vessel activities include maneuvering with tugs and hotelling with boilers

[g] From revised EFSEC application (Flint 2014)

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6 Attached Figures

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Note that figures are formatted for printing on the "front" side of double-sided pages, and the "back" sides of these pages are unnumbered, but nonetheless included in the page count.

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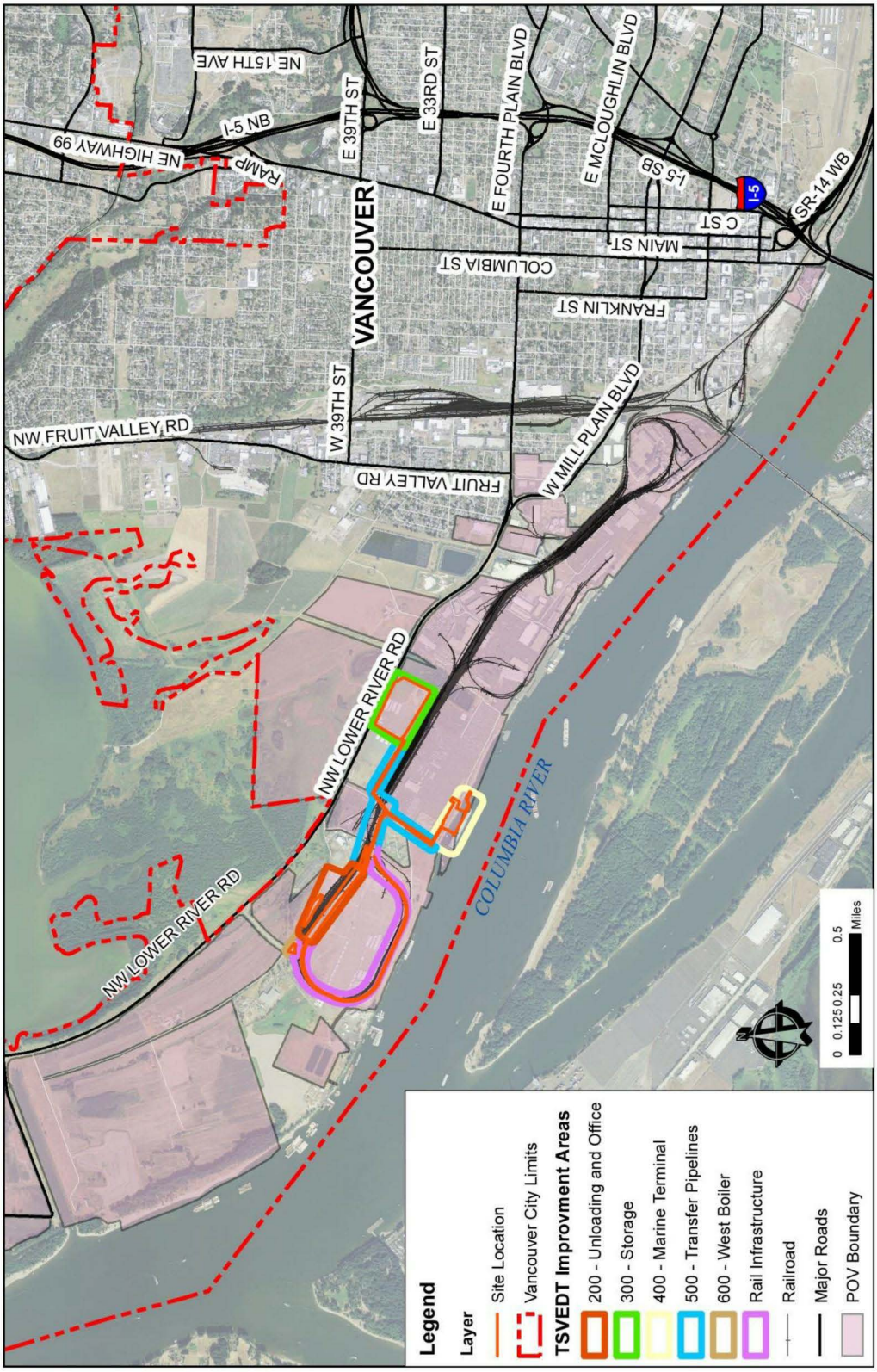

Figure 1. Project Vicinity Map

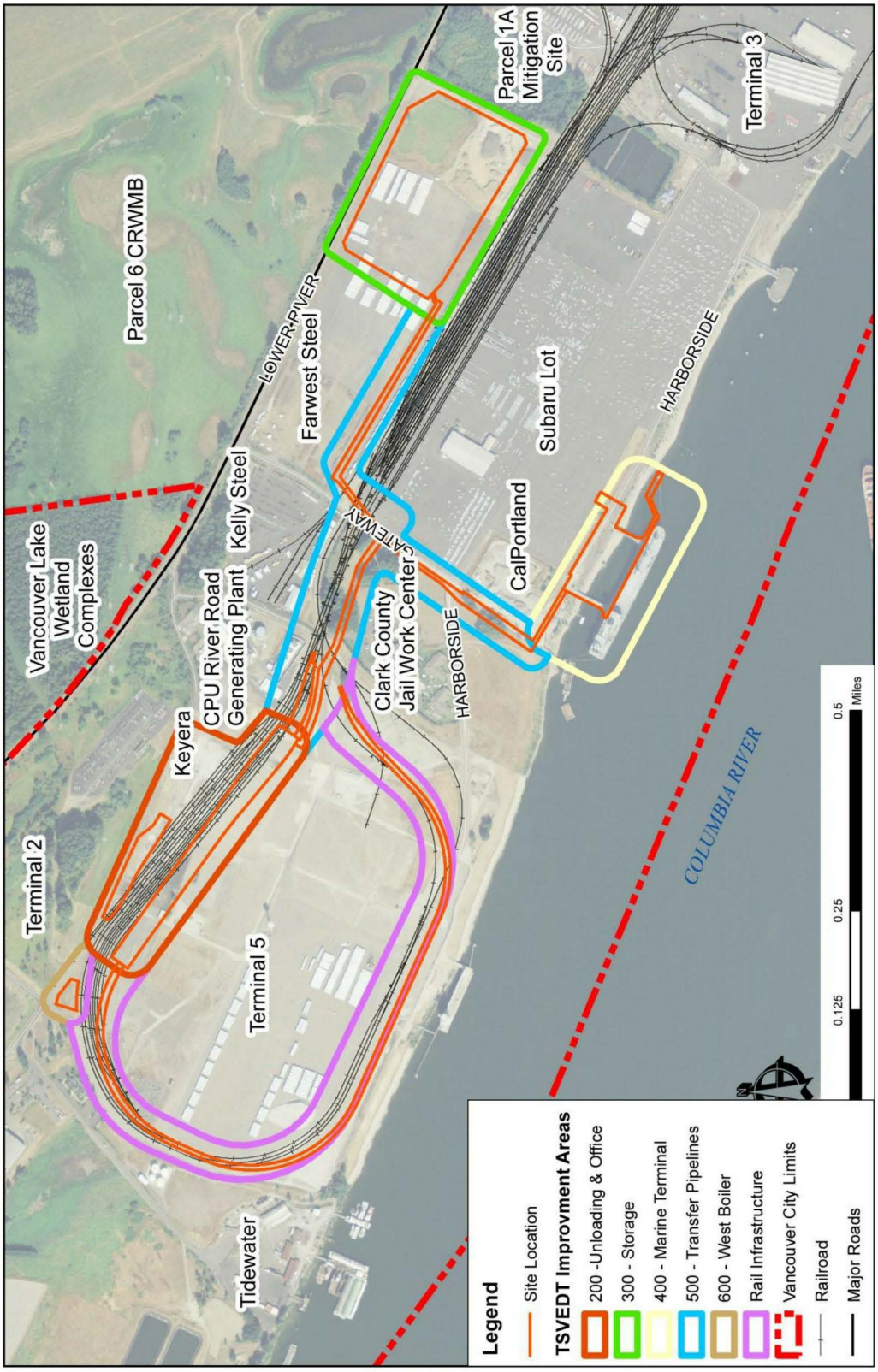

Figure 2. Facility General Layout

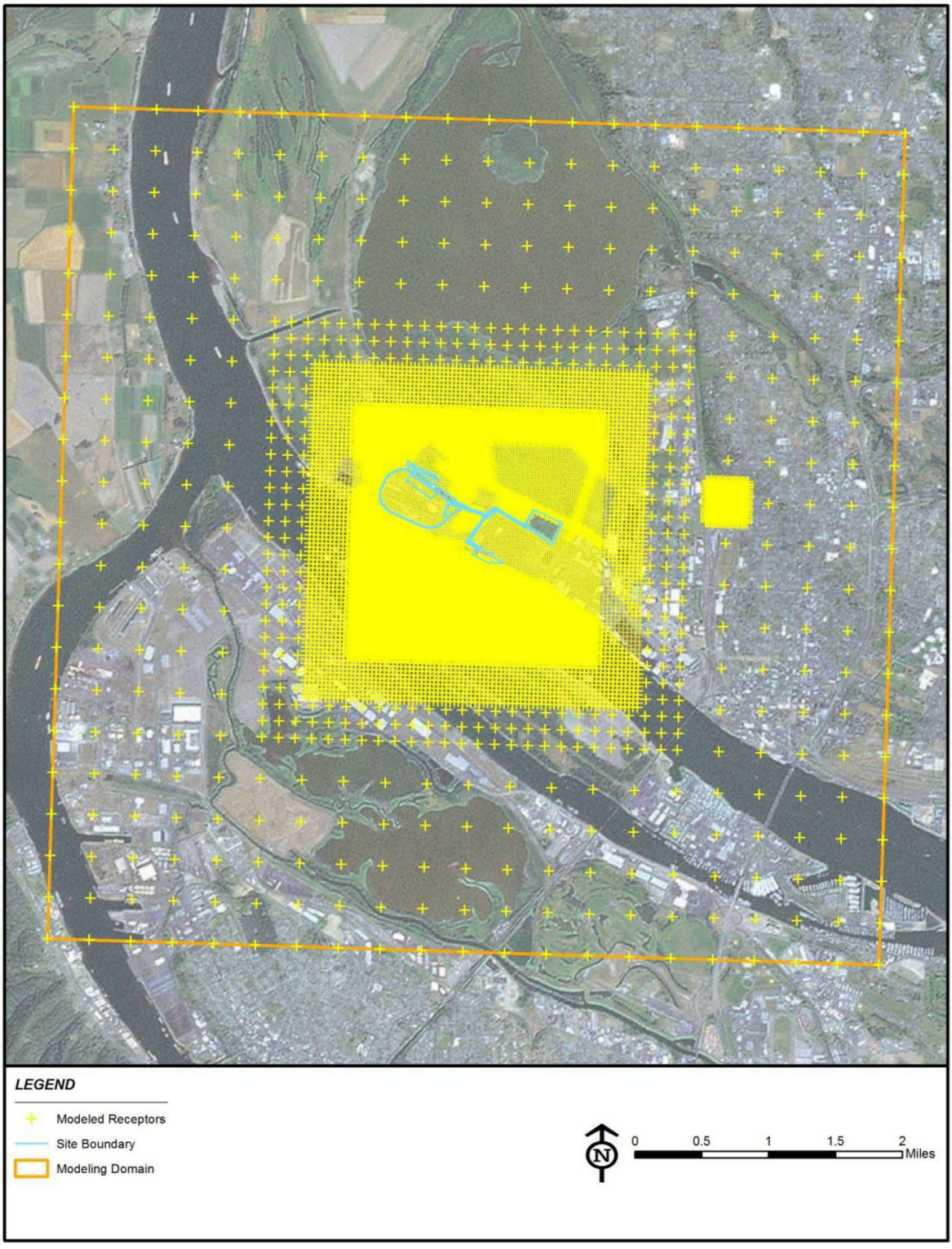

Figure 3. AERMOD Modeling Domain and Modeling Receptor Grids

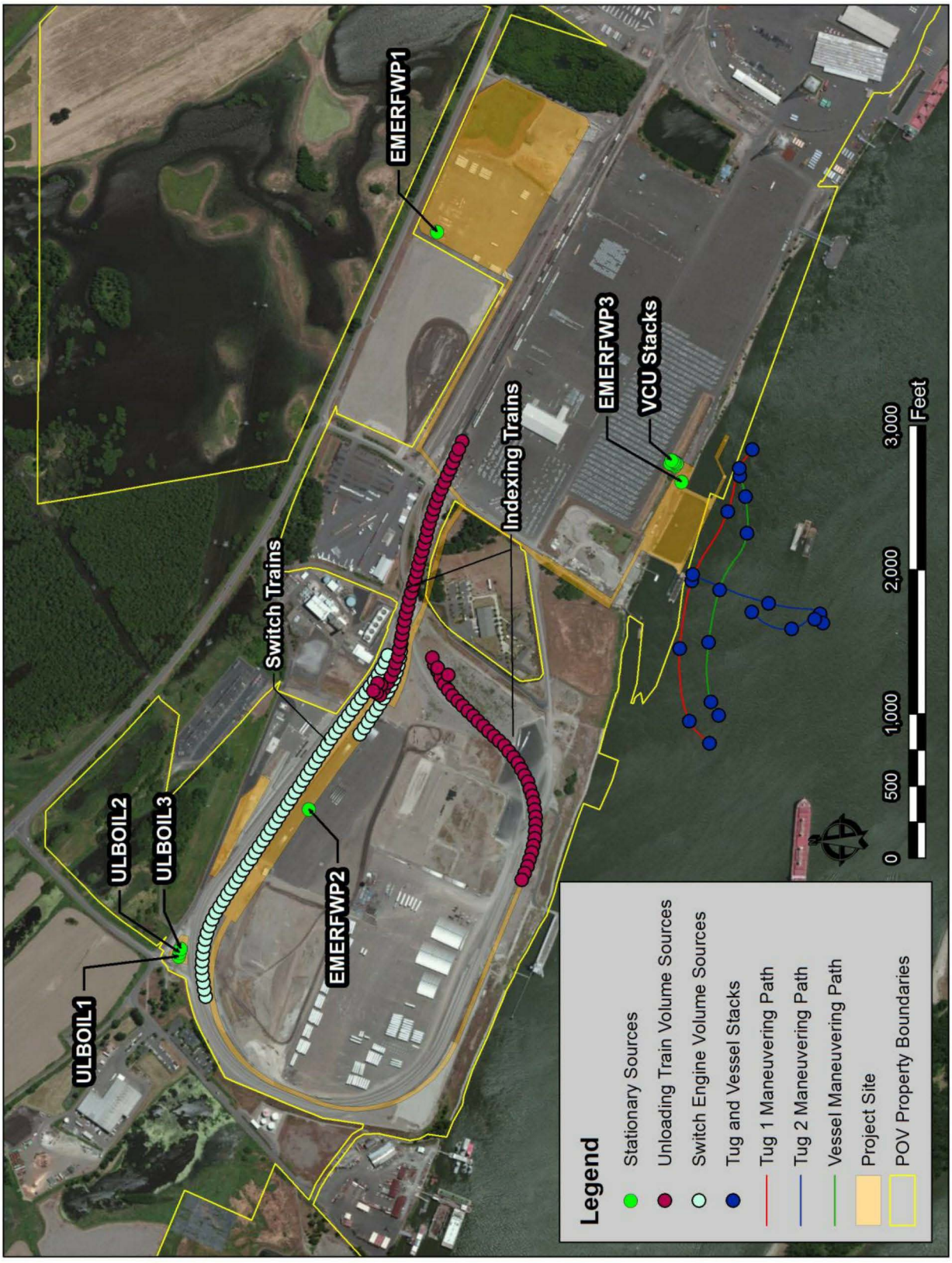

Figure 4. Short-term Modeling Scenario Sources

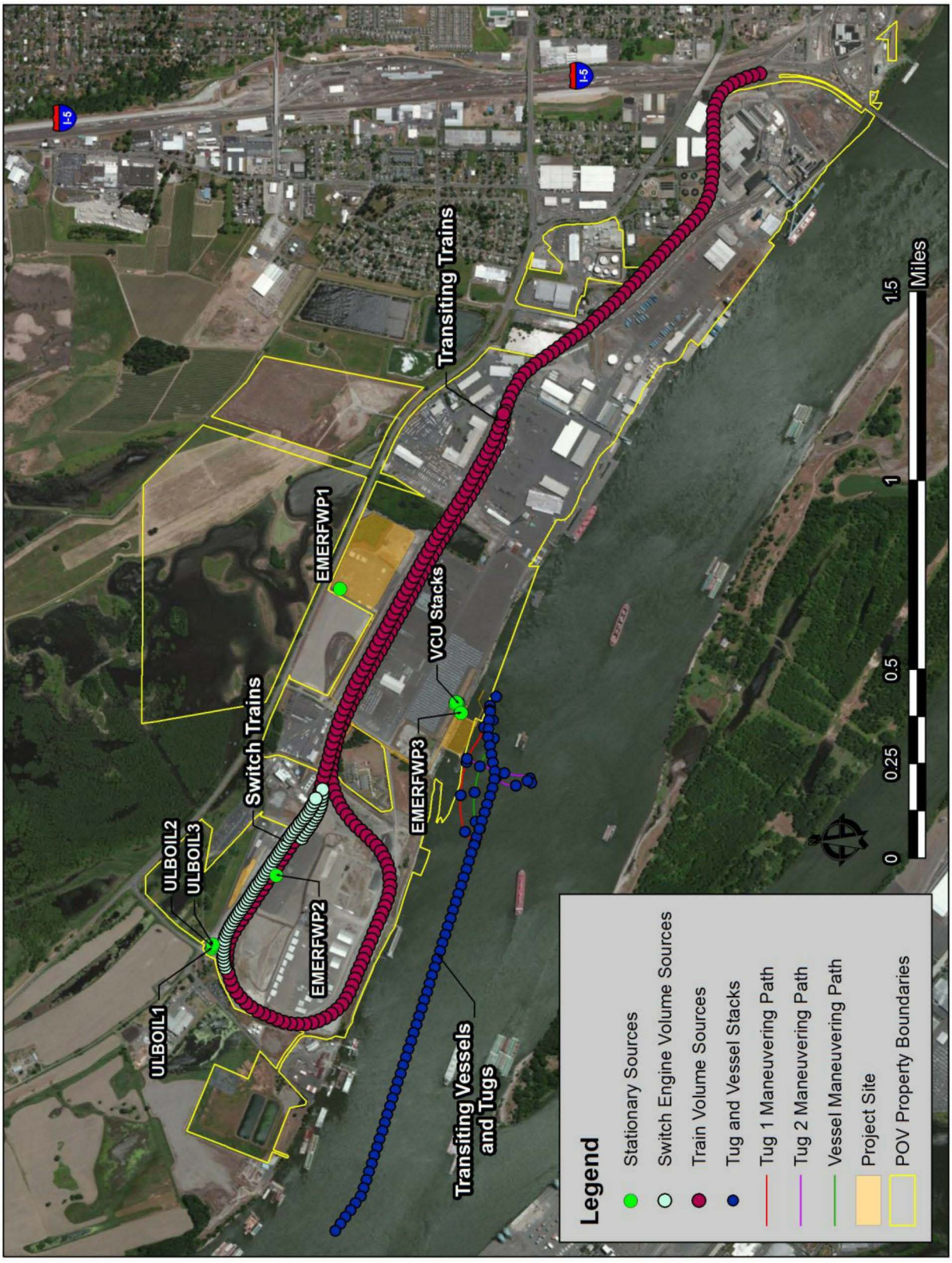

Figure 5. Long-term Modeling Scenario Sources

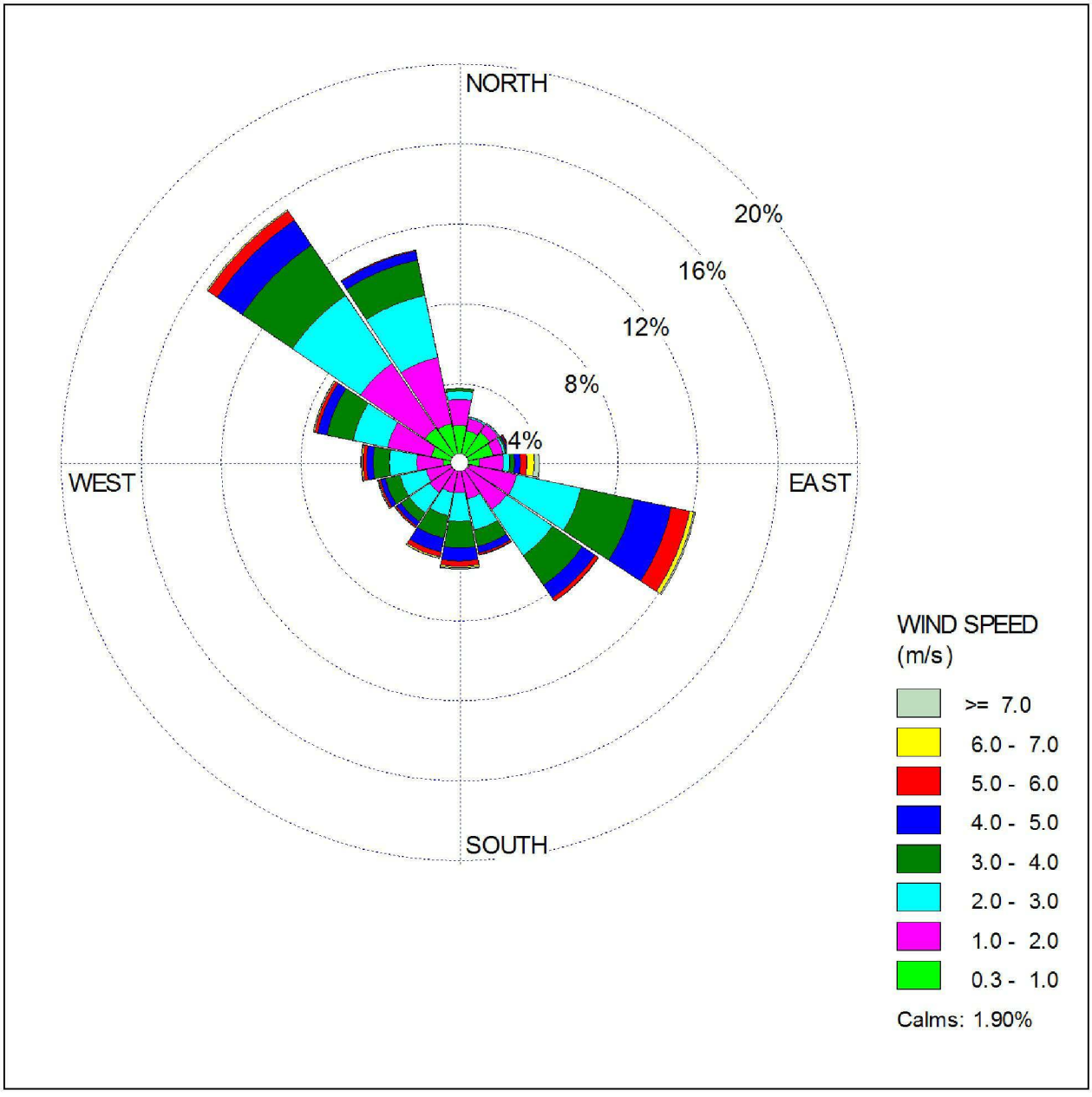

Figure 6. 5-Year Meteorological Data Set Wind Rose

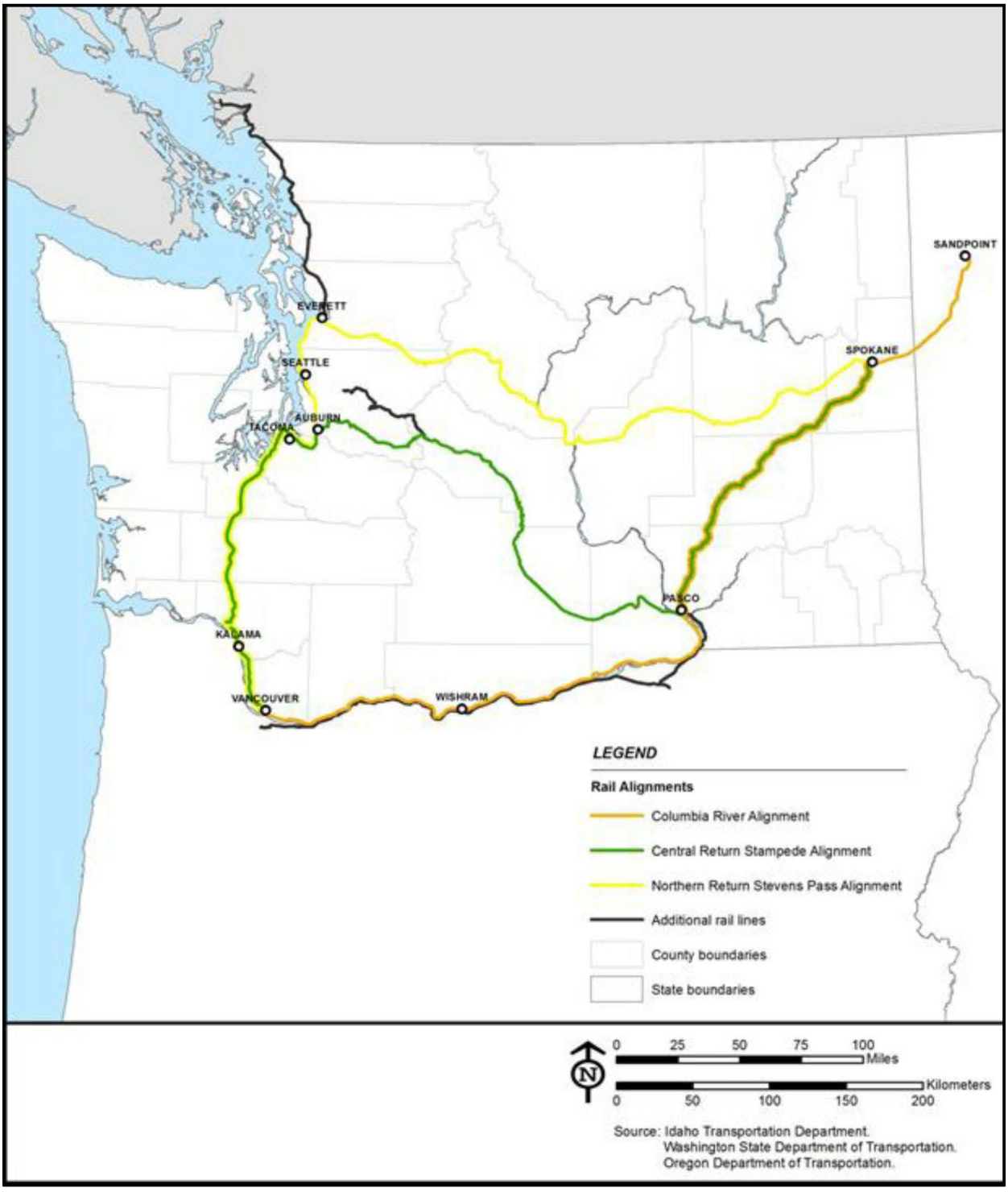

Figure 7. Primary Rail Routes in Washington State

Attachment A: GHG Emissions Inventory

Attachment A
GHG Emissions Calculations

Project-Related GHG Emissions: Summary

Operational Emissions	Annual Emissions CO_2e - Metric Tons
Rail Product Delivery [a]	
Transiting (within Washington) [b]	156,684
On-Site [c]	3,257
Vessel Product Export [d]	
Transiting (within Washington) [e]	17,232
On-Site [f]	6,829
Total Product Transport Emissions	184,002
Facility Operations Stationary Sources	86,184
Total Annual Facility-Related GHG Emissior	**270,186**

Source: ENVIRON International Corporation 2014

[a] GHG emission factors taken or calculated from the 2009 EPA "Emission Factors for Locomotives" and 2008 EPA "Greenhouse Gas Inventory Protocol Core Module Guidance - Direct Emissions from Mobile Combustion Sources" , EPA Climate Leaders, Table A-6.

[b] Transiting emissions assume route along the Columbia River while loaded and along central rail route when empty

[c] On-site activity data provided by Savage, 2013

[d] GHG emission factors taken or calculated from the 2009 EPA "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories" and 2004 IVL "Methodology for calculating emissions from ships. 1. Update of emission factors".

[e] Vessel transit operations assumed to occur between the facility and the mouth of the Columbia River

[f] On-site vessel activities include maneuvering with tugs and hotelling with boilers

On-site Locomotive Activity

Action	Notch	Time (min)	Distance (feet)	Speed (mph)	Distance (miles)	Time @ 10 mph	Gallons Consumed (gal)[a]
Spur to facility	Notch 3[b]	15	10685.8	10	2.02	12.14	35.25
Wait for switch at facility yard	Idle[c]	10	0	0	-	-	1.65
Proceed forward to personell switch	Notch 3	10	6585.3	10	1.25	7.48	23.50
Switch personnel BNSF > Savage	Idle	10	0	0	-	-	1.65
Proceed forward to unloading	Notch 3	5	2956	10	0.56	3.36	11.75
Unload	Idle	120	0	0	-	-	19.80
Proceed forward 1800 feet	Notch 3	3	1800	10	0.34	2.05	7.05
Unload	Idle	120	0	0	-	-	19.80
Proceed forward 1800 feet	Notch 3	3	1800	10	0.34	2.05	7.05
Unload	Idle	120	0	0	-	-	19.80
Proceed forward 1800 feet	Notch 3	3	1800	10	0.34	2.05	7.05
Unload	Idle	120	0	0	-	-	19.80
Exit Unloading area	Notch 3	3	1800	10	0.34	2.05	7.05
Switch personnel Savage > BNSF. Inspection	Idle	60	0	0	-	-	9.90
Proceed to Spur	Notch 3	10	5376	10	1.02	6.11	23.50
Wait for track alignment	Idle	10	0	0	-	-	1.65
						Total Gallons of Fuel	**216.25**

[a] *Assumes 3 locomotives per train*

[b] *Notch 3 fuel consumption estimated by Savage to be 47 gallons per hour (Savage, 2013)*

[c] *Idle fuel consumption estimated by Savage to be 3.3 gallons per hour (Savage, 2013)*

Locomotive GHG Emissions

Pollutant	Global Warming Potential[a]	Emission Factor[b] (g/gal)	Emissions (metric tons)	CO_2 Equivalent (metric tons)
CO_2	1	10217.28	3225.85	3225.85
CH_4	25	0.80	0.25	6.31
N_2O	298	0.26	0.08	24.46
			Total CO_2 Equivalents	**3256.63**

[a] *Global warming potentials taken from U.S. Code of Federal Regulations, Title 40, Part 98, Subpart A, Table A-1.*

[b] *GHG emission factors taken or calculated from the 2009 EPA "Emission Factors for Locomotives" and 2008 EPA "Greenhouse Gas Inventory Protocol Core Module Guidance - Direct Emissions from Mobile Combustion Sources", EPA Climate Leaders, Table A.6*

Gross Train Weights

Variables	Weight (metric tons)	Loaded Weight[d] (metric tons)	Unloaded Weight[e] (metric tons)
Weight of Crude Oil[a]	11444.57		
Weight of Tanker Cars	3631.51	15616.22	4171.65
Weight of Locomotives	540.14		

[a] *Assumes crude oil specific gravity of 0.8 (http://www.cenovus.com/contractor/docs/CenovusMSDS_BakkenOil.pdf); water density of 8.345 lb/gal; 90,000 bbl moved per train*

[b] *Assumes maximum loaded car weight of 286,000 lbs (http://www.law.cornell.edu/cfr/text/49/179.13) minus the weight of crude oil; 116 cars per train (expected barrels moved divided by car capacity of 32,500 bbl)*

[c] *Assumes average weight of C44-9 (http://www.thedieselshop.us/DataC44-9.HTML) and SD70 (http://www.thedieselshop.us/Data%20EMD%20SD70.HTML) locomotives; 3 locomotives per train*

Alignment-Specific Fuel Consumption

Route Alignment	Basis	Length[a] (mi)	Gross ton-miles	Fuel Consumption[b] (gal)
Columbia	Loaded	432.9	6,760,261	7,436.3
Central	Unloaded	648.4	2,704,895	2,975.4

[a] *Calculated in ArcGIS using the ESRI Data and Maps U.S. Rail dataset*

[b] *Fuel consumption rate of 0.0011 gal/GTM calculated ffrom BNSF activity in the 2008 American Association of Railroads analysis data*

GHG Emissions

Pollutant	Global Warming Potential[a]	Emission Factor[b] (g/gal)	Loaded Emissions (metric tons)	Unloaded Emissions (metric tons)
CO_2	1	10,210	75.92	30.38
CH_4	25	0.80	0.006	0.002
N_2O	298	0.26	0.002	0.001
CO_2e	--	10,307	76.65	30.67
		Annual CO_2e (metric tons)		**156,684**

a Global warming potentials taken from U.S. Code of Federal Regulations, Title 40, Part 98, Subpart A, Table A-1.

[b] *GHG emission factors taken or calculated from the 2009 EPA "Emission Factors for Locomotives" and 2008 EPA "Greenhouse Gas Inventory Protocol Core Module Guidance - Direct Emissions from Mobile Combustion Sources" , EPA Climate Leaders, Table A-6.*

Vessel Engine Specifications[a]

Vessel Type	Engine Type	Power (kW)
Tanker	Main	8,680
	Auxiliary[b]	2,400
	Boiler[c]	371
Tugs	Main	1,420
	Auxiliary	110

[a] *Vessel specifications provided by Savage (2013)*

[b] *3 Auxiliary engines at 800 kW each*

[c] *Boiler rating selected from "Current Methodologies in Preparing Mobile Source Emission Inventories", EPA 2009. Assumes a boiler for a loading tanker operates at the same rating as maneuvering.*

Vessel Emission Factors[a]

Vessel Type	Engine	CO_2 (g/kWh)	CH_4 (g/kWh)	N_2O (g/kWh)
Tanker	Main	588.79	0.012	0.031
	Auxiliary	690.71	0.008	0.031
	Boiler	690.71	0.008	0.031
Tugs	--	690	0.02	0.09

[a] *GHG emission factors taken or calculated from the 2009 EPA "Current Methodologies in Preparing Mobile Source Emission Inventories" and 2008 EPA "Greenhouse Gas Inventory Protocol Core Module Guidance - Direct Emissions from Mobile Combustion Sources" , EPA Climate Leaders.*

Vessel Engine Load Factors[a]

Vessel Type	Engine	Mode	Load	Low-Load Adj.[d]
Tanker	Main	Cruise Outer	83.0%	--
		Cruise Inner[b]	36.4%	--
		Maneuver	4.6%	2.01
	Auxiliary[c]	Cruise	24.0%	--
		Reduced Speed Zone	28.0%	--
		Maneuver	33.0%	--
		Hotelling	26.0%	--
Tugs	Main	All	85.0%	--
	Auxiliary	All	56.0%	--

[a] *GHG emission factors taken or calculated from the EPA, 2009 "Current Methodologies in Preparing Mobile Source Emission Inventories" and 2008 EPA "Greenhouse Gas Inventory Protocol Core Module Guidance - Direct Emissions from Mobile Combustion Sources" , EPA Climate Leaders.*

[b] *Cruise within the Columbia River is assumed to be limited to a maximum of 10 knots.*

[c] *With the cruise speed within the Columbia limited, the reduced speed zone load for auxiliary engines is used during cruising.*

d Low-Load adjustment applied to CO_2 calculations based on information provided in the EPA, 2009 "Current Methodologies in Preparing Mobile Source Emission Inventories". These low-load adjustments are not applied to CH_4 and N_2O

On-Site Emissions

Mode	Engine	Time in Mode[a] (hr)	CO_2 (g)	CH_4 (g)	N_2O (g)	CO_2e[e] (metric tons)
Transit[b]	Main	0.2	372,500	7.59	19.61	0.38
	Auxiliary	0.2	92,831	1.08	4.17	0.09
	Boiler					
	Tug - Main	0.2	166,566	4.83	21.73	0.17
	Tug - Auxiliary	0.2	8,501	0.25	1.11	0.01
Maneuvering[c]	Main	2	935,906	9.49	24.52	0.94
	Auxiliary	2	1,094,085	12.67	49.10	1.11
	Boiler	2	512,507	5.94	23.00	0.52
	Tugs - Main	2	3,331,320	96.56	434.52	3.46
	Tugs - Auxiliary	2	170,016	4.93	22.18	0.18
Hotelling[d]	Main					
	Auxiliary	17	7,327,052	84.86	328.85	7.43
	Boiler	17	4,356,308	50.46	195.52	4.42
					Daily CO_2e (metric tons)	**18.71**
					Annual CO_2e (metric tons)	**6829.00**

[a] *Time in mode for each activity was determined based on communications with Savage and their expected activity operations. For the transit and maneuvering time-in-mode values, it is assumed that activities occur both inbound and outbound.*

[b] *Transiting is assumed to occur for 1 nautical mile at 10 knots within the on-site region during inbound and outbound operations. This is also associated with tug movements to meet or depart the vessel.*

[c] *Maneuvering is expecetd to occur for one hour inbound and one hour outbound. These activities are assumed to utilize two tugs to aid in positioning or turning the vessel.*

[d] *Hotelling is expected to occur for 17 hours each day; 15 hours of crude oil exchange and an hour each for setup and dismantel.*

[e] *Global warming potentials (CO_2 = 1, CH_4 = 25, N_2O = 298) taken from U.S. Code of Federal Regulations, Title 40, Part 98, Subpart A, Table A-1.*

Transiting Emissions[a]

Mode	Trasit Distance[b] (nautical miles)	Transit Speed[c] (knots)	Transit Time (hr)	Engine	CO_2 (g)	CH_4 (g)	N_2O (g)	CO_2e[e] (metric tons)
Transit	99.89	10	9.989	Main	18,604,502	379.17	979.53	18.91
				Auxiliary	4,636,465	53.70	208.09	4.70
				Boiler				
							Daily CO_2e[d] (metric tons)	**47.21**
							Annual CO_2e (metric tons)	**17232.16**

[a] *Emissions, off-site, between the facility and the mouth of the Columbia River.*

[b] *Transit distance calculated using USGS navigation charts and ESRI ArcGIS software.*

[c] *transit speed within the Columbia River for the tanker vessels is expected to not exceed 10 knots (Savage, 2013)*

[d] *Within a 24-hour period the transiting emissions are expected to occur twice; one in and one out.*

[e] *Global warming potentials (CO_2 = 1, CH_4 = 25, N_2O = 298) taken from U.S. Code of Federal Regulations, Title 40, Part 98, Subpart A, Table A-1.*

Attachment B: Pasco to Vancouver Rail Versus Tug/Barge Emissions Inventory

Barge Alternative Emissions Comparison (tons/day)[1]

Pollutant	Rail[2]	Barge and Tug[3]
NO_x	2.62	3.66
$PM_{2.5}$	0.07	0.21
CO_2e	223.25	314.39

[1] Distance between Pasco and Vancouver calculated as approximately 250 miles. Same distance applied for rail and marine calculations.

[2] Emissions from three locomotives per train based on estimated gross-ton miles traveled for 90,000 barrels of crude per train, 4 trains per day, BNSF-specific fuel consumption per gross-ton mile, and emission factors from EPA, 2009.

[3] Barge and Tug emissions based on 30,000 barrel capacity barges, one tug with 2,208 kW propulsion engine and 150 kW auxiliary engine, 0.31 propulsion and 0.43 auxiliary load factors, 24 barge trips per day (12 load deliveries), and 80 minutes of maneuvering per transit (40 minutes each of arrival and departure). Vessel characteristics taken from Chevron, 2014.

Conversions/Basis		
Variables	Value	Units
galPerBbl	42	gal/bbl
SpecGravFuel	0.8	
WaterDensity	8.345	lb/gal
FuelDensity	3200	g/gal
FuelDensityLbs	6.676	lb/gal
lbsPerTon	2000	lb/ton
Trips_per_day	4	#
gramsperton	907185	

Route Gross Ton Mileage		
Route	Length (mi)	GTM
Pasco2Van	250	4308907.5
--		

Calculations		
Variables	Value	Units
bblMoved	90000	bbl
MaxCarWeight	286000	lbs
CarCapacity	32500	gal
WeightC44	425000	lbs
WeightSD70	394000	lbs
AvgLocoWeight	409500	lbs
CarCount	116	#
LocoCount	3	#

Emission Factors		
Pollutant	Emission Factor[1]	Units
NOx	121	g/gal
PM10	3.1	g/gal
HC	5.1	g/gal
CO_2	10210	g/gal
CH_4[2]	0.80	g/gal
N_2O[2]	0.26	g/gal
CO_2e	10307.48	g/gal
Fuel Consumption[3]	0.00114	gal/gtm

[1] Taken from "Emission Factors for Locomotives", Office of Transportation and Air Quality, U.S. EPA, April 2009 (EPA-420-F-09-025)

[2] Taken from "Direct Emissions from Mobile Combustion Source", Climate Leaders Greenhouse Gas Inventory Protocol Core Module Guidance, U.S. EPA, May 2008.

[3] Calculated BNSF specific fuel consumption rate from "AAR Analysis of Class I Railroads, 2008", Association of American Railroads, published 2009.

Gross Train Weight		
Variables	Value	Units
CrudeOil	12,618	tons
Cars	4,004	tons
Loco	614	tons
Gross Tons Loaded	**17,236**	**tons**
Gross Tons Unloaded	**4,618**	**tons**

Emissions (per trip)		
Pollutant	Columbia	Units
NOx	0.6552	tons
PM10	0.0168	tons
HC	0.0276	tons
CO_2	55.2843	tons
CH_4	0.0043	tons
N_2O	0.0014	tons
CO_2e	55.81	tons

Daily Emissions	Pasco2Van	Units
NOx	2.62	tons/day
PM10	0.07	tons/day
HC	0.11	tons/day
CO2e	223.25	tons/day

Tug and Barge Characteristics[1]							
Barge Type	Build Date	Barge Aux. Power	Tug Hull Build Date	Tug Power (kW) Propulsion	Tug Power (kW) Auxiliary	Service Speed	Capacity (bbls)[1]
Barge 1D	2005	80	1976	2208	150	12	30,000

[1] *ICF, 2014 Table 3-1*

[2] *ICF, 2014 Reported average capacity of 28,862 bbls. Here, we assume an even 30,000 bbls.*

Engine Load Factors (Tugs Pushing Barges)[1]	
Propulsion	Auxiliary
0.31	0.43

[1] *ICF, 2014 Table 3-9*

Fuel Correction Factors[1,2]	
NOx	PM
0.93	0.72

[1] *ICF, 2014 Table 3-10*

[2] *Assumes Model Year <1996, power >130 kW*

GIS Distance	250 miles 217.2 nm
Speed	12 knots
One-Way Transit Time (hr)	18.1
Maneuvering Time/trip (hr)	1.3
Total Time (hr)	19.4
Tug Trips/Day	24
24 trips per day (12 up and 12 down)	

Emission Factors (g/kWh)

	NOx	PM10	PM2.5	CO	ROG	SOx	CO2	BSFC	CH4	N2O
Tug Propulsion	9.35	0.56	0.54	2.75	0.72	0.01	789	247	0.02	0.09
Tug Auxiliary	11.15	0.71	0.69	4.88	1.17	0.01	789	247	0.02	0.09

Emission Factors (g/h)

	NOx	PM10	PM2.5	CO	ROG	SOx	CO2	BSFC	CH4	N2O
Tug Propulsion	6,400	383	370	1,882	493	7	540,055	169,067	14	62
Tug Auxiliary	719	46	45	315	75	1	50,891	15,932	1	6

Pasco to Vancouver Emissions (tons/day)

	NOx	PM10	PM2.5	CO	ROG	SOx	CO2	BSFC	CH4	N2O	CO2e
Tug Propulsion	3.29	0.20	0.19	0.97	0.25	0.004	277.70	86.94	0.01	0.03	287.32
Tug Auxiliary	0.37	0.02	0.02	0.16	0.04	0.000	26.17	8.19	0.001	0.003	27.07
Total	**3.66**	**0.22**	**0.21**	**1.13**	**0.29**	**0.004**	**303.87**	**95.13**	**0.01**	**0.03**	**314.39**

Response to EFSEC Draft
EIS Data Request
Vancouver Energy, Vancouver, Washington

Attachment 2
NPDES Engineering Report

DRAFT
National Pollutant Discharge Elimination System Permit Engineering Report

Tesoro Savage Vancouver Energy Distribution Terminal
EFSEC Application No. 2013-01
Docket No. EF131590

Submitted to

Tesoro Savage Petroleum Terminal LLC
Vancouver, Washington

9 April 2014

Submitted by

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DRAFT
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT
ENGINEERING REPORT

Tesoro Savage Vancouver Energy Distribution Terminal
Vancouver, Washington

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NPDES PERMIT ENGINEERING REPORT
TESORO SAVAGE VANCOUVER
ENERGY DISTRIBUTION TERMINAL

EXECUTIVE SUMMARY

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1.0 PROJECT OVERVIEW

The project will construct a facility to receive crude oil by rail, store it on site, and load it on marine vessels for shipment to various consumers and end users primarily located on the West Coast. Unit trains will be indexed through the unloading area where crude oil will be gravity-drained into the collection piping system, and pumped through transfer pipelines to storage tanks. Marine vessels will arrive and moor at the dock where crude oil will be pumped from the storage tanks and loaded to marine vessels.

1.1 Introduction

This engineering report is based on the Washington Administrative Code (WAC) 173-240 and in response to the letter, dated February 6, 2014, from the Energy Facility Site Evaluation Council (EFSEC) to Kelly Flint, Tesoro Savage Petroleum Terminal LLC. EFSEC's has requested additional supporting information related to construction stormwater and industrial stormwater and related to the National Pollutant Discharge Elimination system (NPDES) permits.

1.2 Regulatory Applicability

As required by WAC 173-240-110, before constructing or modifying industrial stormwater facilities, engineering reports, plans, and specifications for the project must be submitted to EFSEC and the Washington State Department of Ecology (Ecology). Table 1 is a complete list of all federal, state, and local permits and requirements that would apply to the project if it were not reviewed under the EFSEC process.

Table 1 – Applicable Federal, State, and Local Permits and Requirements

Permit or Approval	Agency/Statute and/or Regulation
National Environmental Policy Act (NEPA) Compliance	U.S. Army Corps of Engineers (USACE) (anticipated federal lead agency for this project) 40 CFR 1500-1508
Endangered Species Act (ESA) Section 7 Consultation	U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) Section 7 of ESA
Magnuson Stevens Fisheries Conservation and Management Act	NMFS 50 CFR 600
Marine Mammal Protection Act (MMPA)	USFWS and NMFS 50 CFR 18 and 50 CFR 216
National Historic Preservation Act (NHPA) Section 106 Review	USACE, in consultation with Washington State Department of Archaeology and Historic Preservation (DAHP) 16 USC 470
Section 10 Permit	USACE

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Permit or Approval	Agency/Statute and/or Regulation
	Rivers and Harbors Act 33 CFR 322
Private Aids to Navigation (PATON) Permit	U.S. Coast Guard (USCG) 33 CFR 62
Hazardous Materials and Oil Transportation Regulations	U.S. Department of Transportation Hazardous Material Transportation Act (HMTA), 49 CFR 100-185
Railroad Workplace Safety	Federal Rail Administration 49 CFR 214
Maritime Procedures	USCG 46 CFR 35 (Tank Vessels – Operations)
Marine Transportation Safety Act (MTSA)	USCG 33 CFR 101-107
State Environmental Policy Act (SEPA) Compliance	Ecology (EFSEC lead agency for this project) Revised Code of Washington (RCW) 43.21C and WAC 197-11
Hydraulic Project Approval (HPA)	Washington Department of Fish and Wildlife (WDFW) Hydraulic Code (RCW 77.55 and WAC 220-110)
Ballast Water Management	WDFW RCW 77.120 and WAC 220-150
Aquatic Land Management	Washington State Department of Natural Resources (DNR) RCW 79.105 and WAC 332-30-123
NPDES Industrial Stormwater Permit	Ecology Clean Water Act, 40 CFR 122.28, RCW 90.48 and WAC 173-220
NPDES Construction Stormwater General Permit	Ecology Clean Water Act, 40 CFR 122.28, RCW 90.48 and WAC 173-220
Model Toxics Control Act (MTCA) Consent Decree/Restrictive Covenant Work	Ecology RCW 70.105D, RCW 64.70, WAC 173-340
Facility Oil Handling Standards • Oil Transfer Requirements • Design Standards • Operations Manual • Training/Certification • Oil Transfer Response Plans	Ecology 33 CFR 154 (Facilities Transferring Oil or Hazardous Material in Bulk), 40 CFR 112 (Oil Pollution Prevention), 40 CFR 300 (National Oil and Hazardous Substances Pollution Contingency Plan) WAC 173-180 (Facility Oil Handling Standards)
Vessel Oil Transfer Advance Notice and Containment	Ecology 40 CFR 112 (Oil Pollution Prevention) WAC 173-184
Spill Prevention and Contingency Plans	Ecology 40 CFR 112 (Oil Pollution Prevention) RCW 90.56 (Oil and Hazardous Substance Spill Prevention and Response), WAC 173-180 (Facility Oil Handling Standards), WAC 173-182 (Oil Spill Contingency Plan), WAC 173-183 Oil Spill Natural Resource Damage Assessment
Dangerous/Hazardous Waste Regulations	Ecology RCRA 40 CFR 260 RCW 70.105 (Hazardous Waste Management), WAC 173-303
Safety and Health Regulations	Washington State Labor and Industries Occupational Safety and Health Administration (OSHA) RCW 49.17 (WISHA), WAC 296

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Permit or Approval	Agency/Statute and/or Regulation
Site Plan Review	City of Vancouver (City) VMC) 20.270
Shoreline Substantial Development Permit	City RCW 90.58 and City Shoreline Management Program (SMP)
Critical Areas Permit	City VMC 20.740
Tree Ordinance	City VMC 20.770
Archaeological Predetermination Review	City VMC 20.710
Transportation Concurrency	City VMC 11.70
Major Grading Permit	City International Building Code (IBC), VMC Title 12 and Title 17
Civil Engineering Review	City VMC Title 10, Title 11, and Title 14
Building, Fire, Mechanical and Electrical Permits	City IBC, International Mechanical Code (IMC), International Fire Code (IFC), UPC, National Electric Code (NEC), Washington State Energy Code, VMC Title 16 and Title 17
Industrial Waste Discharge Permit	City Wastewater Discharge Standards WAC 173-221A VMC 14.10
Air Discharge Permit(s)	Southwest Clean Air Agency (SWCAA) Clean Air Act Vapor Combustion System design and operation regulation by USCG 33 CFR 154 New Source Performance Standards (NSPS) 40 CFR 60 Crude Oil Storage Tanks equipment and procedures defined in 40 CFR 60.112b Hazardous Air Pollutants (HAPs) 40 CFR 61 Maximum Achievable Control Technology (MACT) Standards 40 CFR 63 RCW 70.94 Notice of Construction (NOC) preconstruction permit WAC 173-400-110 Title V air operation permit WAC 173-401 Toxic Air Pollutants (TAPs) WAC 173-460 Particulate Matter WAC 173-470 Sulfur Oxides WAC 173-474 Volatile Organic Compounds (VOCs) WAC 173-490

1.3 Site Description

The proposed Tesoro Savage Vancouver Energy Distribution Terminal (Facility) will be constructed at the Port of Vancouver (port) within the City in Clark County, Washington. The Facility includes construction and operations in different "areas" of the overall facility, each area serving a different function. The site is located on the Washington shore of the Columbia River. State Route (SR) 501 (Lower River Road) is

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located immediately to the north of the site and is available from the east. Each area of the proposed Facility is described in further detail below. The entire Facility will be constructed on approximately 47.4 acres. See the vicinity map shown in Figure 1.

This report is primarily organized into three sections, each addressing the elements of the proposed Facility located within the three primary drainage basins. The three primary drainage basins are addressed by their respective terminal designations, Terminal 4, Terminal 5, and the Marine Terminal. Table 2 identifies which Facility areas are located within the three primary drainage basins. A detailed list of facility elements and appurtenances in each facility area is enumerated in Table 3.

Table 2 – Drainage Basin & Facility Areas

Drainage Area	Facility Areas
Terminal 4	Area 300 – Storage Area 500 – Transfer Pipelines
Terminal 5	Area 200 – Unloading and Office Area 600 – West Boiler Building
Marine Terminal	Area 400 – Marine Terminal Area 500 – Transfer Pipelines

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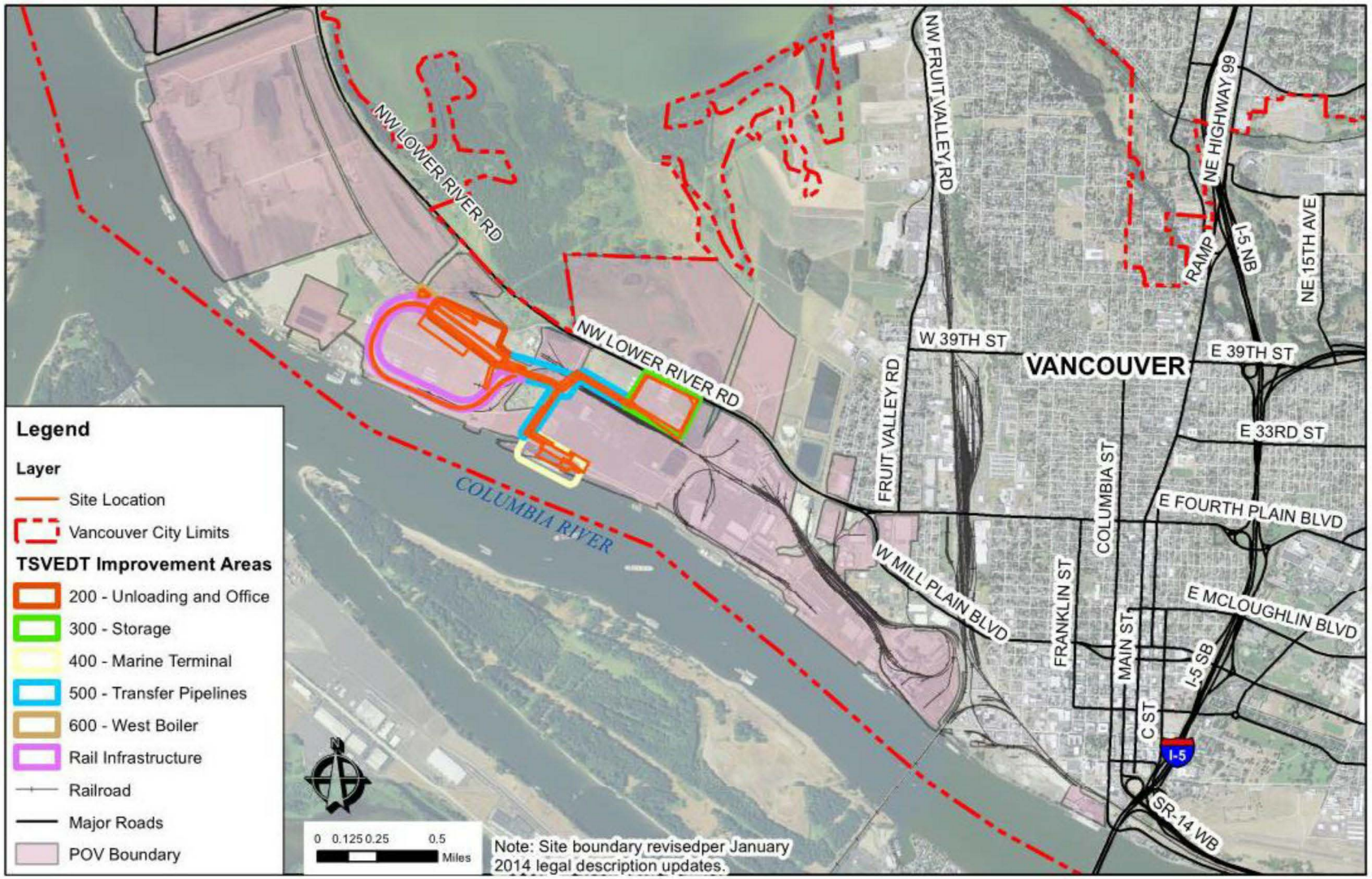

Figure 1 – Vicinity Map

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Most of the site will be leased from the port and will be used exclusively by the Applicant for the construction and operation of the Facility. The transfer pipelines will be located on non-exclusive easements within the port.

The site is located in the SE 1/4 of Section 18, NW 1/4 of Section 19, and the NW and NE 1/4 of Section 20, Township 2 North, Range 1 East W.M. Berths 13 and 14 are located at approximately Columbia RM 103.5. Table 3 lists the project site areas that are discussed in detail below while Figure 2 shows a site plan schematic that demonstrates the site development plan.

Table 3 – Summary of Facility Areas

Facility Area	Project Elements	Acreage
200 – Unloading and Office	Rail Unloading Area Control Rooms/E-houses Fire Pump and Foam Building Admin/Support Buildings	7.8 Acres
300 – Storage	Crude Oil Storage Tanks Secondary Containment Berm Storage Building Pump Basin Control Room/E-house Fire Pump and Foam Building	20.8 Acres
400 – Marine Terminal	Marine Vessel Loading Hoses and Equipment Control Room/E-house Dock Safety Unit MVCU Vapor Blower Skid Spill Prevention, Response and Containment Equipment Dock Improvements	7.7 Acres
500 – Transfer Pipelines	Transfer Piping from Area 200 to Area 300 Transfer Piping from Area 300 to Area 400 Piping from vessel loading to MVCU	5.3 Acres
600 – West Boiler	West Boiler Building	0.4 Acres

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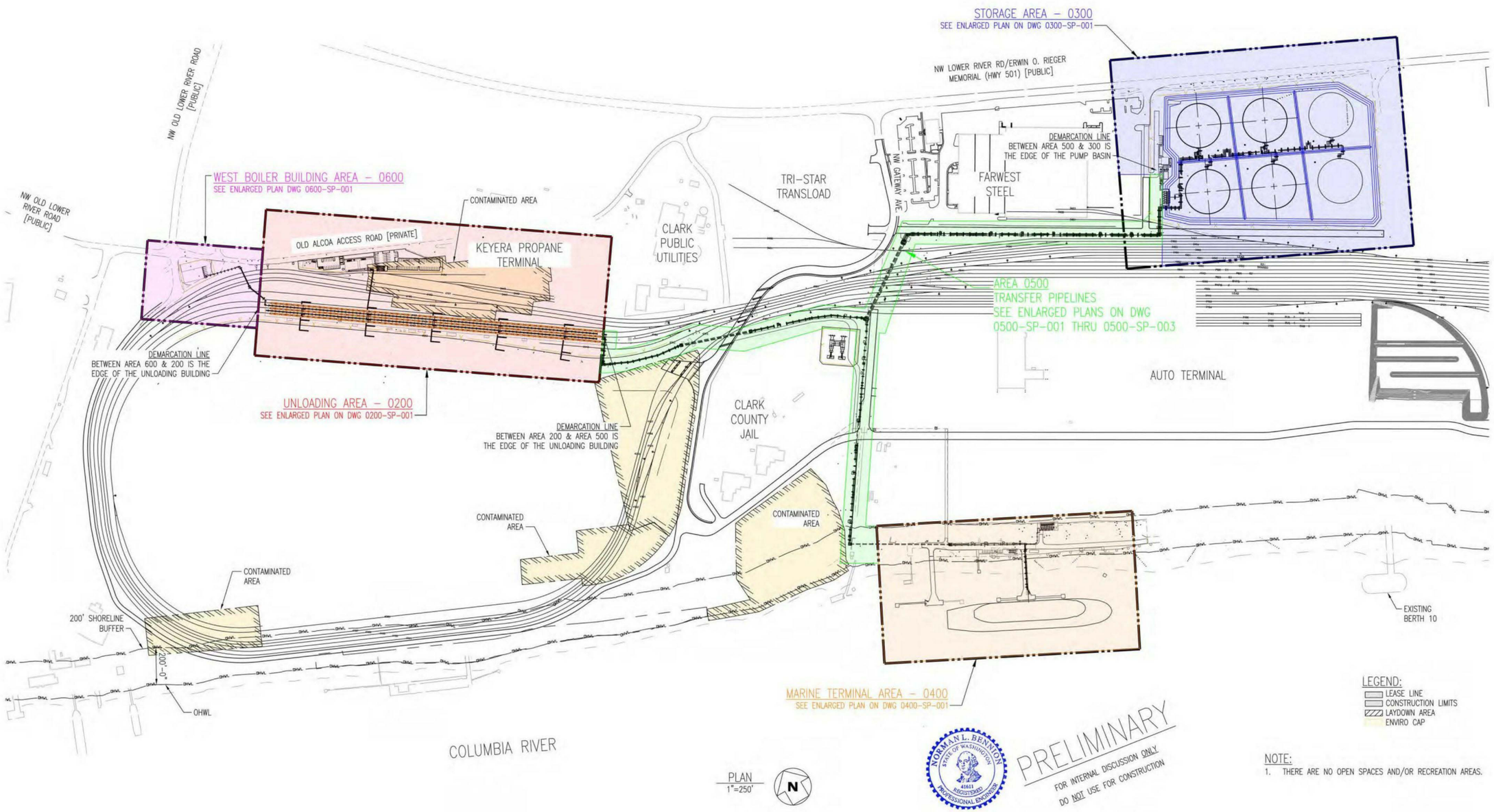

Figure 2 – Development Site Plan

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1.4 Existing Conditions

A thorough description of the existing conditions within and adjacent to the project area is included below. The existing condition descriptions are provided to delineate the geographic and natural resource elements of the Facility. Descriptions of the existing conditions include the following elements.

- Stormwater Conveyance and Treatment Systems
- Surface Water Bodies
- Flood Plains
- Wetlands
- Soil Evaluations
- Past Site Remediation
- Climate

1.4.1 Stormwater Conveyance and Treatment Systems

A detailed description of the three primary drainage basins (Terminal 4, Terminal 5, and the Marine Terminal) is provided in the following sections. The designations are intended to delineate the portion of the site described and its respective downstream drainage system. According to the port, the described Marine Terminal is technically part of Terminal 4; however, it has a distinct and separate stormwater system and, for that reason, is segregated as its own descriptive area.

1.4.1.1 Terminal 4

The Terminal 4 drainage system comprises approximately 250 acres of industrial land. A system of inlets and conveyance pipelines collect stormwater from the basin and discharge the stormwater to the Terminal 4 water quality pond, as shown in Figure 3. The water quality pond was modified recently to increase detention time and vegetative plantings were added for shading and bio-uptake. From the water quality pond, the stormwater is routed to the southeast where it is discharged through an outfall to the Columbia River.

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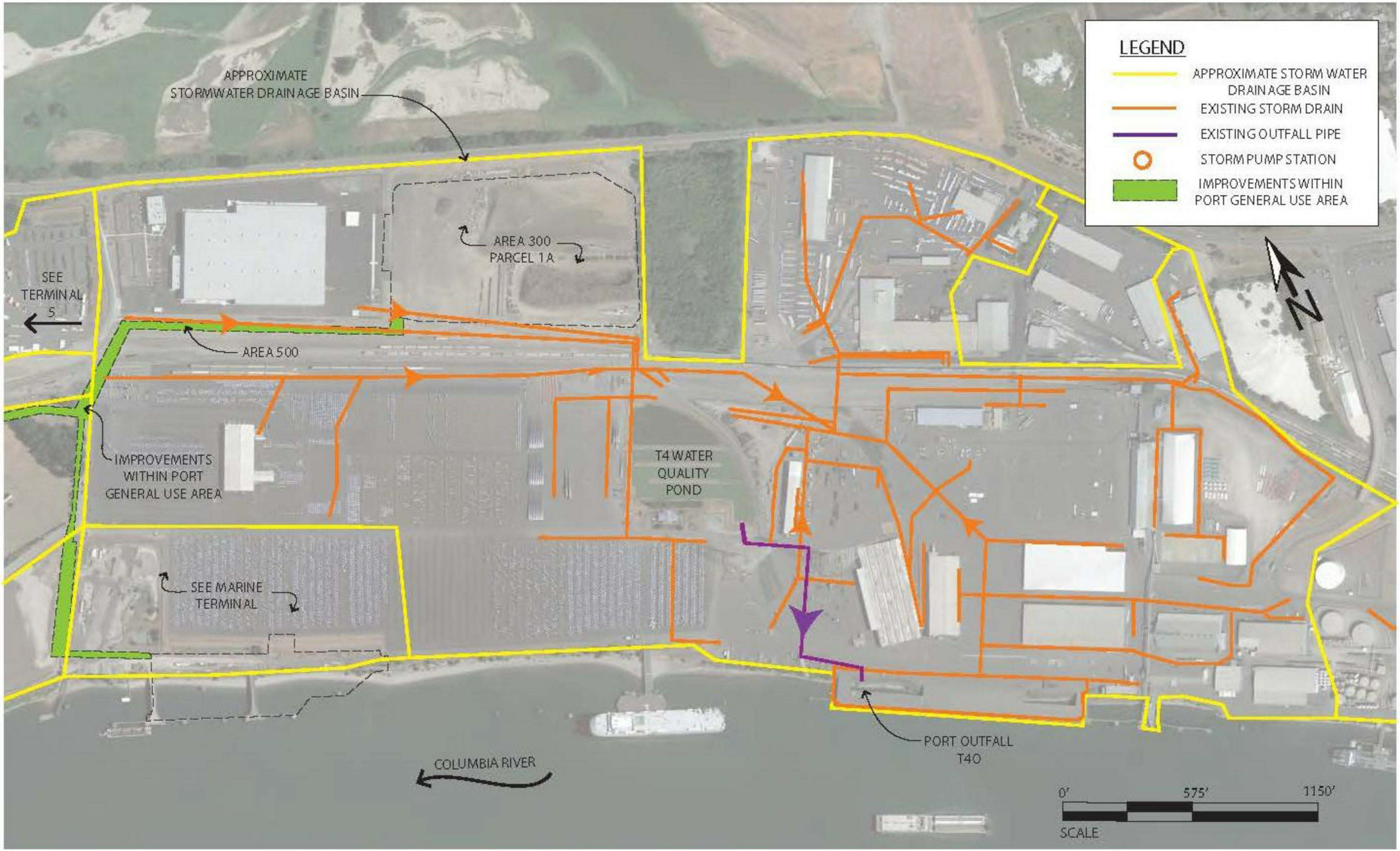

Figure 3 – Existing Terminal 4 Stormwater System

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Located within the Terminal 4 drainage basin is Area 300 – Storage, and a portion of Area 500 – Transfer Pipelines. There are two parallel stormwater systems running east-west along the south side of Area 300 and the portion of Area 500. The southern pipeline was installed for stormwater from the Port's General Use Area and rail corridor. The northern pipeline was installed for the use of port tenants and is intended to bypass the water quality pond. Farwest Steel is the only current discharger into this system. Upon completion of the Facility, stormwater from Area 300 will be discharged into the northern pipeline. Area 500 is located within the General Use Area and will continue to runoff to the Port's stormwater southern system.

Both pipelines currently discharge to the Terminal 4 water quality pond. However, construction to complete the separation of tenant stormwater from port General Use Area stormwater is anticipated to occur simultaneously with construction of the Facility.

1.4.1.2 Terminal 5

The Terminal 5 drainage system was installed as part of the remediation and decommissioning of the former ALCOA/Evergreen aluminum smelter and construction of the West Vancouver Freight Access project. The drainage system was designed and analyzed by HDR as part of its analysis for the construction of the West Vancouver Freight Access Project. A copy of the report is attached in Appendix F.

The Terminal 5 drainage basin consists of approximately 91 acres of industrial land that is collected through inlets and conveyed to a common stormwater pump station as shown in Figure 4. The stormwater system includes provision for a high flow or pump station failure to overflow to the Columbia River. During normal operations, stormwater from the basin is pumped to two treatment lagoons that were installed to treat both process water and stormwater from the ALCOA/Evergreen plant. The treatment lagoons are capable of providing final treatment and polishing of stormwater prior to discharge to the Columbia River.

Congruent to the site, three legs of the stormwater system extend through the rail unloading facility running north/south. The west lateral extends towards Old Lower River Road for future use, the middle lateral collects contributing runoff atop the Vanexco Cap, and the east lateral connects to the collection system for a portion of Old Lower River Road and the Keyera Energy propane terminal. The Facility areas constructed on Terminal 5 include Area 200, Area 600, and a portion of Area 500.

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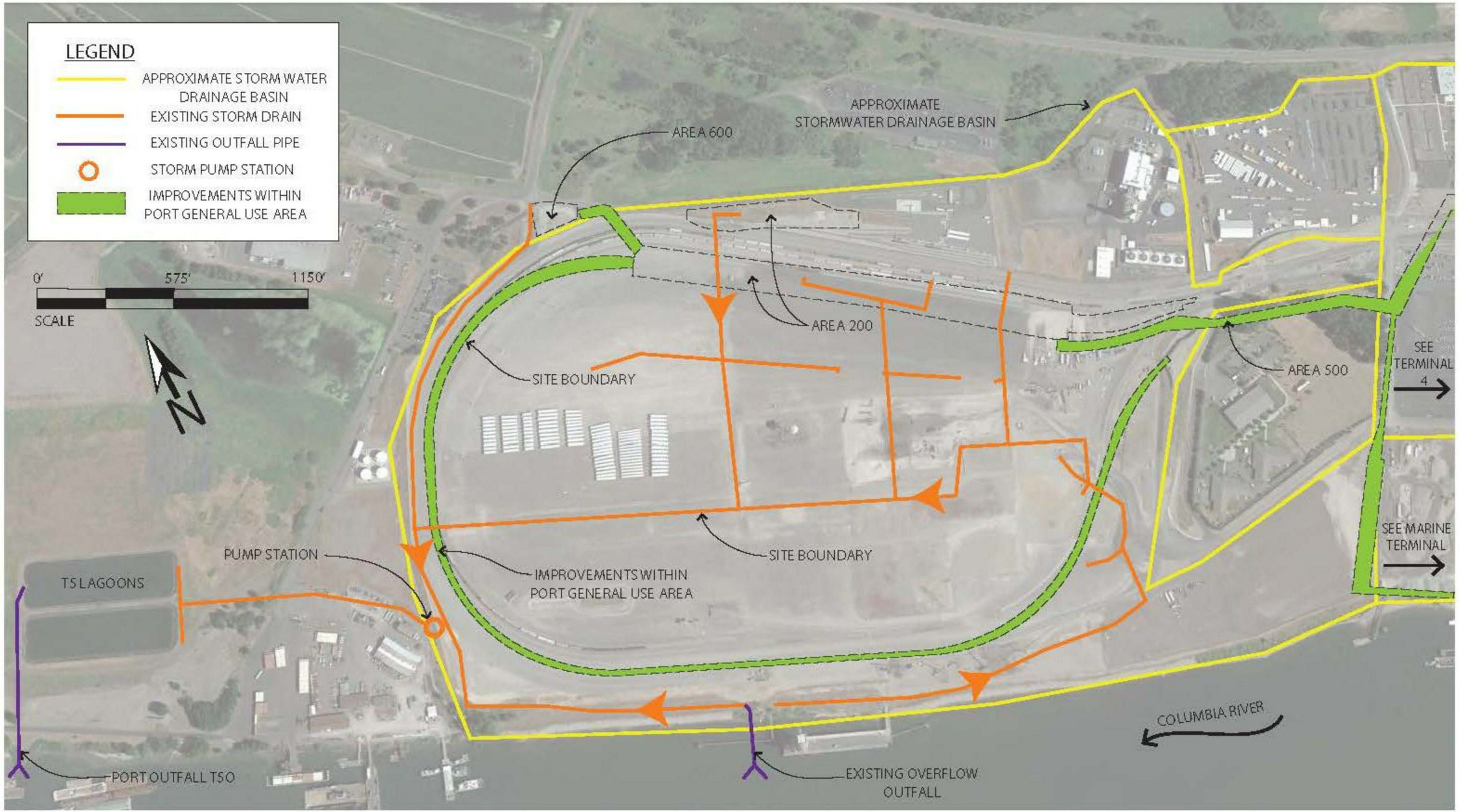

Figure 4 – Existing Terminal 5 Stormwater System

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1.4.1.3 Marine Terminal

The Marine Terminal stormwater system was installed when the Auto Terminal was constructed as part of the Columbia Gateway project. The stormwater basin collects stormwater from the Marine Terminal area, CalPortland/Glacier Northwest, and a portion of the Auto Terminal. In total, the basin consists of approximately 25 acres. Stormwater is collected through a series of inlets and conveyance pipes from which it is discharged to the treatment and infiltration swales. The existing Marine Terminal area sheet flows directly into the infiltration swales.

Stormwater is diverted to a number of biofiltration swales for Basic water quality treatment and flows into two hydraulically connected infiltration swales. Figure 5 shows the general arrangement of the collection and treatment facilities located at the Marine Terminal.

1.4.2 Surface Water Bodies

The project site is located immediately north of the Columbia River. The site is also bordered along portions of the project by nearby wetlands. A discussion of the wetlands follows in subsection 1.4.3. No streams or open surface water features are located within the areas of the site development.

The project site is located within the Salmon-Washougal Watershed (WRIA 28) located in southwest Washington. The nearest surface water feature is the Columbia River. The river drains an estimated basin of roughly 258,000 square miles and is approximately 1,243 miles long. The project site is located at approximately river mile 104. The Columbia River eventually discharges to the Pacific Ocean near Astoria, Oregon.

A description of the water quality of the Columbia River is included in section 12.2.

The average water level in the Columbia River is usually 7 to 8 feet during the winter. Flood stage is considered to occur at 16 feet when low level flooding begins to occur. A detailed discussion of the floodplain limits follows immediately in subsection 1.4.2. The flood of record is a 1996 event when the river crested at 27.2 feet (National Geodetic Vertical Datum [NGVD] 29). This is not the highest recorded event, which occurred on June 13, 1948 with a crest of 31.00 feet.

The floodplain elevations below are provided in the North American Vertical Datum (NAVD) 88, which is approximately 3.1 feet higher than the NGVD of 1929.

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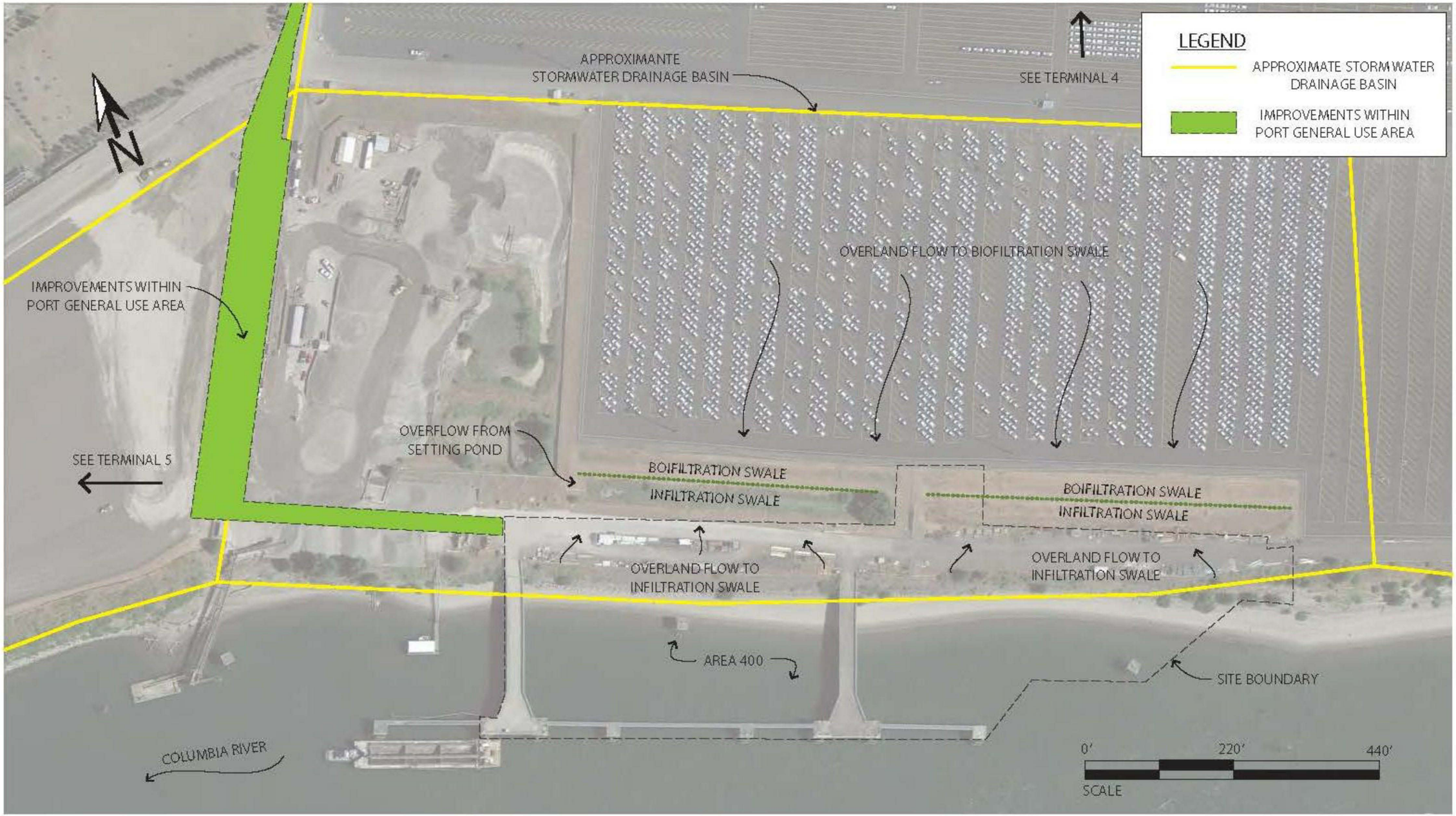

Figure 5 – Existing Marine Terminal Stormwater System

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1.4.3 Floodplains

The local floodplain within the project vicinity is defined by the Columbia River. This lower portion of the Columbia River is generally regulated by the upstream Bonneville Dam. Flooding in and adjacent to the site from the north watershed, including Vancouver Lake, is hydraulically connected directly to the elevation of the water surface of the Columbia River.

This site area has been extensively studied for floodplain and flood impacts. The most recent analysis conducted by the Federal Emergency Management Agency (FEMA) developed Flood Insurance Rate Maps (FIRM) issued on 5 September 2012. The base flood elevation and limits are shown on the FIRM maps contained in Appendix D. The FEMA FIRMs that cover the project site are Map Item ID numbers 53011C0363D and 553011C0364D.

1.4.3.1 100-Year Floodplain

The Base Flood Elevation (BFE) is identified in the FIRM for the 100-year floodplain as 30 feet based upon the NAVD 88 datum. The limits of the 100-year floodplain are classified in the FIRMs as Zone AE which indicates that there is a 1 percent annual chance flood, with the BFE being the water surface elevation of the 1 percent annual chance flood.

The 100-year floodplain is delineated along the top of the river bank. One component of the 100-year floodplain is shown in the FIRMs encroaching into Area 300 on Terminal 4, and Area 600 at Terminal 5. The 2012 FIRM maps do not reflect rough grading and filling of these sites that occurred since the adoption of the FIRMs. Due to filling and grading the Facility is outside of the 100-year floodplain.

1.4.3.2 500-Year Floodplain

The 500-year floodplain is identified in the FIRM as Zone X with the black dotted hatch pattern. The area of the Zone X is an area with a 0.2 percent annual chance flood. The 0.2 percent annual chance flood is listed with average depth of less than 1 foot.

With very little exception the 500-year floodplain extends across the entire project site. The rough grading completed since the adoption of the 2012 FIRMs does not impact the limits of the 500-year floodplain.

1.4.4 Wetlands

The National Wetland Inventory map for Vancouver (USFWS 1989) indicates the presence of numerous wetlands within the project vicinity. Before the development of this parcel, nine wetlands, totaling approximately 16 acres in size, were present on this specific site, but they were all filled through permitted actions that began in 1996.

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There are two wetland mitigation sites in the vicinity of the project site. The approximately 7.9-acre Parcel 1A wetland mitigation site, located immediately east of Area 300, was established in 1994. This is a depressional, palustrine forested wetland vegetated with mature black cottonwood trees and a variety of native shrubs and herbaceous species. Stormwater from Area 300 or 500 will not discharge to any existing wetlands. The wetlands are not hydraulically connected to any of the project elements.

The Parcel 2 wetland mitigation site is an approximately 16.4-acre mitigation site situated immediately north of the existing Terminal 5 site. The wetland was established in 2000 for impacts associated with the initial development of Parcel 1A. The site is currently a mosaic of forested, scrub-shrub, and emergent vegetation. Stormwater from the Facility will not discharge to Parcel 2 wetlands.

The most significant complex of wetlands in the general vicinity is associated with the southern end of Vancouver Lake. The wetlands in this area are a mosaic of emergent, scrub-shrub, and forested wetlands that are hydraulically connected to Vancouver Lake and, by extension, the Columbia River. These wetlands provide high quality seasonally inundated and tidally influenced habitats that most closely resemble the original hydrologic and wetland habitat functions of the Vancouver Lake Lowlands.

1.4.5 Soils Evaluation

A geotechnical investigation was performed by GRI for the proposed Facility. The following section on geology and subsurface conditions is excerpted from the Geotechnical Investigation Report, dated December 20, 2013, and attached in Appendix L.

1.4.5.1 Geology

Based on an understanding of the geology at the site, experience with nearby sites, and the available exploration data, the project area is mantled by fill that is underlain by recent alluvial soils to depths of 50 to 90 feet below the existing ground surface. The manmade fills typically consist of fine to coarse granular soils, with silt, silty sand, and sandy silt. The alluvial soils typically consist of very soft to medium stiff silt with varying percentages of clay interbedded with layers of sandy silt and sand that are underlain by sand with a trace of silt. The recent alluvial soils are typically underlain by alluvial gravels that range from gravel in a matrix of sand to open-graded gravel. Recent geologic investigations near the Interstate 5 bridge about 3 miles upstream from the project site indicate the alluvial gravels on the Washington side of the Columbia River can be up to 100 feet thick near the project site.

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Available geologic information indicates the alluvial gravels are underlain by the Troutdale Formation, a Pliocene-age unit of well-consolidated or cemented conglomerate and sandstone.

1.4.5.2 Subsurface Conditions

Subsurface materials and conditions at the site were investigated between June 5 and October 29, 2013 with 26 borings, designated B-1 through B-26, and six cone penetration test (CPT) probes, designated CPT-1 through CPT-6. The borings were advanced to depths of 21.5 to 104.2 feet, and the probes were advanced to depths of about 54 to 83 feet.

The locations of borings and probes are shown on figures 2 through 5 of the GRI report included as Appendix L. Referring to Figure 4, note that explorations have not been completed for the southeast and middle south tank footprints. Access to this area was not permitted due to the presence of a large stockpile of scrap metal. The field exploration and laboratory testing programs completed for this investigation are described in Appendix L. Logs of the borings and CPT probes are shown on figures 1A through 32A of the GRI report. The terms used to describe the soils encountered in the borings and CPTs are defined in tables 1A and 2A of the GRI report..

In addition to the borings and CPT probes, GRI also reviewed and used the logs of previous explorations by GRI and others in the site vicinity for other projects. Overall, the four results of the explorations recently completed for this investigation are in good agreement with previous work.

Soils

For the purpose of discussion, the materials disclosed by the explorations have been grouped into four units based on their physical characteristics, geologically significant features, and engineering properties. Listed as they were encountered from the ground surface downward, the units are fill, silt, sand, and gravel. Each is discussed below.

- Fill was encountered at the ground surface in all explorations except B-26 and extends to depths ranging from about 5 to 25 feet (elevation +24.5 to +2 feet). The fill was thinnest near the northeast area of Parcel 1A (Area 300), where the port plans to place additional fill, and near the northwest boundary of the unloader structure. The fill is thickest at the top of the riverbank in the dock area, where it is typically 20 to 25 feet thick.

  The fill consists of layers of silt, sand, and gravel. Based on N-values and CPT tip resistances that vary widely across the site, the relative consistency of the sand and gravel fill varies from very loose to very dense, and the relative consistency of the silt fill ranges from very soft to hard. The fill in Area 300 is typically sand and gravel and medium dense to dense. The fill in Area 200 and 600 typically

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consists of layers of sand and gravel, is typically medium dense to dense, and grades to loose to medium dense below depths of 5 to 12.5 feet in several borings in the area. The fill in Area 400 consists primarily of sand and is typically loose to medium dense. The moisture content of sand fill ranges from 7 to 33 percent and increases with increasing silt content. The moisture content of silty fill ranges from 15 to 48 percent.

- **Silt** was encountered in all explorations except borings B-10, B-23, and B-26. The silt was encountered beneath the fill in all borings and CPTs, except B-11, B-12, B-16, B-17, B-20, and B-25, where the silt was encountered beneath a layer of native sand that ranges from 2.5 to 15 feet thick. The silt extends to depths of 15 to 26 feet, and to the maximum depth explored in borings B-9, B-12 through B-14, and B-19. The silt ranges from 4-inch-thick interbedded layers to 19-foot-thick zone in Area 200 and 600; from 4 to 17 feet thick in Area 300; from 4 inches to 5 feet thick in Area 400; and from 12.5 to 17.5 feet thick in Area 500. Sand layers ranging from 3 to 4.5 feet thick are interbedded in the silt in Area 200. Based on N-values, Torvane shear strengths, and CPT side friction, the relative consistency of the silt ranges from very soft to stiff. Based on Atterberg limits testing, the liquid limit (LL) of the silt ranges from 27 to 76 percent, and the plasticity index (PI) ranges from 5 to 33 percent, indicating the soil has a low to high plasticity. The results of the Atterberg limits testing are shown on the Plasticity Charts, Figures 33A and 34A of the GRI report in Appendix L. The silt in Area 300 is typically very soft to medium stiff and has a medium to high plasticity with a PI greater than 16 percent. The silt in Area 200 and 600 is typically very soft to medium stiff and has a relatively low plasticity with a PI ranging from 5 to 15 percent and more typically 5 to 6 percent. The silt in Area 500 is very soft of medium stiff. The silt in Area 400 is medium stiff. An approximately 1-foot-thick layer of silt with varying gravel content was encountered above the gravel in the explorations in Area 400.

  Consolidation test data for selected samples of silt obtained from borings B-4, B-5, B-7, B-8, B-11, and B-19 at depths of 10 to 32 feet indicate the silt is slightly preconsolidated and displays a relatively low compressibility in the preconsolidated range and a moderate compressibility in the normally consolidated range of stresses. Consolidation test results are shown on figures 35A to 40A in the GRI report included in Appendix L. Secondary compression testing was completed on selected samples and is shown on figures 41A and 42A in the form of curves showing dial reading versus the log of time.

- **Sand** was encountered at the ground surface in boring B-26 and beneath the silt in the remaining borings and CPTs and extends to the underlying gravel at depths ranging from 40 to 64 feet. Borings B-10, B-11, B-15, B-17, B-18, and B-20 were terminated in sand. The sand is fine to coarse grained and contains varying percentages of silt, ranging from a trace of silt to silty. A trace of gravel was

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present in some of the sand. The thickness of the sand ranges from 20 to 67 feet. Interbedded layers of silt ranging from 1 to 14 feet thick are present in the sand in Area 200 and 600. N-values recorded in the borings in Areas 200 and 600 indicate the relative density of the sand is typically loose from 10 to 20 feet and medium dense below a depth of about 30 feet. In Area 300, the sand is typically loose in the upper 5 to 10 feet of the sand layer and typically grades to medium dense below depths of 25 to 40 feet. In Area 400, the sand is typically loose to a depth of 35 feet and medium dense below a depth of 35 feet. In Area 500, the sand is typically loose in the upper 5 to 10 feet of the sand layer and grades to medium dense below a depth of 30 to 40 feet.

- **Gravel** was encountered beneath the sand in borings B-1 through B-8, B-16, B-21 through B-26, and probes CPT-1 through CPT-6. Gravel was encountered at about elevation -24 to -30 feet in Area 300, elevation -64.5 feet in Area 200, elevation -25.5 feet in Area 500, and elevations -43.5 to -60 feet in Area 400. The gravel is typically in a matrix of sand and silt and contains scattered cobbles and possible boulders. Layers of relatively open-graded gravels were noted in Area 300. Interbedded layers of sand ranging from 4 inches to 4.5 feet thick occur in the gravel in Area 300. Based on N-values, the relative density of the gravel ranges from medium dense to very dense.

Groundwater

Groundwater levels in the project area fluctuate in response to seasonal river levels, precipitation, and daily tidal fluctuations in the river. Shallow perched groundwater conditions can develop above the less-permeable silty deposits at the site and approach the ground surface during periods of prolonged or intense rainfall.

The level of the Columbia River is lowest in late summer and early fall. Historical low water in the last 20 years is about elevation +2.5 feet. The 100-year flood level is about elevation +28 feet. The ordinary high water level (OHW) is about elevation 17 feet. The higher river levels typically occur during storm events and the spring freshet, when snowmelt runoff causes high river flows. Note: The 100-year flood elevation noted above is based on NGVD 29 and not the FIRM 100-year flood elevation which is based on NDVD 88.

Vibrating-wire piezometers were installed in borings B-4 and B-7 in Area 300. The piezometers are connected to data logger systems that automatically record the groundwater level. The groundwater elevations between June 7 and July 10 and August 2 through 23, 2013, were recorded at up to 2-hour intervals and are shown on Figure 6 in the GRI report. The piezometer data indicate the groundwater elevation fluctuated between elevation +4 and +10 feet over the recorded period. Hydrograph river levels recorded at a nearby station on the Columbia River during the same period were converted to NGVD elevations and are shown on the figure. Comparison of the recorded groundwater and river levels suggests the groundwater

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is typically near or slightly higher than the river elevation. In this regard, it should be anticipated the groundwater level at the site could rise to or very near the ground surface during flood events. The groundwater elevations shown on Figure 6 are based on survey data provided to GRI by MacKay Sposito. The batteries in the data loggers recording piezometer data in borings B-4 and B-7 stopped working on June 19 and July 10, 2013, respectively, and were replaced on August 2, 2013. It should be anticipated the groundwater level in the project area will reflect the water levels in the Columbia River.

1.4.6 Past Site Remediation

Terminal 5 is the former location of the Evergreen/ALCOA smelter, which operated until 2000. Industrial and solid wastes from the construction and operation of the aluminum smelter were stored in waste piles and consolidated in landfills on site over the years. Hazardous contaminants in these wastes include petroleum hydrocarbons, polychlorinated biphenyls (PCBs), cyanide, fluoride, trichloroethylene (TCE), low-level organic chemicals, and metals. ALCOA and Evergreen completed site remediation and facility decommissioning under Consent Decree No. 09-2-00247-2 and Enforcement Order 4931 with Ecology. Efforts included removing structures and foundations to a depth of approximately 4 feet and the site soil and sediment with concentrations of chemicals of concern above the cleanup levels established by the consent decree.

Five locations within the boundary of the Facility are subject to the consent decree. Descriptions of those areas follow and are shown in Figure 6.

- **Vanexco/Rod Mill Site** – Environmental assessments concluded that there is evidence of PCB contamination below the Vanexco Cap. The building foundation was largely maintained as a cap to restrict surface water from migrating through the contaminates below. Where the foundation was removed to facilitate rail improvements additional drainage and liner systems were installed.
- **Spent Pot Liner (SPL) Storage Area** – In 2010, the port placed an asphalt cap over the HDPE that had previously covered the contaminated soil.
- **North/North 2 Cap** – This area is covered by a restrictive covenant due to elevated contaminate levels that exceeded cleanup levels for soil and/or groundwater established in the MTCA.
- **Shoreline Restrictive Covenant** – This area is covered by a restrictive covenant due to elevated contaminate levels that exceeded cleanup levels for soil and/or groundwater established in the MTCA.
- **Ingot Plant Cap** – Environmental assessments concluded that there is evidence of PCB contamination below the Ingot Capt. This cap was constructed of a 1-foot layer of soil.

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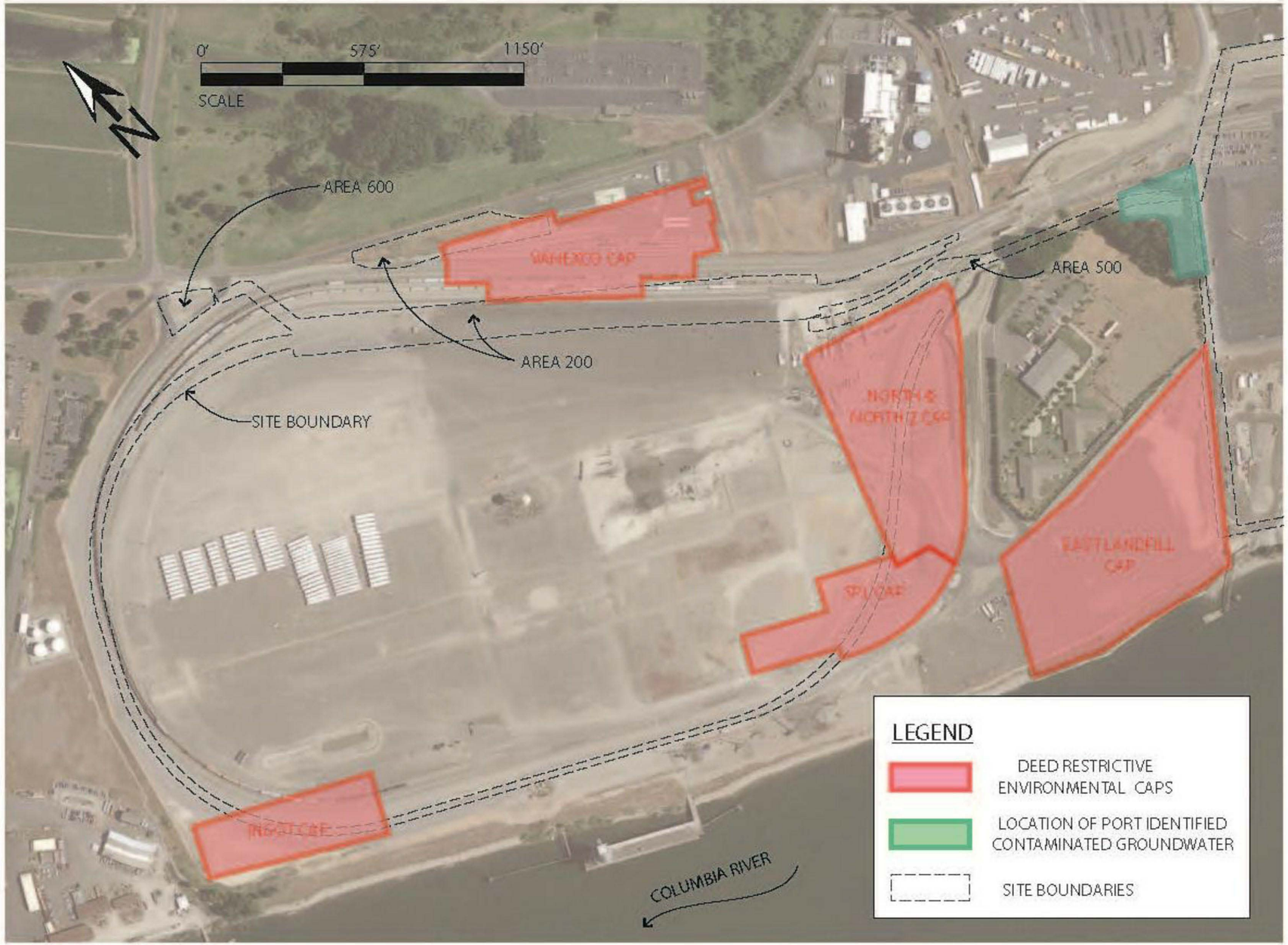

Figure 6 – Contaminated Media Locations

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1.4.7 Climate

The climate of the City is predominantly temperate, characterized by wet, mild winters and dry warm summers. The climate is influenced by the relative proximity of the Pacific Ocean and the Cascade and Coast ranges of Oregon and Washington. Temperature and precipitation measurement records from the "Vancouver 4 NNE" agricultural meteorological station were accessed to analyze the climate at the project site. The station is located approximately 4 miles northeast of the project site and has been collecting measurements since 1856. The maximum temperature ever recorded at the site was 106° F on July 30, 2009 and minimum temperature recorded was -8.0° F in 1909. The site averages about 39.6 inches of rainfall and 6.5 inches of snow a year, with most of the precipitation occurring during the winter months. Prevailing winds are from the west-northwest.

Isopluvial mapping of Washington was prepared by the National Oceanic and Atmospheric Administration. Table 4 shows estimates of precipitation amounts for the following design storms as shown in Volume IX of the NOAA Atlas 2 and attached in Appendix C.

Table 4– Design Storm Rainfall Intensity

Design Storm	Precipitation (in)
2-Year, 24-Hour	2.4
5-Year, 24-Hour	2.7
10-Year, 24-Hour	3.2
25-Year, 24-Hour	3.6
50-Year, 24-Hour	4.0
100-Year, 24-Hour	4.3

Precipitation amounts shown in Table 4 are used in the conveyance system model which uses the SCS Type 1A rainfall distribution hydrograph to determine the peak flow rates for the design storm. The Western Washington Hydraulic Model (WWHM) used catalogued map information that is automatically selected when the project site is selected. The gauge used in the WWHM is "Portland" with a precipitation factor of 0.933.

1.5 Proposal Overview

The project will construct a facility to receive crude oil by rail, store it on site, and load it on marine vessels for shipment to end users primarily located on the West Coast. Unit trains will arrive at the project site and be stationed on the Facility rail loops. The trains will be brought to the unloading area (Area 200) where the crude oil will be gravity-drained into the collection piping system, and pumped into the transfer pipeline system (Area 500). Crude oil will be pumped through the transfer pipelines to the storage tanks (Area 300) where it will be held until marine vessel loading operation. The storage tanks are designed to allow blending the various

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types of crude oil at the Facility to meet customer demands for specific qualities. Marine vessels will arrive and moor at the dock (Area 400) where they will be preboomed. Crude oil will be pumped from the storage tanks to the loading area, and loaded to marine vessels.

2.0 TYPE OF INDUSTRY OR BUSINESS

The proposed Facility is classified as a transload facility. The Facility will receive crude oil by rail, store it on site, and load marine vessels. The Standard Industrial Classification for the Facility is 5171 "Petroleum Bulk Station and Terminal" and the equivalent North American Industry Classification System code is 422710. The Facility will be staffed by approximately 120 employees and will operate 24 hours a day, 7 days a week, 365 days a year.

3.0 KIND AND QUANTITY OF PRODUCT

The proposed Facility is designed to receive 360,000 barrels of crude oil per day. The storage area consists of six storage tanks designed with a shell volume of 380,000 barrels and an operational volume of 360,000 barrels. The Facility is designed predominantly to handle crude oil sourced from the Williston Basin. The Facility is conservatively designed to transfer a range of crudes from API 10 to API 42. Sample Material Safety Data Sheets (MSDS) for crude oil are attached in Appendix M. The Marine Terminal is designed to serve oceangoing vessels and articulated tug barges with an operational capacity up to 500,000 barrels.

4.0 PROJECT SUMMARY

The sections that follow in the remainder of this report discuss the use and disposal of construction- and operations-related stormwater by the development of the Facility at Terminal 4, Terminal 5, and the Marine Terminal.

This section summarizes the project, the three drainage basins, the BMPs that apply to each, the amount of water projected to be used and disposed, the methods of disposal, and other significant factors. Table 5 and Figure 7 portray related information in graphical form.

Table 5 – Summary Table; placeholder

To be added at a later date.

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Figure 7 – Affected Areas (placeholder)

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5.0 CONSTRUCTION QUANTITY AND QUALITY OF WATER USED AND DISPOSAL METHODS

Construction, earthwork, testing, and commissioning activities require the use and disposal of construction-related water. This project is applying for an NPDES and State Waste Discharge Permit for Stormwater Discharges Associated with Construction Activities. The discharges and construction water use will meet the water quality standards associated with the state Construction Stormwater General Permit.

5.1 Construction Water

The project anticipates that an average of 20,000 gallons per day (gpd) will be used on site for construction water with a maximum instantaneous flow of 500 gallons per minute (gpm). This construction water will be necessary for construction activities including but not limited to on-site dust control, temporary irrigation, and the compaction of existing native soil and imported granular backfill. In addition, construction water will be necessary to test and commission the public water main.

Ground improvements, including installation of stone columns and deep soil mixing, will require additional water use. Preliminary estimates for the water use of these methods will be a maximum of 320,000 gpd. This estimate includes the operation of four complete crews installing vibratory replacement stone columns using the wet-feed method occurring simultaneously with deep soil mixing at the Marine Terminal.

Commissioning the crude oil portion of the system, including hydrostatic testing of the pipelines and storage tanks, is estimated to require 20 million gallons (MG) over a three-month period if no on-site reuse is available. To the maximum extent possible on-site reuse of testing water will be accomplished, thus reducing the amount of commissioning water necessary.

Construction water will be obtained either from the port's potable water supply system, the City, or existing groundwater wells on site. In accordance with the regulations of the state Department of Health, all connections to either potable water system will include the required backflow devices and/or air gap to protect the public systems from any form of back pressure, siphons, or contamination.

5.2 Construction Water Collection, Conveyance, and Treatment

This section addresses all non-stormwater sources and related collection, conveyance, and treatment systems used during construction. The following water discharges are categorically allowed by the state Construction Stormwater General Permit in Section S1.3.C. They include:

- Fire hydrant system flushing
- Potable water, including uncontaminated water line flushing
- Pipeline hydrostatic test water

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- Uncontaminated groundwater
- Uncontaminated excavation dewatering water
- Water used to control dust
- Landscape irrigation water

Facility construction also includes the following water discharges that are not categorically allowed by the state Construction Stormwater General Permit:

- Concrete wastewater
- Ground improvement slurry water
- Wastewater from washout and clean-up of construction materials
- Wheel wash water

Construction water use on site has been categorized into the following groupings; the paragraphs below discuss the use, how the water is collected and conveyed, and the selected treatment methodology.

- **Water and Fire System Commissioning** – Water used for hydrostatic testing, flushing, and chlorinating the water main will be collected into surge tanks and discharged in accordance with provisions of the Construction Stormwater General Permit. Water will be dechlorinated, tested, and discharged to the existing stormwater system.
- **Compaction Water** – Water used for the compaction of native and import material is used to adjust the moisture content of the material to assist the compaction effort and increase the Contractors ability to meet minimum specified compaction performance requirements. Water used will generally infiltrate or evaporate before reaching collection and conveyance systems. Any water that does runoff on the surface will eventually contribute to on-site temporary erosion and sediment control systems discussed in Section 5.
- **Excavation Dewatering** – Water obtained from dewatering will be collected in shallow sumps located within the limits of the excavation and pumped to settling tanks or a sediment pond. To ensure discharges meet turbidity requirements, settling tanks or the sediment pond will be sized according to the design methodology specified in "Volume II, Construction Stormwater Pollution Prevention," of Ecology's *Stormwater Management Manual for Western Washington* (the stormwater manual). (See Chapter 4 – Best Management Practices [BMPs] and Specifications, Section 4.2 Runoff Conveyance and Treatment BMPs, BMP C241 of Volume II.) Water quality will be periodically tested to ensure treatment system consistently meets discharge requirements of 25 NTUs. Additional water quality treatment measures will be implemented if necessary to meet permitted discharge standards.
- **Dust Control** – Water obtained for dust control will be loaded into water trucks for application to disturbed and trafficked industrial yard areas. Water used for

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dust control will be applied with spray nozzles. Dust control water typically evaporates. If over-applied, dust control water can become surface runoff, which will be handled by the temporary erosion and sediment control measures described in section 6.0.

- **Irrigation** – Temporary or permanent irrigation systems consisting of sprinklers and drip systems typically apply irrigation water. The system includes rainfall shutoff sensor to shutoff irrigation during rainfall events. If over-applied, irrigation water can become surface runoff, which will be handled by the temporary erosion and sediment control measures described in section 6.0.
- **Ground Improvement Slurry** – Each separate area for ground improvements will be surrounded by a containment dike and sloped to a single sump. Surface water runoff resulting from ground improvements is typically heavily sediment-laden. Collected runoff will be pumped to settling tanks or a sediment pond. As with excavation dewatering, to ensure discharges meet turbidity requirements, settling tanks or the sediment pond will be sized according to the BMPs specified in Volume II of the stormwater manual. Water quality will be tested periodically to ensure that the treatment system consistently meets discharge requirements of 25 NTUs or less. If necessary, additional water quality treatment measures will be implemented to meet permitted discharge standards.
- **Commissioning of Product Pipelines and Storage Tanks** – Water used for hydrostatic testing and flushing of the product pipelines and storage tanks will be discharged in accordance with the provisions of the Construction Stormwater General Permit. Water will be tested and discharged to the existing stormwater system. When necessary, commissioning water discharges will be metered to ensure downstream system capacities are not exceeded.
- **Concrete Wastewater** – Water used in curing and cleanout of concrete trucks will be discharged to a containment tank or lined settling pond for pH adjustment. After settling and pH adjustment, water meeting the permitted discharge limits will be discharged to the on-site sanitary sewer in accordance with City pretreatment discharge requirements.
- **Wheel Wash Water** – Where necessary, the project will install wheel wash units to limit sediment tracking onto adjacent roadways. Wheel wash water will be discharged to the on-site sanitary sewer in accordance with City pretreatment discharge requirements.
- **Wastewater from Construction Activities** – Water used for washing of paint, form release, curing compounds, and other construction materials will be discharged to the on-site sanitary sewer in accordance with City pretreatment discharge requirements.

Section 7.0 includes summary descriptions of treatment methodology and estimates of water discharged during construction. The proposed treatment methodologies

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will be included in a comprehensive stormwater pollution prevention plan (SWPPP) and include the implementation of BMPs to address runoff from the site.

A draft SWPPP was submitted with the original EFSEC application for site certification. The final SWPPP will be completed concurrently with final construction drawings and will be submitted concurrently with final construction drawings.

Table 6 lists the construction activities that may be required for each of the basins as well as the treatment BMPs and proposed discharge locations.

Table 6 - Construction Non-Stormwater Discharges

Construction Activity	Treatment BMP	Terminal 4 Discharge Location	Terminal 5 Discharge Location	Marine Terminal Discharge Location
Water and fire system commissioning	Dechlorination	Discharge to ground or haul to Terminal 5 stormwater system	Discharge to ground or discharge to Terminal 5 stormwater system	Discharge to ground or haul to Terminal 5 stormwater system
Compaction water	N/A	Discharge to ground	Discharge to ground	Discharge to ground
Excavation dewatering	Settling tank or settlement pond	Terminal 4 stormwater system	Terminal 5 stormwater system	Treatment and infiltration swales
Dust Control	N/A	Evaporation	Evaporation	Evaporation
Irrigation	N/A	Evaporation	Evaporation	Evaporation
Ground improvement slurry	Settling tanks or settlement pond	Terminal 4 stormwater system	N/A	Pump or haul to Terminal 5 stormwater system
Product pipeline and tank commissioning	N/A	Terminal 4 stormwater system	Terminal 5 stormwater system	Terminal 4 stormwater system
Concrete wastewater	Storage tanks or pond with pH adjustment	Sanitary sewer	Haul to sanitary sewer	Haul to sanitary sewer
Wheel wash water	Storage tank	Sanitary sewer	Haul to sanitary sewer	N/A
Wastewater from construction materials	Storage tank	Sanitary sewer	Haul to sanitary sewer	Haul to sanitary sewer

Figures 8 through 10 show the construction sites with treatment BMPs and discharge locations.

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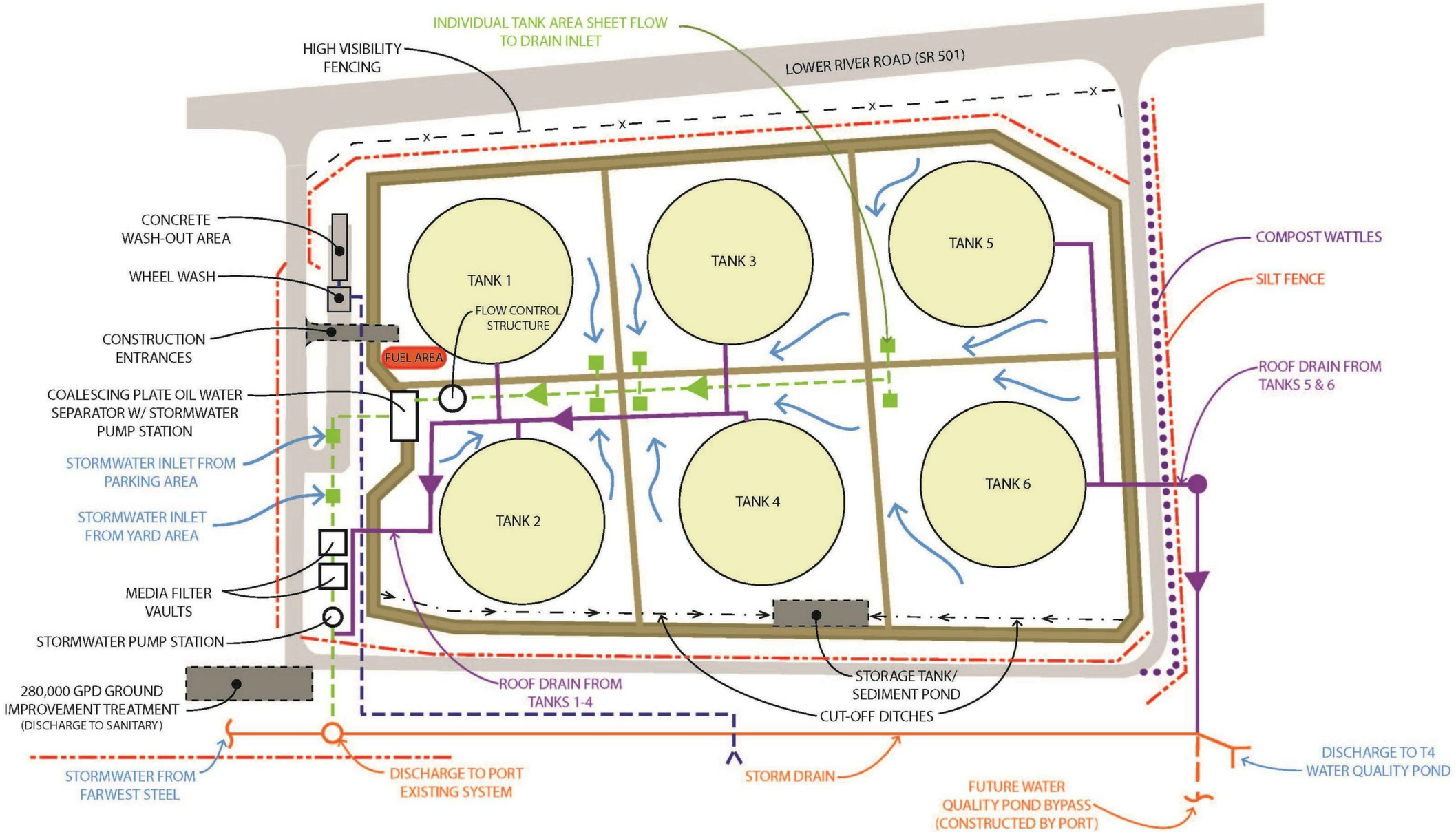

Figure 8 – Terminal 4 Construction Site BMPs

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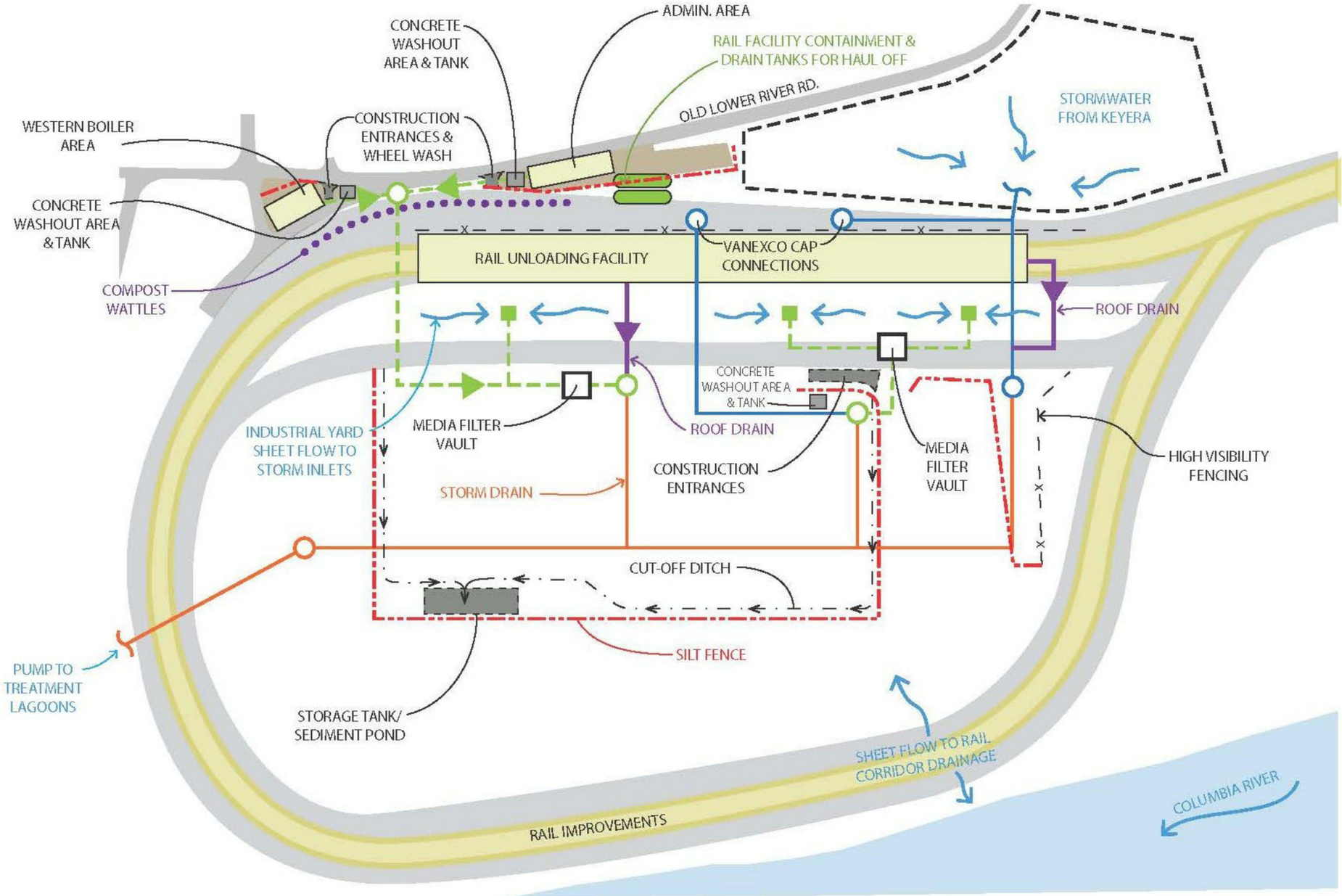

Figure 9 – Terminal 5 Construction Site BMPs

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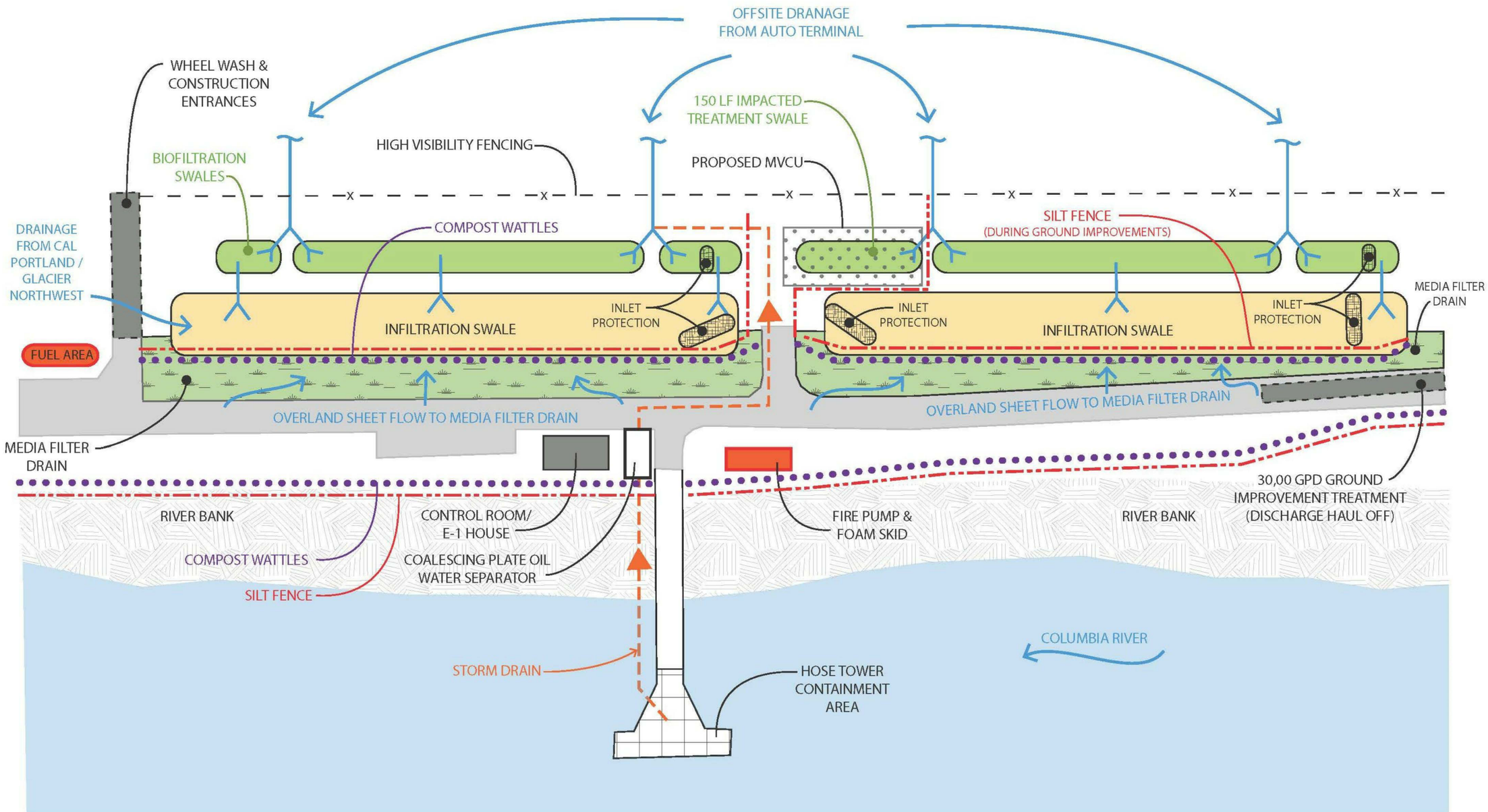

Figure 10 – Marine Terminal Construction Site BMPs

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6.0 CONSTRUCTION QUANTITY AND QUALITY OF STORMWATER AND DISPOSAL METHODS

The management of construction-related stormwater impacts is important to the management of a construction site. Construction of the Facility is planned to occur during the wet season with the bulk of ground-disturbing activities occurring during the winter and spring months. A final construction SWPPP will be prepared and submitted with the construction drawings as part of the permit process.

6.1 Construction Limits and Surfaces

Construction limits have been established for the entire site and include the lease and port General Use Area as well as the additional land that will be required temporarily during construction for construction offices, to stage materials and equipment, and for the movement of equipment. Table 7 shows the land coverage within the construction limits. The following paragraphs summarize the existing surfacing conditions in four categories:

- **Asphalt or Concrete Surfacing** – These areas are defined primarily as existing pollution-generating roadways or access pathways for vehicular traffic. When modeled in Western Washington Hydrology Model Version 3 (WWHM3), such an area is classified as "Roadway Flat."
- **Industrial Yard/Laydown Areas** – These areas are defined primarily as existing gravel surfacing, compacted industrial laydown areas, or railroad yard areas. When modeled in WWHM3, such an area is classified as "Parking Flat."
- **Miscellaneous Impervious Coverage** – These areas consist of either areas in which there construction within the limits of an impervious environmental cap, undeterminable asphalt or concrete surfacing used underneath stockpiled materials, and impervious surfacing out on the dock. When modeled in WWHM3, such an area is classified as "Parking Flat."
- **Existing Pervious** – These areas consist mostly of poorly maintained vegetative areas. Under no circumstance are these manicured or maintained landscape facilities. The existing treatment swales located at the Marine Terminal are additionally included in this classification. When modeled in WWHM3, such an area is classified as "Lawn Flat."

Table 7 - Existing Land Coverage within Construction Limits

	Asphalt or Concrete Surfacing (acres)	Industrial Yard/ Laydown Areas (acres)	Miscellaneous Impervious Coverage (acres)	Existing Pervious (acres)
Area 200 – Office and Rail Unloading	0.6	22.0	0.8	0.1
Area 300 – Storage	0.3	25.0	0	0
Area 400 – Marine Terminal	1.0	1.0	0.4	2.6

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	Asphalt or Concrete Surfacing (acres)	Industrial Yard/ Laydown Areas (acres)	Miscellaneous Impervious Coverage (acres)	Existing Pervious (acres)
Area 500 – Conveyance Pipeline	2.0 *89,616.38*	6.4 *278,881.48*	1.1 *49,761.84*	3.3
Area 600 – West Boiler Building	0.2	0.5	0	0
Rail Improvements	0	5.4	0	0
Total	4.3	60	2.4	6.0

Temporary erosion and sediment control measures are based upon the results of the WWHM3. The land coverages above were divided into contributing areas and the systems were designed to the 10-year, 24-hour storm event.

6.2 Construction Stormwater Collection and Conveyance

Construction of the Facility will require permanent and temporary modifications to the existing stormwater collection and conveyance systems on site to ensure that construction activities on site do not contaminate existing surface water features. A detailed discussion of the improvements and modifications required for the three primary stormwater collection systems on the site follows. Note that the following sections primarily address collection and conveyance of stormwater. Detailed discussion regarding the erosion and sediment controls are provided in Section 7.

6.2.1 Terminal 4

Stormwater runoff at the storage area will be contained within a constructed containment dike designed to contain the ground improvement slurry. Stormwater will be collected, treated, and conveyed in the same system discussed above in Section 4. Additionally, temporary erosion and sediment controls designed and shown in Figure 8 will also be installed. Following ground improvements, the permanent stormwater system will be installed and temporary pumps and conveyance piping will be used to direct stormwater to settling tanks or a constructed sediment pond prior to commissioning of the permanent stormwater system described in Section 8.0.

The majority of Area 500 – Transfer Pipelines is also located within Terminal 4. Land disturbing construction activities for the transfer pipelines predominately consists of shallow excavations for spread footings and above ground welding of prefabricated pipeline sections. Erosion control measures for these areas are described in detail Section 7. Table 8 shows a detailed breakdown of the surfacing coverage in Terminal 4, specifically contributing to the sediment pond or storage tank.

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Table 8 – Terminal 4 Construction Stormwater Areas

WWHM3 Type	Acres
Roads/Flat	0.3
Parking/Flat	24.6

Using the areas classified above in the total contributing area, a basin was set up with the values shown in WWHM3. From the model results, the 10-year, 24-hour storm yielded a design flow rate of 13.82 cfs. The 100-year design flow rate of 21.04 cfs and was evaluated to assure that safe conveyance is provided.

6.2.2 Terminal 5

Stormwater from the area of the admin/support buildings at Terminal 5 will be collected on site. Stormwater will be directed to stormwater BMPs prior to discharge to the existing stormwater system. Once the proposed stormwater system has been installed, the construction stormwater will be discharged to it.

Stormwater from the rail unloading area includes the project's primary staging and construction office area. For this area, runoff will be collected through a series of cutoff ditches and sheet flow to a sediment pond and/or sump with settling tanks prior to its discharge to the existing on-site stormwater system. Table 9 shows a detailed breakdown of the surfacing coverage in Terminal 5, specifically contributing to the sediment pond or storage tank.

Table 9 – Terminal 5 Construction Stormwater Areas

WWHM3 Type	Acres
A/B, Lawn, Flat	0.1
Roads/Flat	0.8
Parking/Flat	28.7

Using the areas classified above in the total contributing area, a basin was set up with the values shown in WWHM3. From the model results, the 10-year, 24-hour storm yielded a design flow rate of 11.73 cfs. The 100-year design flow rate of 17.85 cfs and was evaluated to assure that safe conveyance is provided.

6.2.3 Marine Terminal

Stormwater runoff at the Marine Terminal will continue to sheet flow across the site towards the treatment swales. Runoff will be directed to treatment BMPs prior to its discharge to the swales.

Where necessary for construction excavation, dewatering sumps and pumps will be used to keep trench and foundation excavations dry. Discharge from the dewatering pumps will be directed upland to a sediment filter bag and discharged into the

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treatment swales. Table 10 shows a detailed breakdown of the surfacing coverage in the Marine Terminal, specifically contributing to the sediment pond or storage tank.

Table 10 – Marine Terminal Construction Stormwater Areas

WWHM3 Type	Acres
A/B, Lawn, Flat	2.6
Roads/Flat	1.0
Sidewalks/Flat	0.4
Parking/Flat	1.1

Using the areas classified above in the total contributing area, a basin was set up with the values shown in WWHM3. From the model results, the 10-year, 24-hour storm yielded a design flow rate of 1.49 cfs. The 100-year design flow rate of 2.41 cfs and was evaluated to assure that safe conveyance is provided.

7.0 CONSTRUCTION TREATMENT PROCESS AND OPERATION

Construction treatment BMPs and the operation thereof are standardized across the region. The stormwater manual describes the selection and components of typical construction BMPs in detail. The BMPs for this project were designed and implemented in the erosion control drawings and in the preliminary SWPPP. A final version of the construction documents, including the SWPPP, will be prepared and submitted to EFSEC prior to construction.

7.1 Chemicals Used in Treatment Process

Most construction stormwater-related BMPs do not use active treatment systems. The BMPs selected for this facility largely include passive construction stormwater BMPs such as silt fences, inlet protection filters, and settling tanks, and do not use chemicals in their treatment process. These passive BMPs are described below.

The following chemicals or additives to construction water and stormwater runoff may be used to increase efficiency of turbidity removal techniques and pH control. A listing of the chemicals and their purpose follow.

- **Chitosan (coagulant)** – Chitosan is used as a component of enhanced sand filtration. Chitosan acetate is a derivative of the chitin found in shellfish. Chitosan has been proven effective at reducing total suspended solids in construction water and causes no harm to aquatic life in receiving streams.
- **Dry Ice** - need pHat Box description from Watertectonics

7.2 Design and Sizing of Treatment Process and Units

The following sections summarize the treatment processes, units, and BMPs used in the different portions of the project. The following list shows Construction BMPs used on the site. For a detailed description of the BMPs and their requirements, see

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"Volume II, Construction Stormwater Pollution Prevention" of the stormwater manual.

- High Visibility Fence (BMP C103)
- Stabilized Construction Entrance (BMP C105)
- Wheel Wash (BMP C106)
- Construction Road/Parking Area Stabilization (BMP C107)
- Temporary and Permanent Seeding (BMP C120)
- Mulching (BMP C121)
- Plastic Covering (BMP C123)
- Surface Roughening (BMP 130)
- Dust Control (BMP C140)
- Materials on Hand (BMP C150)
- Concrete Handling (BMP C151)
- Sawcutting and Surfacing Pollution Prevention (BMP C152)
- Material Delivery, Storage, and Containment (BMP C153)
- Concrete Washout Area (BMP C154)
- Certified Erosion and Sediment Control Lead (BMP C160)
- Scheduling (BMP C162)
- Interceptor Dike and Swale (BMP C200)
- Grass-Lined Channels (BMP C201)
- Storm Drain Inlet Protection (BMP C220)
- Silt Fence (BMP C233)
- Wattles/Compost Sock (BMP C235)
- Temporary Sediment Pond (BMP C241)
- Construction Stormwater Chemical Treatment (BMP C250)
- Construction Stormwater Filtration (BMP C251)
- pH Control for High pH in Water (BMP C253)
- Dechlorination
  Dechlorination as a BMP will be used only when discharging test water from pipelines and aboveground storage tanks. Discharges from these sources will be monitored for chlorine residuals and, where necessary, will be discharged through treatment tanks and treated with Vitamin C to reduce chlorine to discharge standards.

Construction activities will use the BMPs listed in Table 11 to reduce the possibility of erosion and to control sediment. In addition to listing the BMPs, the table summarizes the purpose of each BMP and, where applicable, its proposed discharge location. The table summarizes the BMPs for each of the major drainage basins on site.

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Table 11 – Construction Site Water Quality BMPs

BMP	Purpose	Terminal 4 Discharge Location	Terminal 5 Discharge Location	Marine Terminal Discharge Location
High Visibility Fence	Installed on upland construction limits and along east property line	N/A	N/A	N/A
Stabilized Construction Entrance	Control sediment transport	N/A	N/A	N/A
Wheel Wash	Control sediment transport especially during ground improvements	Haul off or discharge to Sanitary under permit with City of Vancouver		Haul off or discharge to sanitary under permit with City
Construction Road/Parking Area Stabilization	Erosion prevention installed after ground improvements at staging/laydown areas.	N/A	N/A	N/A
Temporary and Permanent Seeding	Erosion prevention installed immediately following rough grading and exterior berm construction	N/A	N/A	N/A
Mulching	Erosion prevention installed surrounding localized excavations required for pipeline footings and supports	N/A	N/A	N/A
Plastic Covering	Erosion prevention used to cover stockpiled material	Large stockpiles will utilize TSD and direct runoff to sediment tank or pond	Large stockpiles will use TSD and direct runoff to sediment tank or pond	Large stockpiles will utilize TSD and direct runoff to sediment tank or pond
Surface Roughening	Erosion prevention used during berm construction	N/A		
Dust Control	Sediment transport measure used if necessary during dry weather	N/A	N/A	N/A
Concrete Handling	Pollution prevention used on site during concrete work	See pH Control for High pH in Water	See pH Control for High pH in Water	See pH Control for High pH in Water
Sawcutting and Surface Pollution Prevention	Pollution prevention used at access road connection	Haul off or discharge to Sanitary under permit with City of Vancouver	Haul off or discharge to Sanitary under permit with City of Vancouver	Haul off or discharge to sanitary under permit with City

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BMP	Purpose	Terminal 4 Discharge Location	Terminal 5 Discharge Location	Marine Terminal Discharge Location
Interceptor Dike and Swale	Sediment transport measure used on down-gradient side of area to direct stormwater to sediment pond or settling tanks	Sediment pond or sump pump for discharge to settling tanks	Sediment pond or sump pump for discharge to settling tanks	
Grass Lined Channels	Sediment transport measure used on down-gradient side of area to direct stormwater to sediment pond or settling tanks	Sediment pond or sump pump for discharge to settling tanks		
Storm Drain Inlet Protection	Sediment transport filter installed on existing and installed storm drain inlets.	Existing or installed storm drain system	Existing or installed storm drain system	Existing or installed storm drain system
Silt Fence	Installed on down-gradient construction limits	N/A	N/A	N/A
Wattles/Compost Sock	Installed along down-gradient slopes of containment berm during		N/A	N/A
Temporary Sediment Pond/Settling Tanks	Sediment transport filter installed at down-gradient portion of site. Used to increase detention time to reduce turbidity and total suspended solids (TSS)	Construction chemical treatment, filter, pH control, or existing storm drain system depending upon test results	Construction chemical treatment, filter, pH control, or existing storm drain system depending upon test results	Construction chemical treatment, filter, pH control, or existing storm drain system depending upon test results
Construction Stormwater Chemical Treatment	Coagulant (chitosan) or equal will be used to increase efficacy of filtration units if necessary	Existing storm drain system		Haul to Terminal 5 storm drain
Construction Stormwater Filtration	Sand or cartridge filter used to increase efficacy of settling tanks or ponds if necessary	Existing storm drain system		Haul to Terminal 5 storm drain

Programmatic Measures for the Entire Site

Table 12 lists the BMPs, regardless of their location, that are used across the site to reduce erosion, control sediment transport, and maintain construction stormwater measures.

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Table 12 – Programmatic Construction BMPs

BMP	Purpose	Discharge Location
Materials on Hand	A comprehensive list of replacement/redundant equipment required to maintain TESC items will be developed. Materials will be stored at a single location during construction	N/A
Material Delivery, Storage, and Containment	Pollution prevention procedure used site wide	N/A
Concrete Washout Area	Pollution prevention procedure – location TBD	See pH Control for High pH in Water
Certified Erosion and Sediment Control Lead	Procedure to designate individual responsible to ensure compliance with water quality standards	N/A
Scheduling	Procedure to reduce risk of erosion and sediment transport	N/A
pH Control for High pH in Water	Neutralize pH from contact water with concrete pouring, curing, or washout facilities	Temporary sediment pond/settling tanks

7.3 Treatment Process Operation

The treatment processes that are active and require monitoring include possible construction water filtration, construction water chemical treatment, and pH adjustment. The selected systems that are described in general below are package systems that are supplier designed and supplied for the necessary flow rates. As a result of the package systems, detailed monitoring and process adjustment are not necessary. The systems include analyzers and probes that test the influent water and adjust the treatment process as necessary to ensure that effluent quality standards are obtained.

Treatment processes are designed for the 10-year, 24-hour water quality event. The water quality flow rates were determined using the WWHM3. Model results are included in Appendix G. Table 13 summarizes the design flow for the contributing area designated above in Section 6, as the basis of the treatment flow rate:

Table 13 – 10-Year Design Storm Construction Treatment Flow Rate

Basin	Treatment Flow Rate (cfs)
Terminal 4	13.8
Terminal 5	11.7
Marine Terminal	1.5

Treatment of sediment-laden water resulting from the installation of ground improvements will require the use of an active stormwater treatment process. If

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other on-site construction BMPs are ineffective at reducing turbidity and TSS, the stormwater filtration and/or chemical treatment will be supplemented to ensure that discharges meet the discharge standards of the Construction Stormwater General Permit. A sump pump will transfer the slurry from the installation area to a series of settling tanks and enhanced sand filters for treatment. The coagulant, such as chitosan or an equal product will be added during the process to facilitate the removal of suspended sediments. Automatic monitoring will determine the amount of coagulant needed, and effluent monitors will ensure that downstream effluent is in accordance with discharge standards.

An active system using pH probes and monitoring will also be established to monitor pH from the stormwater from the areas on site in which there are stormwater discharges that are in contact with concrete. A Phatbox by Watertectonics or an equal product will be used to make necessary pH adjustments. The system will provide data recording for use in production of water quality logs.

In addition to the Certified Erosion and Sediment Control Lead (CESCL) for the construction site, trained personnel will be assigned to monitor and maintain the treatment processes. These personnel will also be equipped with necessary additional chemical or mechanical parts for replacement and maintenance of the treatment units.

7.4 Treatment Bypasses

Treatment bypasses are designed only to the extent required by the stormwater manual. In accordance with the manual, treatment systems are designed to perform to the 10-year design storm. Emergency overflows are provided only the improbable event that a storm in excess of the 10-year storm event occurs. The emergency overflows are located such that stormwater will still be required to proceed through the water quality facility and then overflow to the stormwater conveyance systems.

No bypasses designed in the systems would allow construction and construction stormwater to completely bypass a sump, filter, or settling tank before discharge to the stormwater system. If bypasses were to activate, higher levels of turbidity might occur; however, larger particulates within the stormwater would still have sufficient retention time to settle out.

8.0 OPERATIONAL QUANTITY AND QUALITY OF STORMWATER AND DISPOSAL METHODS

This section summarizes the design of the permanent stormwater system, including a description of the contributing areas, collection, and conveyance system design. The description of the treatment methodologies and treatment units are described in detail in Section 9.0.

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8.1 Flow Control Exemption

The project discharges to existing Columbia River outfalls through existing manmade conveyance pipelines. This project is categorically exempt from the flow control provisions of the stormwater manual. According to Appendix I-E of the manual, the Columbia River is listed as a flow control-exempt water body. The areas proposed for redevelopment are located within the existing drainage basins of developed storm drain systems that discharge through manmade conveyances directly to the Columbia River.

Additionally, the existing brownfield nature of the project site is such that the project stormwater does not result in the diversion of drainage from any perennial stream or from any category of wetland and does not discharge stormwater to streams or wetlands.

On-site stormwater will be collected from building roofs through gutter and rain drain systems that will bypass stormwater treatment, as these surfaces are classified as non-pollution generating. Stormwater from surface improvements will be collected through a series of inlets and storm drain systems, routed through on-site treatment, and discharged to existing on-site manmade pipelines. These pipelines continue through manmade conveyance pipes to manmade water quality facilities before discharging through piped outfalls to the Columbia River. From collection to discharge into the river, the stormwater is never conveyed through natural channels.

The design of the downstream conveyance and water quality ponds that are not part of this project assumed that the project sites would be developed as fully impervious. Copies of the design reports for the downstream conveyance systems are attached in Appendix ? and Appendix ?.

8.2 Wastewater Collection, Conveyance, and Treatment

8.2.1 Collection System Design

The stormwater collection system generally consists of catch basins and area inlets located throughout the project. To the maximum extent practical, the site has been graded to drain gently towards the located inlets. All of the on-site pollution-generating surfaces are directed towards existing or proposed inlets.

The elements of the Facility that are located within the port's General Use Area will be constructed without impacting the existing grading or drainage patterns. The transfer pipelines located within the General Use Area will be fully welded steel pipe and monitored for leaks and damage. Downstream drainage inlets will be retrofitted with spill control devices capable of containing a minimum 5 gallons.

The rail improvements are located within the port's General Use Area and within the existing master-planned rail corridor. The rail improvements will be constructed without impacting the existing drainage patterns of the site and are located within a

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previously master-planned improvement with a master-planned drainage system. Downstream drainage inlets will be retrofitted with spill control devices capable of containing a minimum 5 gallons.

8.2.2 Conveyance System Design

The proposed conveyance system was designed to handle the 25-year, 24-hour storm event. The design was also evaluated for the 100-year, 24-hour storm event to determine flooding potential during this extreme event. In general, pipe sizes and slopes were chosen so as not to exceed 75 percent of full flowing capacity during the 25-year storm event. An exception to this rule was made for the tank farm area, which is constrained by the rated capacity of a proposed downstream oil-water separator (OWS). As each individual oil storage tank will be surrounded by a spill containment berm, storm runoff in excess of the OWS-rated capacity will be allowed to temporarily pond within the bermed areas. Hydraulic modelling estimated the maximum depth of ponded water within the containment berms to be approximately 0.15 feet (2 inches) during the 25-year storm event. In addition to collected surface runoff, the proposed conveyance system will be required to convey subsurface flows collected from the existing Vanexo Cap (located between the proposed rail offloading and admin building areas) along with intermittent washdown from the rail shed fire protection system. Contribution from the fire protection system was estimated to be approximately 1,000 gpm (2.23 cfs) at each extreme west and east ends of the building.

A hydraulic model of the proposed conveyance system was constructed using the Storm and Sanitary Analysis (v.2012) module by Autodesk. Conveyance piping, orifice structures, and pumps were input to the model as links. Inlets, catch basins, manholes, and storage structures (including pump station wetwells) were input as junction structures. Contributing subbasin areas and characteristics assumed all new development with negligible in-flow, out-flow, or evaporation. The hydrology method used to estimate peak flows and total storm volumes was the Santa Barbara Urban Hydrograph (SBUH), with time series graphs obtained from Clark County using a Soils Conservation Service (SCS) Type 1A 24-hour storm distribution. The total rainfall depth for the 25-year and 100-year, 24-hour storm events is 3.6 inches and 4.3 inches, respectively.

Full model results for each storm event are included in Appendix I. Summary results are listed in Table 14. Rainfall intensity amounts described earlier in section 1.4.7 are used in the development of the Type 1A rainfall distribution hydrograph. The results are shown in Table 14.

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Table 14 - Summary of 25-Year Storm Event Model Results

Subbasin No.	Total Area (acres)	Contributing Area (acres)	25-Year Storm Flow Rate (cfs)	100-Year Storm Flow Rate (cfs)
Area 200 Admin/Support Buildings[1]	1.6	1.6	0.89	1.07
Area 200 Rail Offloading Area[2]	6.2	5.3	7.56	8.45
Area 300 Containment Berm[3]	18.2	18.2	2.0	2.0
Area 300 Support Buildings and Parking[4]	2.7	2.7	0.84	1.1
Area 400 Marine Terminal[5]	7.7	2.2	N/A	N/A
Area 500 Transfer Pipeline	4.9	N/A	N/A	N/A
Area 600 West Boiler[6]	0.5	0.5	0.15	0.21
Rail Infrastructure	5.4	N/A	N/A	N/A

Notes:

1. Modelled flow in manhole 0200-SDMH-002.
2. Includes ground area surrounding building plus modelled fire flows at inlets 0200-CB-003 and 0200-CB-005, plus rail unloading shed roof drains connected to manholes 0200-SDMH-009 and 0200-SDMH-022.
3. Flow rate restricted by orifice structure 0300-CS-001 OR to match peak capacity of oil-water separator 0300-OWS-001 (approx. 880 gpm). Tank roof drains connected to storm system outside berm area.
4. Includes sub-basins 0300-1, 0300-2, and 0300-3.
5. Marine Terminal area storm drains not modelled.
6. Modelled flow rate at manhole 0600-SDMH-001.

The hydraulic model used for the capacity of the conveyance system was Storm and Sanitary Analysis (Autodesk). The software is using the Santa Barbara Urban Hydrograph (SBUH) method. Rainfall intensity amounts described earlier in section 1.4.7 are used in the development of the Type 1A rainfall distribution hydrograph.

8.2.3 Terminal 4

The conveyance system for Terminal 4 consists of two separate systems with two outfalls to the existing stormwater conveyance system. Stormwater from the storage tank roofs will be segregated from the remaining site, which consists of the area within the containment berm and remaining area consisting of the parking lots and support buildings. A schematic of the collection and treatment system units is shown in Figure 11.

The proposed surface coverage located within Terminal 4 is summarized below in Table 15. The table is broken up into the subbasins that were analyzed in the hydraulic and water quality models. The surface type used in the WWHM water quality model is also identified.

Table 15 – Terminal 4 Proposed Surface Coverage

Surface Description	Existing Condition	WWHM Type	Area (acres)
Storage Tank Area			
Storage Tank Roofs	Untreated Impervious	Roof Tops/Flat	6.23
Storage Area Uncollected Stormwater			
Exterior Berm Landscaping	Untreated Impervious	A/B, Lawn Flat	1.2
Containment Area Stormwater			
Containment Yard Area	Untreated Impervious	Roads/Flat	11.96
Storage Area Support Buildings, Parking, and Industrial Yard			
Landscaping	Untreated Impervious	A/B, Lawn, Flat	0.64
Support Buildings	Untreated Impervious	Roof Tops/Flat	0.08
Sidewalks	Untreated Impervious	Sidewalks/Flat	0.05
Parking Area /Drive Aisle	Untreated Impervious	Roads/Flat	0.32
Industrial yard	Untreated Impervious	Parking Flat	0.30

Stormwater and runoff from the roofs of the storage tanks will be immediately intercepted and segregated from the site's pollution-generating surfaces. The runoff from the roofs of the four storage tanks will be discharged into the Facility's stormwater system immediately downstream of the stormwater pump station. The runoff from the roofs of the two future storage tanks will discharge through a storm drainage line installed along the east side of the containment berm and be discharged into the existing storm drainage system located at the southeast corner of the Facility.

Stormwater runoff from the tank farm will sheet flow and collect into six individual sumps located within each tank's intermediate berm. The sumps will flow into a common header and through a control structure to the oil-water separator.

The control structure includes a preliminary settling bay to remove the larger suspended solids, and baffles to remove and contain easily separated oils from the stormwater. The control structure additionally will limit the flow from the containment basin at a maximum of 880 gpm, the capacity of the coalescing plate separator bay. After the coalescing plate separator bay, a downstream stormwater pump station is located within the containment area. The pump station operation will require a manual inspection of the water quality within the wetwell to operate the pumps.

If a sheen is visible or hydrocarbon monitoring probes detect oil in the water the pump station will not be activated and water will be hauled off from the site for disposal.

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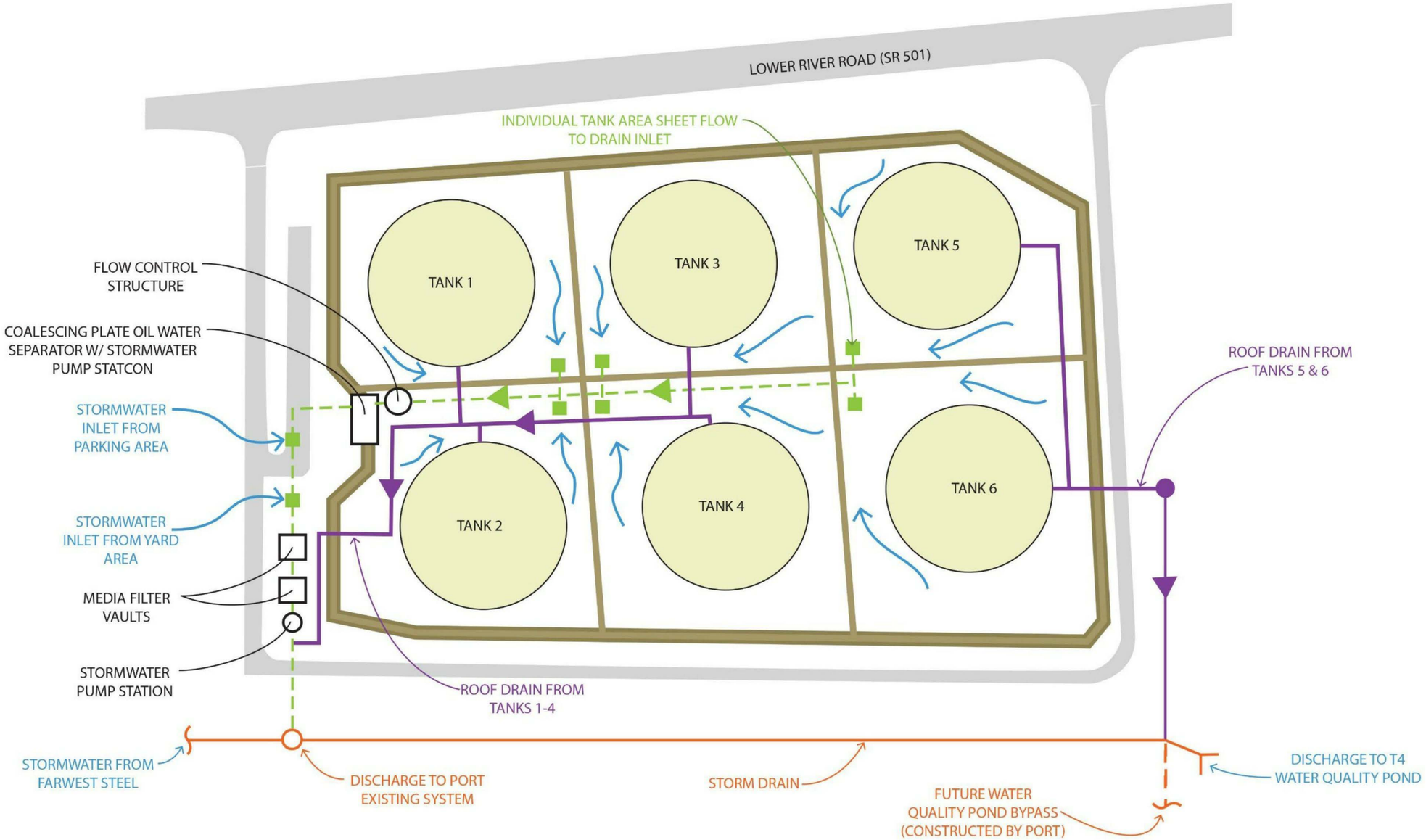

Figure 11 – Terminal 4 Collection and Treatment System Schematic

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Flow from the containment area will be discharged into the stormwater system located within the drive aisle portion of the area of the admin/support buildings located next to the west side of the containment berm. Stormwater from the parking areas and support buildings intermixes with the pre-treated containment runoff. The combined runoff from the pollution-generating surfaces will contribute to a series of water quality vaults for final treatment. After final treatment, a stormwater pump station and monitoring manhole will be provided prior to discharge to the Port's system.

Table 16 – Terminal 4 Collection System Model Results

Collection System ID	Total PG Area (acres)	Total NPG Area (acres)	25-Year Storm Flow Rate (cfs)
West Outfall (0300 STM-1):			
Storage Tanks (4)[1]	0	4.2	3.45
Containment Berm[2]	5.4	0	2.0
Support Buildings and Parking	0.4	2.3	0.84
Total	5.8	6.5	6.29
East Outfall (0300 STM-2):			
Future Storage Tanks (2)	0	2.1	1.84
Total	0	2.1	1.84

Note:

1. Modelled flow from basin "Tank Roofs".
2. Flow rate listed is prior to orifice structure 0300-CS-001 OR. Flow rate is restricted by the orifice structure to match peak capacity of oil-water separator 0300-OWS-001 (approx. 880 gpm). Flow rates in excess of conveyance system capacity allowed to pond within berm area.

8.2.4 Terminal 5

The conveyance system for Terminal 5 consists of three separate systems with three outfalls to the existing stormwater conveyance system. Stormwater from the roof of the rail unloading facility and runoff from the existing underdrain system installed for the Vanexco Cap will be segregated from the remaining site. Stormwater from the remaining improvements on the site, including the West Boiler Building, admin/support buildings, and the rail unloading area, will be collected, treated, and conveyed to the existing on-site stormwater system. A schematic of the collection and treatment is shown in Figure 12.

The proposed surface coverage located within Terminal 5 is summarized below in Table 17. The table is broken up into the subbasins that were analyzed in the hydraulic and water quality models. The surface type used in the WWHM water quality model is also identified.

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Table 17 – Terminal 5 Proposed Surface Coverage

Surface Description	Existing Condition	WWHM Type	Area (acres)
Rail Unloading Uncollected Stormwater			
Walkways	Untreated Impervious	Sidewalks/Flat	0.01
Industrial yard	Untreated Impervious	Parking/Flat	0.3
Rail Unloading Facility West Roof			
Building	Untreated Impervious	Roof/Flat	1.9
West Boiler Building, Admin/Support Area, & Portion Industrial Yard			
Parking and drive isle	Untreated Impervious	Roads/Flat	0.9
Buildings	Untreated Impervious	Roof Tops/Flat	0.5
Sidewalk/Walkways	Untreated Impervious	Sidewalks/Flat	0.1
Industrial yard	Untreated Impervious	Parking/Flat	0.4
Landscaping	Untreated Impervious	A/B, Lawn, Flat	0.5
Vanexco Cap Industrial Yard			
Sidewalk/Walkways	Untreated Impervious	Sidewalks/Flat	0.01
Industrial yard	Untreated Impervious	Parking/Flat	0.6
Rail Unloading Facility East Roof			
Building	Untreated Impervious	Roof/Flat	1.9
Portion of Industrial Yard			
Sidewalk/Walkways	Untreated Impervious	Sidewalks/Flat	0.04
Industrial yard	Untreated Impervious	Parking/Flat	1.1
Buildings	Untreated Impervious	Roof/Flat	0.04
Mechanical Equipment	Untreated Impervious	Roads/Flat	0.03
Rail Improvements			
Industrial yard	Untreated Impervious	Parking/Flat	5.4

Stormwater and runoff from the roof of the rail unloading structure will be intercepted and segregated from the site's pollution-generating surfaces. Roof runoff is collected along the south side of the structure and discharged to the storm system from two downspouts located along the the roof structure. The western section of the roof discharges to a proposed manhole located to the southwest of the downspout to be installed on over the existing stormwater system. The eastern section of the roof discharges to the southeast of the downspout and mixes with a portion of the runoff from the Vanexco Cap underdrain. This blended runoff discharges to the furthest east portion of the existing storm drainage system.

The Vanexco Cap underdrain system drains to two discharge locations. Due to conflicts with the proposed structure the two discharge pipes from the underdrain system will be relocated. The west underdrain discharge will extend underneath the rail unloading building and discharge to the east into the existing storm drainage system. The east underdrain discharge is going to be extended immediately east and connect to the existing storm drainage pipe from the Keyera Energy propane terminal. The Keyera Energy discharge line will be relocated within the limits of the

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rail unloading building to avoid conflicts with the foundation and piles to be installed. The line will be reconnected to the same downstream discharge point.

Stormwater from the admin/support buildings will be collected through a series of catch basins and area inlets into the proposed stormwater system. The runoff will be conveyed west to the connection point with the future West Boiler Building. Similarly, the West Boiler Building stormwater will be collected through catch basins and area inlets and conveyed east to the connection manhole with the runoff from the admin/support buildings. From here, stormwater is conveyed south across the rail loops in a cased crossing where stormwater will be mixed with stormwater from the non-pollution generating industrial yard area. The project is proposing to collect stormwater from the area between the rail unloading building and the lease line. This yard area is accessible only to foot traffic and is isolated from any roadway by rail tracks. The yard area includes electrical and control rooms as well as electrical and mechanical equipment including electrical transformers, switch gear, electrical meters, air compressors, and dryers.

Runoff from the admin/support buildings, West Boiler Building, and half of the yard area will be collected together, treated in a water quality vault, and discharged to the existing port storm drainage system. A monitoring manhole will be installed near the collection location to ensure water quality standards are met.

Runoff from the remaining half of the yard area will be collected, treated in a water quality vault, and discharged to the port storm drainage system at a point further east. A monitoring manhole will be installed near the collection location to ensure water quality standards are met.

Runoff from the rail improvements is located within the port's General Use Area and will be managed by the already-installed storm drainage system. The project will confirm that downstream inlets have spill control devices capable of capturing 5 gallons of oil.

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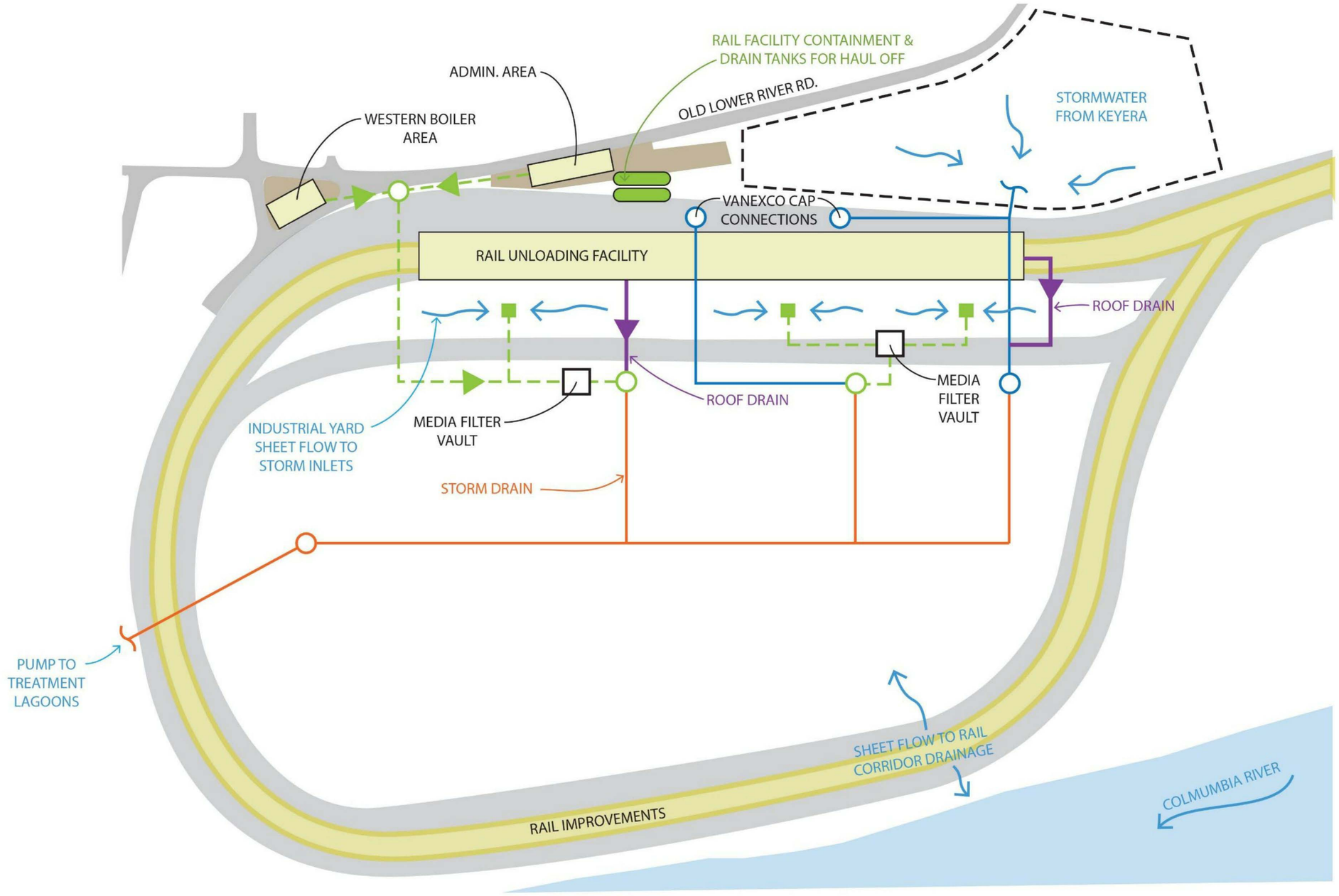

Figure 12 – Terminal 5 Collection and Treatment System Schematic

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Table 18 – Terminal 5 Collection System Model Results

Collection System ID	Total PG Area (acres)	Total NPG Area (acres)	25-Year Storm Flow Rate (cfs)
West Outfall (0200 STM-1):			
Area 200 Admin/Support Buildings	1.6	1.6	0.89
Area 200 Rail Offloading Area[1]	0.0	1.9	1.35
Area 600 West Boiler	0.5	0.5	0.15
Total	2.1	4.0	2.39
Central Outfall (0200 STM-2):			
Vanexo Cap - West	2.6	0	2.21
Area 200 Rail Offloading Area[2]	0	1.8	2.28
Total	2.6	1.8	4.49
Eastern Outfall (0200 STM-3):			
Vanexo Cap - East	4.8	0	3.85
Area 200 Rail Offloading Area[3]	0	2.0	1.70

Notes:
1. Western portion including at-grade areas and roof totaling approximately half of the Rail Unloading Area. Includes 1,000 gpm fire flow.
2. Eastern portion of at-grade area. Includes 1,000 gpm fire flow.
3. Eastern half of rail shed roof.

8.2.5 Marine Terminal

The conveyance system for the Marine Terminal has two components. Stormwater from the upland components drains through sheet flow and across a media filter drain for treatment and is then discharged directly into the infiltration swales. Stormwater from the containment area on the dock is collected in a floor drain and piped back to the shore where it is treated by an oil-water separator. Containment water is then pumped directly into the treatment swales. A schematic of the collection and treatment system is shown in Figure 13.

The proposed surface coverage located within the Marine Terminal is summarized below in Table 19. The table is broken up into the subbasins that were analyzed in the hydraulic and water quality models. The surface type used in the WWHM water quality model is also identified.

Table 19 – Marine Terminal Proposed Surface Coverage

Surface Description	Existing Condition	WWHM Type	Area (acres)
Landscaping	Untreated Impervious	A/B, Lawn, Flat	0.75
Parking/Drive Aisle	Untreated Impervious	Roads/Flat	1..17
Buildings	Untreated Impervious	Roof/Flat	0.03
Sidewalk/Walkways	Untreated Impervious	Sidewalks/Flat	0.01
Industrial Yard	Untreated Impervious	Parking/Flat	0.09

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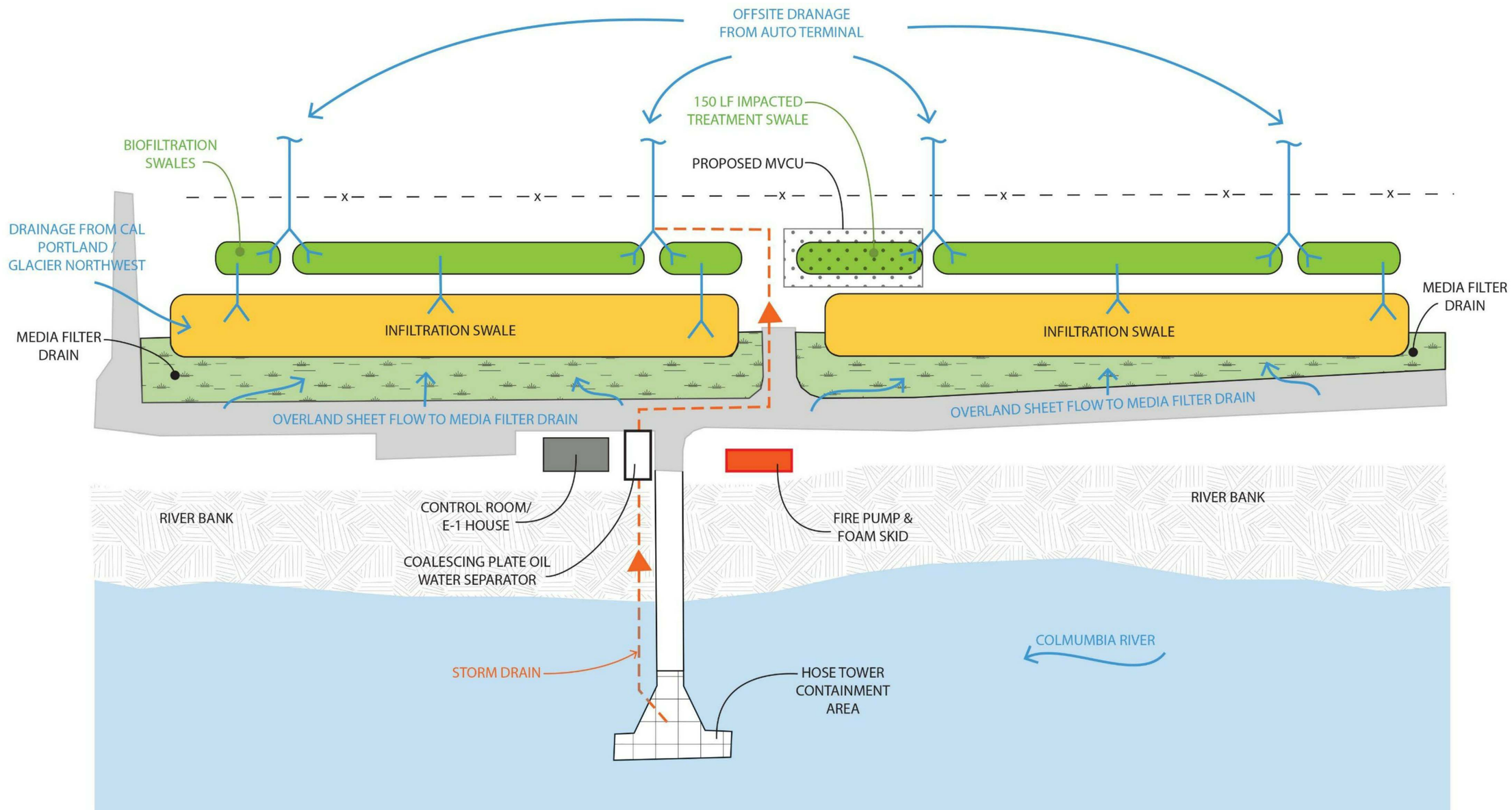

Figure 13 – Marine Terminal Collection and Treatment System Schematic

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9.0 OPERATIONAL TREATMENT PROCESS AND OPERATION

Stormwater treatment necessary to meet discharge standards is implicitly dependent upon the amount and types of contaminates the stormwater absorbs or transports along its route. The primary intent of the stormwater system development is to limit to the maximum practical extent the mixing of the industrial activity and stormwater.

To that end, the primary treatment process for Facility stormwater is the utilization of extensive source controls that segregate stormwater from crude oil and its vapors. In addition to the source controls, when compared to the industrial yard and laydown areas as they now exist on the site, the Facility will include additional landscaping and pervious features. Because of the source controls that segregate stormwater and industrial operations, meeting the water quality discharge standards of the Industrial Stormwater General Permit will not require an active treatment system.

The following sections discuss the materials, source controls, and BMPs used to collect, convey, and treat site stormwater.

9.1 Chemicals Used in Treatment Process

The Facility will employ a system of passive stormwater treatment units, including oil-water separators, oil traps, and cartridge filter vaults, to provide stormwater treatment. Descriptions of the proposed media and composition follow. Reference MSDS sheets are included for the treatment units in Appendix M.

- **Granular Activated Carbon (GAC)** – Consists of 100 percent activated carbon (CAS# 7440-44-0)
- **MetalRx Leaf Media** – An absorbent filtration medium which contains 100 percent Earth-Wise certified compost material (CAS# N/A)
- **Perlite** – Consists of 100 percent perlite, which is a mineral composed of sodium potassium aluminum silicate (CAS# 93763-70-3). Perlite contains less than 0.1 percent of alpha-Cristobalite, tridymite, and alpha quartz.
- **Zeolite** – Consists of 100 percent of potassium-calcium-magnesium-aluminosilicate (CAS# 12173-10-3). The components include clinoptilolite zeolite/potassium, calcium, sodium, aluminosilicate, hydrated (a).

9.2 Design and Sizing of Treatment Process and Units

The following sections summarize the treatment processes, units, and BMPs used in the different areas of the project. The following operational and structural BMPs are used. (For detailed descriptions of each BMP and its requirements, see "Volume V, Runoff Treatment BMPs" of the stormwater manual.)

- Landscaping and lawn/vegetation management (BMP S411)
- Loading and unloading areas (BMP S412)

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- Maintenance of public and private utility corridors and facilities (BMP S415)
- Maintenance of stormwater drainage and treatment systems (BMP S417)
- Mobile fueling of vehicles and heavy equipment (S419)
- Parking and storage of vehicles and equipment (BMP S421)
- Railroad yards (BMP S422)
- Soil erosion and sediment control at industrial sites (BMP S425)
- Spills of oil and hazardous substances (BMP S426)
- Storage of liquids in permanent aboveground tanks (BMP S427)
- Washing and steam cleaning of vehicles/equipment/building structures (S431)
- Media filter drain (BMP T8.40)
- Basic biofiltration swale (BMP T9.10)
- Coalescing plate separator bay (BMP T11.11)
- Oil trap – The purpose and geometric design of the oil traps are very similar to a pre-settling basin (BMP T6.10). The oil traps meet the same purpose as the pre-settling basins for removal of suspended solids while also functioning as an additional spill containment device. The construction of the internal baffles is similar to an American Petroleum Institute-style oil-water separator but the outlet is equipped with a manually controlled flap valve. In the event of a spill on site, the flap valve will be closed and the internal hydraulic pressure will maintain positive valve closure until the contaminated liquid is hauled off site.
- StormFilter using ZPG Media – This BMP has a general use level designation from Ecology. The Stormwater Management StormFilter, a flow-through stormwater filtration system, improves the quality of stormwater runoff from the urban environment by removing pollutants. The StormFilter is used to treat runoff from a wide variety of sites, including but not limited to, industrial sites. The ZPG media consists of a blend of zeolite, perlite, and GAC.
- StormFilter using MetalRx – This BMP has a conditional use-level designation from Ecology. The Stormwater Management StormFilter, a flow-through stormwater filtration system, improves the quality of stormwater runoff from the urban environment by removing pollutants. The Storm Filter is used to treat runoff from a wide variety of sites including but not limited industrial sites. The MetalRx media consists of a blend of compost media capable of absorbing dissolved metals in stormwater.
- StormFilter using GAC – This BMP will reduce volatile organic concentrations in stormwater by approximately 40 percent. Using an arrangement similar to the StormFilter units described above, the GAC units have shown that, at concentrations similar to the site's anticipated runoff, removal efficiencies are capable of meeting the discharge standards.

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9.2.1 Programmatic Measures for the Entire Site

Regardless of their location, Table 20 summarizes the BMPs applied to provide programmatic stormwater quality treatment and operational practices across the entire site.

Table 20 – Programmatic Operational BMPs

BMP	Purpose	Discharge Location
Landscaping and Lawn Vegetation Management	Erosion Prevention	N/A
Maintenance of Public and Private Utility Corridors and Facilities	Erosion Prevention	N/A
Maintenance of Stormwater Drainage and Treatment Facilities	Operational Procedure	N/A
Soil Erosion and Sediment Control at Industrial Sites	Erosion Prevention	N/A
Spills of Oil and Hazardous Material	Pollution Prevention	Haul off site for legal disposal
Washing of Building Structures	Pollution Prevention	N/A

9.2.2 Terminal 4

Stormwater from Terminal 4 must be treated to the highest level of water quality before its discharge on site. Stormwater from Terminal 4 will mix with runoff from Farwest Steel and discharge immediately downstream of the Terminal 4 water quality pond. As a result, at the point of connection to the port's stormwater system, the stormwater must meet the discharge criteria for the Industrial Stormwater General Permit.

The Facility is using the following techniques to isolate stormwater from industrial processes and reduce the amount and cost of stormwater treatment.

Storage Tanks – At other bulk handling facilities, the storage tanks are typically the point at which stormwater has the highest risk of contact with the product. For this project, the storage tanks will be constructed with an internal floating roof in addition to a second, fixed roof. Stormwater contributing to the fixed roof will be collected by a gutter and discharged directly to the port's stormwater system. The fixed roof eliminates the possibility of stormwater contributing to the internal floating roof and possibly contacting crude oil vapor.

Intermediate Containment Berms – Stormwater from each intermediate containment berm will be collected at a catch basin before connecting by gravity to a common header. The catch basin allows for the settling of larger solids and separation of floatables. In addition, a fabricated spill control tee is installed within the basin capable of storing a minimum of 5 gallons of oil. A valve installed on the outlet of the basin provides manual isolation of each intermediate berm area.

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Interior Storage Space – The proposed storage building is a source control measure as it will protect materials on site from being stored in the elements and eliminate any contact of stormwater with the stored materials, including pesticides, herbicides, fertilizers, detergents, lubricants, spare parts, and other items necessary to operate the Facility.

Landscaping – Additional landscaping beyond the minimum requirements is proposed on site. Landscaping will allow stormwater to infiltrate on site and limit possible erosion.

Sidewalks and Asphalt Surfacing – The design of impervious surfaces is intended to limit the movement of vehicular and pedestrian traffic. The remaining yard area will be maintained in its current condition, and confining traffic and movement on these impervious areas will reduce the continued wearing of the granular surface of the yard area which, over time, would contribute to the transport of sediments.

As a result of the extensive source controls used to segregate stormwater from pollution-generating surfaces and reduce the possibility of erosion on site, the following treatment and operational BMPs will provide treatment. Table 21 lists the BMPs used at Terminal 4, their purpose, and, if applicable, the proposed discharge location.

Table 21 – Terminal 4 Treatment and Operational Stormwater BMPs

BMP	Purpose	Discharge Location
Loading and Unloading Areas	Loading and unloading will occur only at the storage area/Boiler Building.	On-site stormwater system
Storage of Liquids in Aboveground Tanks	Product storage and appurtenant chemical , fuel storage will occur in above ground storage tanks with required secondary containment	Roofs discharge directly to port stormwater system; containment area discharges to pre-settling basin
Coalescing Plate Separator Bay	Separation of oil from stormwater	Stormfilter treatment vault train
Stormfilter using MetalRx	Stormwater filtration for Basic treatment and dissolved metals	Discharge to either GAC vault or port stormwater system (pending trial)
Stormfilter using GAC	Stormwater filtration for benzene and volatile organic compounds	Discharge to either MetalRx vault or port stormwater system (pending trial)
Flow Control Structure	Limit flow from containment area to oil-water separator to not exceed rated capacity. Includes oil spill control valve.	Coalescing plate separator bay

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Prior to discharging to the port's stormwater system, a monitoring manhole is installed downstream of the project's treatment system to allow monitoring and testing for water quality compliance.

9.2.3 Terminal 5

Stormwater from Terminal 5 must be treated to Ecology's Basic water quality treatment standard before its on-site disposal. Stormwater from the Facility will be mixed with the remaining stormwater runoff at Terminal 5 and be discharged downstream to the Terminal 5 water quality lagoons. As a result, at the point of connection to the port's stormwater system, the stormwater must meet the technology limits of the Basic treatment level.

The Facility is using the following techniques to isolate stormwater from industrial processes and reduce the amount and cost of stormwater treatment.

- **Rail Unloading Canopy** – The rail unloading stations are located within a fully covered facility. The shed roof, complete with partial side wall panels on the south side, protects the unloading area from stormwater. The sections below discuss the fully enclosed vapor sealed system and the interior containment and drainage system.
- **Fully Enclosed Vapor Sealed Unloading System** – The unloading process uses a vapor lock system in which a vent pipe extending from the unloading header is connected to the vacuum breaker on the top of the rail car. As crude oil fills the header, the volume of air in the header is displaced and makes up the air necessary for replacing the volume discharged in the rail car. This process is completed for each station. During disconnection, valves are closed to seal vapors inside the piping system.
- **Containment and Drainage Piping** – All liquids that enter the perimeter of the rail unloading canopy are collected into a series of containment drip pans, containment trenches, or floor drains and collected into surge tanks and pumped to the containment tanks located in the area of the admin/support buildings.
- **Interior Storage Space** – The proposed building is a source control measure as it will protect materials on site from being stored in the elements and eliminate any contact of stormwater with stored materials such as pesticides, herbicides, fertilizers, detergents, lubricants, spare parts, and other items necessary to operate the Facility.
- **Landscaping** – As with Terminal 4, additional landscaping beyond the required minimum is proposed at Terminal 5 in the area of the admin/support buildings and the West Boiler Building. Landscaping will allow stormwater to infiltrate on site and limit possible erosion.
- **Sidewalks and Asphalt Surfacing** – Also as with Terminal 4, the design of impervious surfaces at Terminal 5 is intended to limit the movement of vehicular and pedestrian traffic. The remaining yard area will be maintained in its current

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condition, and confining traffic and movement to impervious areas will reduce the continued wearing of the granular surface of the yard area which, over time, would contribute to the transport of sediments.

As a result of the extensive source controls used to segregate stormwater from pollution-generating surfaces, and reduce the possibility of erosion on site, the following treatment and operational BMPs will provide treatment. Table 22 lists the BMPs used at Terminal 5, their purpose, and, if applicable, the proposed discharge location.

Table 22 – Terminal 5 Treatment and Operational Stormwater BMPs

BMP	Purpose	Discharge Location
Loading and Unloading Areas	Pollution prevention installed underneath and around all unloading points	Containment tank for haul off
Mobile Fueling of Vehicles and Heavy Equipment	Mobile fueling will occur at the bad order track location for the Savage rail locomotive	N/A
Railroad Yards	Pollution prevention good housekeeping measures	Existing Terminal 5 stormwater system
Washing of Vehicles/Equipment/ Building Structures	Cleaning of crude piping fittings, and occasional cleaning of rail cars to comply with FRA requirements	Containment tank for haul off
Coalescing Plate Separator Bay	Separation of oil from stormwater	Stormfilter using ZPG media
Oil Trap	Spill control measure allows for isolation of spill from downstream stormwater conveyance structures.	Coalescing plate separator bay
Stormfilter using ZPG Media	Stormwater filtration for Basic treatment	Existing Terminal 5 stormwater system

Prior to discharging to the port's stormwater system, a monitoring manhole is installed downstream of the Facility's treatment system to allow monitoring and testing for water quality compliance.

9.2.4 Marine Terminal

Stormwater from the Marine Terminal is required to be treated to Ecology's Basic water quality treatment standard prior to on-site infiltration. Stormwater will be treated to the Enhanced level with the media filter drain and discharged to the infiltration swales.

The Facility is using the following techniques to isolate stormwater from industrial processes and reduce the amount and cost of stormwater treatment.

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- **Marine Vapor System** – A marine vapor system will pull all vapors off the marine vessel and transport them upland to a marine vapor combustion unit for disposal. The marine vapor system will prevent vapors from the product storage tanks on the vessel from escaping into the atmosphere and contaminating stormwater.
- **Containment and Drainage Piping** – All liquids that enter the perimeter of the containment area at the dock will be collected into a floor drain and piped to the coalescing plate filter bay.
- **Interior Storage Space** – The proposed building is a source control measure as it will protect materials on site from being stored in the elements, and will eliminate any contact between stormwater and stored materials (i.e., pesticides, herbicides, fertilizers, detergents, lubricants, spare parts, and other items necessary for operation of the Facility).
- **Landscaping** – Additional landscaping beyond the minimum requirements is proposed in the area of the admin/support buildings and the West Boiler Building. Landscaping will allow the infiltration of stormwater on site and limit possible erosion.
- **Sidewalks and Asphalt Surfacing** – The use of impervious surfaces is designed to confine the movement of vehicles and pedestrians to hard surfaces. The yard area beyond the hard surfaces will be maintained in its current condition; limiting the traffic and movement in this area will reduce continued wearing of its granular surfacing which, over time, would contribute to sediments being transported.

As a result of the extensive source controls used to segregate stormwater from pollution-generating surfaces and to reduce the possibility of erosion on site, the following treatment and operational BMPs are used in the Marine Terminal. Table 23 summarizes the BMPs used on the site, their purpose, and, if applicable, the proposed discharge location.

Table 23 – Marine Terminal Treatment and Operational Stormwater BMPs

BMP	Purpose	Discharge Location
Loading and Unloading Areas	Pollution prevention installed underneath and around all loading points	Coalescing plate separator bay for treatment or haul off
Washing of Building Structures	Occasional building exterior rinse – good housekeeping measure	Media filter bay
Media Filter Bay	Provide enhanced water quality treatment	Infiltration swale
Basic Biofiltration Swale	Provide Basic water quality treatment	Infiltration swale
Coalescing Plate Separator Bay	Separation of oil from stormwater	Basic biofiltration swale

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9.3 Site Suitability

The site as designed is suitable for the proposed transload facility. The extensive source controls, operational BMPs, and treatment technologies employed can provide stormwater quality meeting the anticipated discharge requirements. Additional structural and operational oil and hazardous material spill control and prevention measures are discussed in section 10.0.

9.4 Treatment Process Operation

The treatment processes proposed during Facility operation are designed to be passive systems. Passive systems are designed to require minimal operational input and rely upon hydraulics to provide treatment. Due to the passive systems selected there are no process operational procedures required. An outline for the proposed sampling and monitoring plan is provided in Appendix A. Detailed discussions of how the treatment BMPs operate and required maintenance activities are provided with the draft operations and maintenance (O&M) manual that is attached as Appendix B.

9.5 Treatment Bypasses

To the maximum extent possible, the proposed treatment systems are designed using on-line water quality flow rates and volumes, and have been placed in-line with the stormwater flow. The design of the water quality vaults considered high-flow rates to ensure that the 100-year design storm can be conveyed safely through the structure. Even during design storms in excess of the water quality storm, the filter vault will continue to treat the water quality storm flow rate.

The only sources of stormwater not directed toward water quality treatment units are:

- Storage tank roof runoff
- Rail unloading facility roof
- Small portion on on-site landscaped areas
- Off-site stormwater from the Vanexco Cap
- Off-site stormwater from Keyera Energy propane terminal

The sources above consist entirely of on-site non-pollution generating surfaces which do not require additional treatment, landscaped areas which naturally flow to adjacent parcels, and previously installed adjacent tenant stormwater. All of the pollution-generating surfaces located within the control of the Facility are treated on site prior to discharge.

10.0 OIL AND HAZARDOUS MATERIAL SPILL CONTROL OR ACCIDENTAL DISCHARGE PREVENTION

Draft spill pollution control and countermeasures and contingency plans were prepared and submitted to EFSEC as part of the permitting process. The provisions

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discussed in these plans prevent and control material spills and accidental discharges of material to the storm drain system.

The primary protection against accidental discharges is conservative design with multiple fail safes to prevent and mitigate for possible equipment or operational malfunction. The systems are designed with equipment redundancy to mitigate for possible equipment malfunction, conveyance pipelines and tanks are designed for pressures and temperatures in excess of anticipated operating ranges, and physical monitoring and telemetry devices are implored to provide operators with real time data to ensure the Facility operates as designed.

In the unlikely event of an accidental discharge or failure, containment and control measures are in place to capture and mitigate the effects of any discharge. Emergency stop buttons are located in crucial parts of the operation and can shut down operations either in the immediate area or plant-wide, depending on the severity of the incident. Automatic and manual valves will isolate sections of the plant to reduce the amount discharged. Spill cleanup kits, booms, and absorbent material are located throughout the Facility for quick deployment.

As discussed above, the Facility's storm system is additionally designed to capture and remove oils from the stormwater in the unlikely event that a discharge reaches the stormwater system before the spill control valves can be shut. Any spilled product or hazardous material will be collected, along with any contaminated media, and hauled off site for legal disposal.

11.0 EXPECTED EFFLUENT CHARACTERISTICS

Classification of the on-site effluent characteristics of stormwater treatment can be difficult to project when influent characteristics are unknown. The project is unique when compared with other operational liquid bulk handling and storage facilities in Washington. Most bulk crude oil facilities are located on sites where finished product is stored, and processing also occurs. This Facility will not process crude oil.

As a result of the crude handling system which is sealed and isolated from the environment, the concentrations of hydrocarbons and volatile organics typically found in stormwater from refineries or finished product storage facilities will not result from this facility. A detailed discussion of the source control measures in place to reduce vapor and liquid surface contact with stormwater is included in section 9.2.

Detailed description of the expected effluent characteristics by stormwater facility is discussed below in sections 11.2, 11.3, and 11.4.

11.1 Anticipated Required Water Quality Benchmarks

Water quality discharges from the site to surface waters are regulated by Ecology, and that department administers the NPDES program for which this project is

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applying. The application requests that the water quality standards applied to this facility be those described below. The combination of the standards listed below for each discharge location and applicable downstream treatment at Terminal 5 and the Marine Terminal will ensure that the port's discharge will meet Industrial Stormwater General Permit levels.

At Terminal 4, stormwater leaving the Facility will blend with stormwater from Farwest Steel and be discharged to the Columbia River without receiving additional treatment. Therefore, the levels of the Industrial Stormwater General Permit apply directly.

At Terminal 5, stormwater leaving the Facility will mix with the remaining drainage from Terminal 5 and be pumped to a series of large treatment lagoons that were designed to treat both stormwater and process water from the previous Evergreen/ALCOA aluminum smelter. The treatment capacity of the lagoons is sufficient that, according to a report by HDR, only Basic treatment is necessary for individual tenants on Terminal 5. The treatment lagoons will provide final stormwater quality polishing and only TSS removal according to Ecology's Basic treatment standard applies.

Stormwater runoff to the treatment and infiltration swales is designed in accordance with the Enhanced level of treatment standard required by the Underground Injection Control (UIC) program. The media filter drain is an Ecology-approved treatment option for infiltration facilities. While the swale is not technically a UIC and therefore will not be permitted as such, its management and infiltration of stormwater apply similarly.

Table 24 details the anticipated water quality benchmarks.

Table 24 - Anticipated Water Quality Benchmarks

Pollutant	Terminal 4 (Enhanced Treatment)	Terminal 5 (Basic Treatment)	Marine Terminal (UIC Enhanced)
Oil and Grease	No visible sheen	No Visible sheen	No Visible Sheen
TSS (mg/l)	100	100	100
pH	6.5-8.5	5.0-9.0	6.5-8.5
Turbidity (NTU)	25	80	25
Total Copper (ug/L)	14	23	14
Total Zinc (ug/L)	117	190	117

11.2 Terminal 4

Stormwater generated from the Facility will be collected, treated, and discharged to the port's existing collection and treatment system. The port system at Terminal 4 is

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permitted as an Industrial Stormwater General Permit system with a single outfall to the Columbia River. The existing permit is WAR000424.

The port's system currently collects stormwater from the entire Terminal 4 area where it is treated with a constructed water quality pond. The water quality pond was reconfigured in October 2012 to maximize the distance between the inlets and outlet. Construction of earthen berms increased settling time and tripled the flow path length. Additionally vegetative riparian planting provide shade and all galvanized equipment was replaced with stainless steel. The port will be constructing a bypass to the water quality pond and diverting stormwater from the Facility directly to the outlet of the Pond. As a result water quality from the Facility will be required to meet the full discharge standards of the state Industrial Stormwater General Permit.

In accordance with the requirements of the Terminal 4 system, the Facility will discharge stormwater from the site to Enhanced water quality treatment levels. Stormwater from the tenant improvement areas at Terminal 4 (Area 300) will be collected and conveyed to water quality filter vaults for treatment. The vaults are designed to achieve a minimum of 80 percent removal of total suspended solids for influent ranges of 100 to 200 mg/L, 40-60 percent removal efficiencies for heavy metals (zinc and copper) and 40 percent removal efficiency for benzene and volatile organics. The proposed water quality standards in Table 25 are the water quality levels required by the state Industrial Stormwater General Permit.

The water quality vault system designed is a series of two StormFilter vaults provided by Contech Engineered Solutions. Each vault will be equipped with different media; one vault will contain MetalRx media sized at a 1 gpm/sq ft media surface area and the other vault will contain GAC sized at a 1 gpm/sq ft media surface area.

Table 25 - Terminal 4 Expected Effluent Characteristics

Pollutant	Influent Concentration	Effluent Concentration	Proposed Water Quality Standard
Oil and Grease	No visible sheen	No Visible sheen	No Visible Sheen
Total Suspended Solids (TSS) (mg/l)	34		100
pH	6	6	5.0-9.0
Turbidity (NTU)	85-196.1		25
Conductivity (umhos/cm	70		-
Total Copper (ug/L)	30		14
Dissolved Copper (ug/L)	4		-
Total Zinc (ug/L)	80		117
Dissolved Zinc (ug/L)	20		-
Benzene (ug/L)	1.2 ug/l		1.0 ug/l

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Pollutant	Influent Concentration	Effluent Concentration	Proposed Water Quality Standard
Naphthalene (ug/L)	<1 ug/l		-
Ethylbenzene (ug/L)	<1 ug/l		-
Toluene (ug/L)	1.2 ug/l		-

11.3 Terminal 5

Stormwater generated from the Facility will be collected, treated, and discharged to the port's existing collection and treatment system. The system at Terminal 5 is permitted as a municipal MS4 system with two outfalls to the Columbia River. The existing permit for the port's system is (to be added).

The port's stormwater system was designed and installed as part of the mitigation and demolition of the old ALCOA smelter site. (The system was designed by HDR and a copy of the design report is included in Appendix F.) The conveyance system was designed for the 25-year storm event and analyzed for the 100-year storm event to confirm safe conveyance. In addition, large water quality lagoons were constructed to provide final treatment prior to discharge to the Columbia River. The downstream lagoons were designed assuming that upstream tenants would perform Basic water quality treatment on site.

In accordance with the requirements of the Terminal 5 system, the Facility proposes to discharge stormwater to Basic water quality treatment levels. Stormwater from the tenant improvement areas at Terminal 5 (areas 200 and 600) will be collected and conveyed to water quality filter vaults for treatment. The vaults are designed to achieve a minimum of 80 percent removal of total suspended solids for influent ranges of 100 to 200 mg/L.

ZPG media will successfully treat concentrations of TSS, but its use is not known or implemented where Enhanced treatment is required. Enhanced treatment includes heavy metal treatment and additional filtering of TSS and reductions in turbidity. Therefore, the water quality standard listed in Table 26 is higher than the Industrial Stormwater General Permit as heavy metal removal and polishing will occur at the port's Terminal 5 lagoons. The development of the proposed water quality standard below assumed that the Terminal 5 lagoons would remove a minimum of 40 percent of the heavy metal concentrations.

The water quality vault is a StormFilter vault provided by Contech Engineered Solutions with ZPG media sized at a 1 gpm/sq ft media surface area. The product received its General Use Level Designation for Basic (TSS) treatment from Ecology in January 2013.

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Table 26 - Terminal 5 Expected Effluent Characteristics

Pollutant	Influent Concentration	Effluent Concentration	Proposed Water Quality Standard
Oil and Grease	No visible sheen	No Visible sheen	No Visible Sheen
TSS (mg/l)	50		100
pH	6	6	5.0-9.0
Turbidity (NTU)	85		80
Conductivity (umhos/cm	60		-
Total Copper (ug/L)	30		23
Dissolved Copper (ug/L)	4		-
Total Zinc (ug/L)	80		190
Dissolved Zinc (ug/L)	20		-
Benzene (ug/L)	1.2 ug/l		1.0 ug/l
Naphthalene (ug/L)	<1 ug/l		-
Ethylbenzene (ug/L)	<1 ug/l		-
Toluene (ug/L)	1.2 ug/l		-

11.4 Marine Terminal

Stormwater generated from the Facility will be collected, treated, and discharged to the port's treatment and infiltration swales.

The port's stormwater system currently collects stormwater from the entire area of the Marine Terminal (Area 400) and approximately 25 acres of Terminal 4. The treatment swales were constructed as part of developing the auto processing facility and were designed by David Evans and Associates. Stormwater enters the water quality swales (north set of swales), is treated, and flows through a series of inlets and outlets to the southernmost infiltration swales for disposal. There is no constructed overflow. Historically, there is no indication of flooding or inundation of the swales.

Stormwater from the tenant improvement areas at the Marine Terminal will sheet flow to the media filter drain for treatment. The media filter received its General Use Level Designation for Enhanced treatment from Ecology in February 2013.

Table 27 - Marine Terminal Expected Effluent Characteristics

Pollutant	Influent Concentration	Effluent Concentration	Proposed Water Quality Standard
Oil and Grease	No visible sheen	No Visible sheen	No Visible Sheen
Total Suspended Solids (TSS) (mg/l)	24		-
pH	6	6.5	-
Turbidity (NTU)	80		-
Conductivity (umhos/cm	60		-

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Pollutant	Influent Concentration	Effluent Concentration	Proposed Water Quality Standard
Total Copper (ug/L)	30		-
Dissolved Copper (ug/L)	4		
Total Zinc (ug/L)	80		-
Dissolved Zinc (ug/L)	20		-
Benzene (ug/L)	1.2 ug/l		-
Naphthalene (ug/L)	<1 ug/l		-
Ethylbenzene (ug/L)	<1 ug/l		-
Toluene (ug/L)	1.2 ug/l		-

12.0 RECEIVING WATER DESCRIPTION

In accordance with the letter directing the scope of this engineering report, the analysis is limited to the discharge location at the point at which the Facility connects the on-site stormwater system to the port's existing system. A complete description of the downstream stormwater system is included in section 1.1.1. The following is a brief description of the discharge locations for the downstream systems to the Columbia River.

12.1 Location of Discharge

The Terminal 4 stormwater system discharges to the Columbia River at a single outfall southeast of the Terminal 4 water quality pond at Berth 9. The port's mapping identifies the outfall as T4O. Figure X shows its location.

The Terminal 5 stormwater system has two outfalls to the Columbia River. The outfall located immediately west of Berth 17 is an overflow to the port's on-site stormwater pump station. The pump station pumps on-site stormwater to existing treatment lagoons located west of Terminal 5. The outfall for the lagoons is located immediately south of the western edge of the lagoons. Figure X shows the location of the two outfalls.

12.2 Water Quality

Multiple government agencies and non-governmental organizations monitor water quality levels within the Columbia River. The U.S. Geological Service (USGS) is the federal agency responsible for conducting water quality testing in the Columbia River. In 2004–2005, the USGS conducted water column samples. Significant findings of this report are summarized below.

- None of the aquatic-life or human health benchmarks established by the U.S. Environmental Protection Agency were exceeded.
- Concentrations of arsenic, copper, and lead were not present at levels of concern with regards to aquatic toxicity.

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- Trace element concentration were higher downstream than at the upstream reaches of the Columbia River.
- Eight of the 54 wastewater compounds analyzed were detected at least once, usually at trace levels. Bisphenol A was the only endocrine disruptor in wastewater compounds detected in the Columbia River.
- During seasonal samplings of suspended sediment no organochlorine compounds or polycyclic aromatic hydrocarbons (PAHs) were detected
- All 11 polybrominated diphenyl ether (PBDE) congeners were detected on suspended sediments, usually in trace amounts.
- 102 of the 209 PCB congeners were detected on suspended sediments, usually in trace amounts.

A full copy of the report is available from the USGS at http://pubs.usgs.gov/ds/2006/213/#download. Additionally, the USGS report "Water Quality of the Lower Columbia River Basin: Analysis of Current and Historical Water-Quality Data through 1994" can be downloaded at http://or.water.usgs.gov/pubs_dir/Abstracts/95-4294.html

12.3 Outfall Analysis

The scope of this report is limited to the location of the connection where the on-site stormwater is discharged to the port's existing system. The outfall locations are described above in section 12.1. The existing outfalls are permitted under stormwater permits WAR000424 and WAR045201.

13.0 RELATIONSHIP TO EXISTING TREATMENT FACILITIES

The Facility will use existing treatment facilities for a portion of its stormwater runoff and all of its wastewater. The Facility's relationship to existing stormwater treatment facilities is discussed in detail in the subsections below. This section discusses the Facility's relationship to wastewater treatment.

The Facility will discharge wastewater to the City's sanitary sewer system and will be treated at the City's treatment plant. The remaining portion of sanitary and process water will be hauled off site and legally disposed of. Disposal companies collecting portable toilet waste from the Marine Terminal will take the waste to a municipal treatment plant for treatment. Contaminated wastes will be taken to local processing facilities that perform pre-treatment prior to discharging the waste to the sanitary sewer.

13.1 Terminal 4 Treatment Facilities

The Terminal 4 collection system collects and treats approximately 250 acres of industrial port land. Currently, Parcel 1A, which will be developed by this project into the storage area, contributes through an existing storm drain to the Terminal 4 water quality pond. When Area 300 is completed, stormwater from it will mix with discharge from the upstream Farwest Steel facility. The port constructed the

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discharge line for these two properties to segregate the flow from the remainder of Terminal 4 stormwater.

Modifications were completed in October 2012 to the Terminal 4 water quality pond to increase its treatment capacity and efficiency. A port-planned construction project, likely to occur during Facility construction, will complete the segregation of runoff from Area 300 and Farwest Steel from the remaining Terminal 4 runoff. The project will result in the discharge of the runoff from the Facility to the outfall from the water quality pond and then to the Columbia River, thus bypassing the water quality pond. As a result of this modification, discharges from Area 300 will be required to comply with the discharge requirements of the Industrial Stormwater General Permit.

13.2 Terminal 5 Treatment Facilities

Stormwater from Terminal 5, including areas 200 and 600 and the rail improvements, will discharge to the existing conveyance and treatment system installed in Terminal 5. The downstream water quality lagoons were constructed to treat industrial and stormwater runoff from the Evergreen/ALCOA smelter once located at the site.

A new stormwater system was installed as part of the site remediation that occurred during the decommissioning of the Evergreen/ALCOA facility. HDR completed the design and engineering for the modification as well as the rail improvements with the West Vancouver Freight Access project. The HDR analysis concluded that the discharge limits of the state Industrial Stormwater General Permit can be achieved if individual tenants treat on-site stormwater to the Basic Ecology threshold.

The Facility will install two water quality vaults which have received General Use Level designation for Basic treatment according to Ecology's Technology Assessment Protocol. Existing sources of stormwater upstream of the site (i.e., Keyera Energy propane terminal and the underdrain system installed above the Vanexco Cap) will be conveyed directly through the site without treatment.

13.3 Marine Terminal Treatment Facilities

The existing stormwater treatment and infiltration facilities located at the Marine Terminal will be used for treatment and infiltration of the Facility's stormwater. The existing facilities provide treatment and disposal for 25 acres of contributing stormwater. The marine vapor combustion unit will be constructed in a portion of one of the treatment swales, affecting approximately 120 feet of biofiltration swale.

To mitigate for the loss of treatment capacity, the Facility is installing over 1,000 linear feet of media filter drain to provide Enhanced treatment for the pollution-generating surfaces constructed at the Marine Terminal. The proposed treatment trade allows additional 1.5 acres of existing contributing area to be treated. The total

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amount of contributing area to the infiltration system is not proposed to be increased.

Stormwater from the containment area at the dock will be collected and piped to an oil-water separator. The oil-water separator will include sufficient storage for the required containment volume of 3 barrels. Discharges from the oil-water separator will be pumped to the treatment swales for final treatment prior to flowing into the infiltration swales.

14.0 MUNICIPAL WASTEWATER SYSTEM ANALYSIS

Sources of wastewater include the boiler plant effluent, miscellaneous part and equipment wash, fire pump cooling water, and domestic sewage. Most wastewater sources will be connected to the City's public sanitary sewer system. Sanitary sewerage collected from within the port area is conveyed to the City's wastewater treatment plant where it is treated and discharged to the Columbia River under NPDES Permit No. WA0024350. All process wastewater discharged from the Facility to the City's sanitary sewer system will undergo pretreatment to ensure compliance with the City's pretreatment program.

A detailed analysis of the sanitary sewer system is not included in this report. This report is developed to support the approval of the stormwater NPDES permits. The Facility will not require wastewater NPDES permits. All wastewater will either be discharged to the City's sanitary sewer or hauled off for legal disposal. A copy of the application for a state waste discharge permit to discharge industrial wastewater to a publicly-owned treatment works was submitted to EFSEC with the application for site certification.

14.1 Conveyance System Capacity

The conveyance system in this portion of the City includes 18-inch diameter gravity sewer mains. The Facility submitted pre-application paperwork to the City for review which specified a maximum flow of 30 gpm. The gravity sewer flows to a regional pump station located adjacent to the southeast corner of the proposed storage area.

The City reviewed a pre-application narrative which listed the wastewater discharges from the Facility at 30 gpm and indicated that the City has sufficient wastewater conveyance system capacity to serve the project.

14.2 Treatment Plant Capacity

Maximum wastewater discharges to the City's sanitary sewer system by the Facility will account for less than 0.1 percent of the total treatment capacity of the City's wastewater treatment plant. The plant uses an activated sludge process, UV disinfection, and sludge incineration for treatment, and is rated for a maximum wet weather treatment capacity of 28.26 MGD. Current treatment plant maximum flow is listed in the most recent Ecology facility fact sheet dated 2003 as 17.4 MGD.

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As stated above, the pre-application narrative reviewed by the City listed the wastewater discharges from the Facility at 30 gpm and the City indicated that it has sufficient wastewater treatment capacity to serve the project.

15.0 SLUDGE DISPOSAL

All materials collected in the proposed treatment BMPs and resulting from routine maintenance – including sweepings, catch basins, sumps, pretreatment solids settling units, oil-water separators, and filter vaults – will be hauled off and legally disposed of.

Replacement of the water quality vault filter media and residue from cleaning coalescing plate cartridges will be completed under a maintenance agreement with the vendor or similar professionally qualified maintenance service. Solids and separated oils will be removed and hauled off site for legal disposal. Water quality facilities will be refilled with clean water to operational levels and commissioned according to the manufacturer's recommendations.

16.0 OWNERSHIP OPERATION AND MAINTENANCE RESPONSIBILITY

The Facility is located on parcels that are owned by the port. Tesoro Savage Petroleum Terminal LLC has entered into a lease with the port for the exclusive use of the property located within the site boundary. A portion of the lease includes a non-exclusive easement for the transfer pipeline corridor. Tesoro Savage Petroleum Terminal LLC will be responsible for the operation, maintenance, and permit compliance for the proposed stormwater collection, conveyance, and treatment systems.

Tesoro Savage Petroleum Terminal LLC is a Delaware limited liability company that is qualified to do business in the state of Washington. Its members are Savage Companies and Tesoro Refining & Marketing Company LLC. Tesoro Refining & Marketing Company LLC is a subsidiary of Tesoro Corporation, which is a Fortune 150 company and an independent refiner and marketer of petroleum products. Savage Companies is a privately held operator that provides supply chain management solutions tailored to meet the needs of a variety of industries.

17.0 COMPLIANCE WITH STATE, LOCAL, OR FEDERAL WATER POLLUTION CONTROL ACT OR PLANS

The project is proposing to ensure compliance with these regulations by using BMPs. The BMPs discussed in the preceding sections include schedules of activities, prohibitions of practices, maintenance procedures, and structural and managerial practices that, when used singly or in combination, prevent or reduce the release of pollutants and other adverse impacts to surface water.

To ensure compliance, the Facility has factored into its design all known, available, and reasonable methods of prevention, control, and treatment to prevent and control

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pollution. The following standards were used in the design and preparation of operational/managerial operations for the Facility.

17.1 Federal Standards

The federal Clean Water Act regulations which include those implemented through the NPDES permits for stormwater and wastewater are locally administered through Ecology. On March 23, 2007, the port was issued an NPDES Western Washington Phase II Municipal Stormwater Permit for discharges of stormwater to surface waters through its municipal separate storm system.

17.2 State Standards

17.2.1 Statutes

Washington's requirements for surface water management are contained in the following statutes:

- Washington State Surface Water Quality Standards (WAC 173-201A)
- Ground Water Quality Standards (WAC 173-200)
- Sediment Management Standards (WAC 173-204)

17.2.2 Stormwater Management Manual

The stormwater manual is not a regulation, but it has been adopted by the City and state permits require compliance with it. Additionally, stormwater management techniques applied in accordance with the manual are presumed to meet the technology-based treatment requirements of RCW 90.52.040 and RCW 90.48.010 – that the project provide all known available and reasonable methods of treatment prevention and control (akart) as required by RCW 90.52.040 and RCW 90.48.010.

Land-disturbing activity carried out by the project will trigger water quality improvements required by the City's NPDES Phase II permit. Therefore, minimum requirements 1 through 9 of the stormwater manual apply. The minimum requirements are listed below.

17.2.2.1 Minimum Requirement No. 1: Preparation of Stormwater Site Plans

Stormwater site plans have been prepared and are attached as Attachment I. Stormwater site plans are required by section 2.5.1 of the stormwater manual and must be prepared according to Chapter 3 of the manual and VMC 14.24, 14.25, and 14.26.

17.2.2.2 Minimum Requirement No. 2: Construction Stormwater Pollution Prevention

The facility will result in more than 2,000 square feet of replaced hard surface and will disturb more than 7,000 square feet of land; stormwater pollution prevention therefore must be considered. To comply with this minimum requirement, a preliminary SWPPP has been prepared; it was attached to the EFSEC Application for Site Certification as Appendix C. A final SWPPP will be prepared in conjunction

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with construction drawings and submitted prior to beginning construction activities on site.

The SWPPP includes narratives and drawings that clearly refer to each of the BMPs that will be used to prevent erosion and control sediment. The SWPPP addresses the 13 elements that are briefly described in the following paragraphs. Seasonal limits are listed and erosion and sediment controls are designed to prevent silt-laden water from leaving the site during the wet and rainy season.

- **Element 1: Preserve Vegetation/Mark Clearing Limits –** Existing vegetation on site is very minimal and consists of herbaceous groundcover not exceeding 6 inches in height. Clearing limits are defined in the stormwater site plans and will be marked in the field by construction of either silt fencing or high visibility fencing. Existing landscape buffers and nearby wetland will be protected from construction activities. The contractor will restore any accidental disturbance.

- **Element 2: Establish Construction Access –** Construction access will be limited to stabilized construction entrances and construction routes assigned for the project. Rock-stabilized construction accesses will be installed at the storage area, rail unloading and office area, marine terminal, and the west boiler. Access to the transfer pipeline is from existing impervious areas, and land-disturbing activities at these sites will be isolated from general truck traffic.

  Wheel wash units are anticipated to be used during installation of ground improvements. Wheel washes will be provided at the storage area and marine terminal. If sediment is transported onto nearby roadways, the tracked sediment will be cleaned during dry weather by shoveling, sweeping, or other collection means. Street washing will be used only after the previously mentioned methods of sediment removal have been completed. If these currently proposed BMPs are not sufficient to control sediment transport, additional wheel wash units will be implemented.

- **Element 3: Control Flow Rates –** Turbid waters will be controlled from downstream properties through installed erosion and sediment control BMPs. All of the sites consist of existing impervious coverage, and runoff rates therefore will not be increased to downstream properties or conveyances. Sediment ponds will be installed to detain stormwater runoff from the rail offloading area and the storage area. Erosion and sediment control BMPs, including sediment ponds and conveyances, will be sized for the Type 1A 10-year 24-hour storm event.

  Construction BMPS will manage stormwater until the site has been stabilized and permanent operational BMPs have been installed. Startup of vendor supplied stormwater treatment equipment will performed by supplier.

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- **Element 4: Install Sediment Controls –** Elimination of soil erosion is the primary goal of the SWPPP as prepared. Sediment controls are added as an extra layer of security against off-site sediment transport if erosion occurs. Sediment controls such as sediment ponds, filters, and cutoff ditches will be installed before land-disturbing activities take place. Stormwater will be directed to installed sediment removal BMPs.

  Construction of erosion or sediment controls will be located above the ordinary high water line and therefore no interference is anticipated with juvenile salmonids. Additionally, the project will construct no new outfalls.

- **Element 5: Stabilize Soils –** Soil stabilizing will be performed on site for all soils exposed more than seven days during the dry season (May 1–September 30) and for all soils exposed more than two days during the wet season (October 1–April 30). Soils will be stabilized by applying BMPs that prevent erosion; as appropriate, these BMPS include temporary and permanent seeding, sodding, mulching, plastic covering, erosion control fabrics and matting, and early application of gravel base on areas to be paved.

  Depending upon the weather forecast, soils will be stabilized at the end of the workday prior to a holiday or weekend. Stockpiles will be protected by plastic covering and silt fencing. To the extent possible, soil disturbance will be limited to areas being worked on, without carrying out clearing and grubbing activities ahead of construction activities.

- **Element 6: Protect Slopes –** The site is generally flat without any slopes requiring protection. Silt fencing will be installed along the edge of the riverbank to protect the river from runoff during construction. Stormwater discharges at the marine terminal will be maintained and directed to existing swale areas just north of the marine terminal. Slope construction necessary during construction of the storage area containment berm will be protected using applicable BMPs. The site will be surrounded by silt fencing and, once constructed, the soils will be tracked and seeded.

- **Element 7: Protect Drain Inlets –** All drain inlets, existing and proposed, will be protected with BMPs to maintain operation and prevent sediment transport. BMPs include insertable filter devices or above-grade filter media. Drain inlet BMPs will be inspected after each storm event to check capacity and the filter media will be cleaned or removed and replaced when sediment has filled one-third of the device's available storage capacity.

- **Element 8: Stabilize Channels and Outlets –** On-site conveyance channels (cutoff ditches) are designed to convey the Type 1A, 10-year, 24-hour storm

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without causing erosion under the 10-minute peak velocity. No modifications are proposed to existing outfalls or outlets.

- **Element 9: Control Pollutants –** All liquid pollutants, including chemicals, gasoline, paints, thinners, solvents, grease, etc., will be stored in covered areas to prevent pollution. Fueling will be conducted off site and, when necessary, at a designated location on site. Detailed spill prevention and control measures are described in the spill prevention control and countermeasures (SPCC) plan included in the EFSEC Application for Site Certification Appendix B.2. Secondary containment will be provided for all chemical, liquid, and petroleum tanks and mechanical piping.

  Wheel washes and tire baths are not anticipated to be required. If necessary, wastewater will be contained in a closed loop system or disposed of to the sanitary sewer system after receiving permission from the City for the discharge.

  BMPs will be used to prevent contaminating stormwater runoff by sources of differing pH. A designated location will be provided for washing concrete trucks, and curing water, or discharge water from concrete sawing etc. Construction stormwater from these processes will be checked for pH prior to its discharge and, when necessary, will be treated to adjust its pH. The pH adjustment will be completed using CO_2 or dry ice only.

- **Element 10: Control Dewatering –** Construction dewatering is anticipated in portions of the site during excavation for underground utilities and building footings. Dewatering discharges will be directed to the on-site cutoff ditches and to on-site sediment ponds.

  If dewatering water cannot be discharged cleanly, additional treatment methods, including off-site disposal and/or settling tanks and flocculating chemical injection, may be completed prior to discharge to on-site systems.

- **Element 11: Maintain BMPs –** All BMPs will be inspected after each storm event to ensure that sediment buildup is less than 30 percent of the storage volume and that all BMPs are operating as designed. BMPs will be removed within 30-days of site stabilization and startup of the permanent operational stormwater system and BMPs.

- **Element 12: Manage the Project –** Initially, construction of the project will be phased to install all the stormwater BMPs necessary to manage stormwater on site in accordance with the stormwater manual. A CESCL must inspect the site; the CESCL will be identified in the final SWPPP. Inspection and monitoring will be completed in accordance with Special Condition S4 of the Construction Stormwater General Permit.

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To the maximum extent possible, construction phasing will avoid exposing disturbed soils for long periods. Soil stabilization will be completed according to Element 8 as frequently as possible to prevent erosion. Permanent facilities and site stabilization will be timed to maximize the effectiveness of stormwater erosion and sediment control BMPs to maintain downstream water quality.

- **Element 13: Protect Low Impact Development BMPs** – Any adjacent low-impact development (LID) BMPs will be protected using construction BMPs to prevent damage, including compaction, sedimentation, and other disruptions.

17.2.2.3 Minimum Requirement No. 3: Source Control of Pollution

Identified sources of pollution are addressed with designed source control BMPs in accordance with the stormwater manual. Possible sources are identified and, where possible, eliminated during design. Remaining sources are protected with BMPs as identified in the erosion and sediment control plans.

17.2.2.4 Minimum Requirement No. 4: Preservation of Natural Drainage Systems and Outfalls

The site is an existing industrial site with no natural drainage channels. Discharges from the site will be maintained and directed to existing conveyance systems using existing outfalls. Discharge rates will not be increased due to the condition of the existing site as fully impervious. The site will discharge to three existing outfall systems, one located downstream of the Terminal 4 pond, one located at Terminal 5, and an infiltration swale located immediately north of the marine terminal.

Stormwater control and treatment structures are not located within the 25-year water elevation of the Columbia River, the only salmonid-bearing water adjacent to the project location. Existing outfalls were sized and designed to account for the construction of the project area as fully impervious surfaces.

17.2.2.5 Minimum Requirement No. 5: On-Site Stormwater Management

Stormwater will be managed on site in accordance with Section 2.5.5 of "Volume I, Minimum Technical Requirements and Site Planning" of the stormwater manual. In addition, in accordance with Section 2.5.7 of Appendix I-E of the manual, the project is flow control-exempt and therefore is not required to achieve the low impact development performance standard, or to consider bioretention, rain gardens, permeable pavement, and full dispersion. Stormwater monitoring manholes will be installed upstream of the connection point to monitor and confirm that on-site stormwater management techniques meet all discharge requirements.

Site grading will be conducted and stormwater improvements installed to minimize the discharge of stormwater run-off from the site. Structural components of design, including manmade conveyances, inlets, and berms, will be used to contain stormwater on site. The project design accounts for the safe conveyance of the 100-year storm event in accordance with the stormwater manual.

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17.2.2.6 Minimum Requirement No. 6: Runoff Treatment

Because the total project adds more than 5,000 square feet of pollution-generating hard surface, the project is required to address runoff treatment. Treatment units are sized for the contributing area and expected water quality flow as determined by the WWHM3. Treatment facilities were selected in accordance with the process identified in Chapter 4 of Volume I and Chapter 2 of Volume V of the stormwater manual. An O&M manual will be developed that adheres to the maintenance schedule required in Volume V. (The manual, Appendix B, will be provided at a later date.)

Discharge water quality monitoring manholes will be provided at all connection points to the existing stormwater conveyances. Stormwater discharges from pollution-generating surfaces in the storage area and marine terminal will be discharged to existing stormwater systems located in Terminal 4. Stormwater will be treated on site to the discharge limits identified in the state Industrial Stormwater General Permit. Terminal 4 discharges are currently permitted through state General Industrial Stormwater Permit No. WAR000424.

Stormwater discharges from pollution-generating surfaces in the West Boiler Building area, rail unloading and office area, and rail infrastructure improvements will be discharged to existing systems located in Terminal 5. Stormwater will be treated on site to the discharge limits identified in the state Phase II Municipal Stormwater Permit. Terminal 5 stormwater is then routed to an existing water quality pond that was designed with sufficient capacity for the built-out project areas, assuming fully impervious coverage. Terminal 5 discharges are currently permitted through state Phase II Municipal Stormwater Permit No. WAR045201.

17.2.2.7 Minimum Requirement No. 7: Flow Control

Flow control is not required for this project, which discharges indirectly to the Columbia River, which is listed in Appendix I-E of the stormwater manual. The areas proposed for redevelopment are located within the existing drainage basins of developed storm drain systems that discharge through manmade conveyances directly to the river.

Additionally, the brownfield nature of the site is such that the project stormwater does not result in the diversion of drainage from any perennial stream or from any category of wetland.

On-site stormwater will be collected from building roofs through gutter and rain drain systems that will bypass stormwater treatment, as these surfaces are classified as non-pollution generating. Stormwater from surface improvements will be collected through a series of inlets and storm drain systems, routed through on-site treatment, and discharged to existing on-site manmade pipelines. These pipelines continue through manmade conveyance pipes to manmade water quality facilities

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before discharging through piped outfalls to the Columbia River. From collection to discharge into the river, the stormwater is never conveyed through natural channels.

The design of the downstream conveyance and water quality ponds that are not part of this project assumed that the project sites would be developed as fully impervious. Copies of the design reports for the downstream conveyance systems are attached in Attachment X and Attachment X.

17.2.2.8 Minimum Requirement No. 8: Wetlands Protection

Wetland protection does not apply to this project. This project does not discharge stormwater directly or indirectly into a wetland.

17.2.2.9 Minimum Requirement No. 9: Operation and Maintenance

An O&M manual consistent with the provisions of Volume V of the stormwater manual will be developed for the facilities and BMPs that are included in the project. (The manual, Appendix B, will be provided at a later date.) A copy of the O&M manual will be retained on the site and available for review. Updated logs and copies of all required monitoring will be retained and included in the O&M manual for reference.

17.3 City Standards

Water Quality Standards – The City's requirements for surface water management are contained within the following ordinances:

- Erosion prevention and sediment control (VMC 14.24)
- Stormwater control (VMC 14.25)
- Water resources protection (VMC 14.26)

Wastewater Pretreatment Ordinance – Pretreatment will be conducted on site in accordance with the requirements of the City industrial wastewater pretreatment permit. Process water wastewater streams requiring pretreatment include blowdown and condensate discharges from the boiler plants. Pretreatment processes for these wastewater streams will be designed and furnished by the boiler manufacturer in accordance with industry practices.

Table 28 includes data provided by the boiler treatment supplier and illustrates example discharge constituents of similar boiler installations within the City. The constituent concentrations shown for the boiler blowdown and softener backwash discharges are the estimated wastewater concentrations prior to pre-treatment. The boiler manufacturer is required to provide on-site pretreatment prior to discharging into the sanitary sewer system. The daily maximum concentration limit is the discharge and constituent concentration limits listed in the City's pretreatment ordinance. Effluent monitoring will be completed to ensure compliance with the City's pretreatment ordinance.

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Table 28 - Process Wastewater Constituent Concentrations

Constituent	Boiler Blowdown	Softener Backwash	Daily Maximum Concentration Limit	Unit
pH (minimum)	10.2	8	5.5-10.0	-
Arsenic	-	-	0.22	mg/L
Biological Oxygen Demand	-	-	500	ppd
Cadmium	<0.04	<0.04	0.14	mg/L
Chromium	<0.01	<0.01	7.22	mg/L
Chromium (hexavalent)	-	-	4.28	mg/L
Copper	4	0.2	3.67	mg/L
Cyanide	-	-	0.47	mg/L
Hydrocarbon based Oil & Grease	-	-	50.0	mg/L
Lead	<0.2	<0.2	0.44	mg/L
Mercury	-	-	0.008	mg/L
Molybdenum	<0.1	<0.1	0.42	mg/L
Nickel	<1	<1	0.90	mg/L
Selenium	-	-	0.31	mg/L
Silver	-	-	1.13	mg/L
Temperature	-	-	104	Degrees Fahrenheit
Thallium	-	-	0.53	mg/L
Zinc	-	-	1.64	mg/L

Additionally, discharges will comply with VMC 14.010.050 Prohibited Discharge Standards, VMC 14.010.060 National Categorical Pretreatment Standards, and VMC 14.010.070 State Pretreatment Standards.

18.0 PROVISIONS FOR FUTURE CONSTRUCTION

The facility is proposed to be constructed in two phases. Most of the work will be completed during initial construction; however, the design includes provisions to facilitate construction of the second phase. The provisions are summarized below.

Stormwater design and analysis for the entire built-out site, including the future phase, were completed for the entire site as part of this engineering report. The expansion areas contribute directly to stormwater systems that will be installed in the initial phase of construction and the design therefore includes adequate capacity sized to handle stormwater from the expansions described below; the design also includes a conservative margin.

18.1 Unloading Stations

Initial construction will include the below-ground improvements located within the limits of the rail unloading facility. The improvements, including the concrete

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containment trench and pump pits, will be completed to allow a third row of unloading stations, bringing the total number of unloading stations to 90. Mechanical and electrical systems will not be installed at this time. Sufficient overhead lighting as well as fire protection systems will be installed in this vicinity to comply with safety standards adopted by the project and required by permit.

Underground "wastewater" collection systems, including floor drains, will be installed and routed to the collection system for the entire rail unloading facility. Stormwater that is "blown" into the covered facility from the sides and any leaks, drips, wash water, etc. from the Facility will be pumped to the containment tanks located in the area of the admin/support buildings for haul off and disposal. No runoff from this area will contribute to existing or planned stormwater systems.

18.2 West Boiler Plant

Constructing the west boiler plant will be necessary if the Facility is supplied with crude oils that must be brought to a more viscous state through additional heating in order to be pumped and handled. Construction of the west boiler plant will not commence until market conditions warrant it.

The west boiler plant includes an enclosed West Boiler Building, parking area, and landscaping. All wastewaters generated within the boiler plant will contribute to flood drains and will be pumped to the area of the admin/support buildings for discharge to the City's sanitary sewer system. Process wastewater, including condensate, blowdown, and cooling water, will be treated on site and discharged to the sanitary sewer.

Stormwater from the west boiler plant will contribute to the 24-inch gravity storm sewer extended underneath the rail corridor to serve the area of the admin/support buildings. The stormwater will be conveyed to a water quality vault (0200-WQV-001) for treatment to Basic treatment levels. The design of the water quality vault is sized to include the contributing area for the west boiler plant. See the design section for details.

18.3 Product Storage Tanks

Initial construction of the facility will include four of the six planned product storage tanks. Initial construction will include completion of the necessary ground improvements and construction of the containment dikes, liners, and required stormwater collection systems.

Stormwater from the future product storage tanks will contribute to the water quality systems installed during initial construction. The treatment systems, including oil-water separator, water quality vault, and proposed hydrodynamic separator, have been sized for the ultimate build-out. See the design section for details.

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19.0 TREATMENT UNIT ALTERNATIVES ANALYSIS

The proposed Facility is designed with an abundance of source controls to limit the contamination of stormwater from the outset. Segregating the stormwater from the Facility from the on-site industrial processes dramatically reduces the anticipated influent levels of contamination in the stormwater. The following sections first describe the selected treatment unit and then list the alternatives that were considered and rejected.

19.1 Basic Treatment Units

Stormfilter Using ZPG Media – Selected as the preferred alternative for providing Basic treatment for areas 200, 300, and 600, this unit has received its General Use Level Designation from Ecology and has a track record of reducing the TSS when designed and maintained appropriately.

Media Filter Drain – Realigning the roadway south left enough space for the installation of the media filter drain that was selected as the preferred alternative for providing Basic treatment at Area 400. The unit has received General Use Level Designation for advanced treatment.

The units that were considered but rejected for Basic treatment are listed in Table 29.

Table 29 – Rejected Alternatives – Basic Treatment

Basic Treatment Unit	Reason for Rejection
MWS-Linear Modular Wetland	Approved for conditional use only – Insufficient area on site
Biofiltration Swale	Insufficient area on site
Wetpond	Insufficient area on site
Wetvault	Filter vault media options provides greater expandability if additional treatment required in long-term.

19.2 Enhanced Treatment Units

Stormfilter using MetalRx Media was selected as the preferred alternative for providing Enhanced treatment for Area 300. The unit has received its Conditional Use Level Designation from Ecology and, when used in treatment train with GAC, provides necessary filter capabilities. The units that were considered but rejected for Enhanced treatment are listed in Table 30.

Table 30 –Rejected Alternatives – Enhanced Treatment

Enhanced Treatment Unit	Reason for Rejection
Filterra System	Modular sizing for Filterra does not treat runoff volume anticipated
Compost-Amended Biofiltration Swale	Insufficient area on site
Treatment Trains from Table 3.4.1 of SWMM	Insufficient area on site

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19.3 Oil-Water Separators

Coalescing Plate Separator Bay – The selected units include two Contech VLC80-3 capable of handling a design flow rate of 880 gpm with over 35,000 square feet of coalescing plate area, OldCastle Pre-cast 612-2 CPS with 1,776 square feet of coalescing plate area, and 576 CPS with 592 square feet of coalescing plate area. The coalescing plate technology provides for oil separation with a smaller footprint.

The units that were considered but rejected for oil treatment are listed in Table 31.

Table 31 – Rejected Alternatives – Oil Treatment

Enhanced Treatment Unit	Reason for Rejection
API-Type Oil-water Separator	Larger footprint
Linear Sand Filter	Insufficient area on site
Filterra System	Modular sizing for Filterra does not treat runoff volume anticipated

19.4 Volatile Organics/BTEX Treatment

Stormfilter Using GAC Media was selected as the preferred alternative for the removal of volatile organics and BTEX/benzene. The rationale for using a passive GAC treatment as opposed to positive pressure/pumped active process (e.g., sand filtration and GAC filters) is that the amount of volatile organics and benzene from the site is anticipated to be minimal because of the abundance of source control and upstream oil-water separation included in the project. The passive system is shown to remove approximately 40 percent of the benzene when concentrations are at or below 1 ug/L.

The units that were considered but rejected for the removal of volatile organics and BTEX/benzene are listed in Table 32.

Table 32 – Rejected Alternatives – Volatile Organic Treatment

Volatile Organic Treatment Unit	Reason for Rejection
Positive Pressure Sand Filtration with GAC Unit	Treatment requires power and increased maintenance. Source controls effectively limit contact water with product eliminating need for advanced treatment technology

20.0 DESIGN AND CONSTRUCTION TIMETABLE

A preliminary schedule for design and construction is presented in Figure 14. Table 33 indicates a summary of key milestones for design and construction of the initial improvements. The future West Boiler Building, unloading stations, and storage tanks will be built when market conditions warrant expansion.

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Table 33 – Permitting & Construction Milestones

Event	Milestone Date
Submit EFSEC Application	August 30, 2013
EFSEC Review	365 days
Bidding	August 20, 2014
Equipment Procurement/Fabrication	October 15, 2014
Construction Begins	October 15, 2014
Construction Complete	April 14, 2014

21.0 SEPA/NEPA COMPLIANCE

The proposed Facility is subject to site certification agreement being considered by EFSEC, and that body is acting as the lead agency under SEPA. EFSEC has issued a determination of significance and an environmental impact statement, which is now in preparation, will be completed before the site certification agreement is issued.

The only aspect of this project subject to NEPA is the decision by the USACE under Section 10 of the Rivers and Harbors Act for work at the existing berths 13 and 14. The USACE will be responsible for NEPA compliance related to the decision under Section 10.

22.0 SOLID WASTE LEACHATE SYSTEMS

This project will not collect solids from wastewater systems. Solids settling out in catch basin sumps, oil-water separators, oil-water traps, and treatment structures will be hauled off and disposed of off site in a legal manner; see Section 15.0 for details about sludge disposal. Operationally, solids will not be collected and dried on site.

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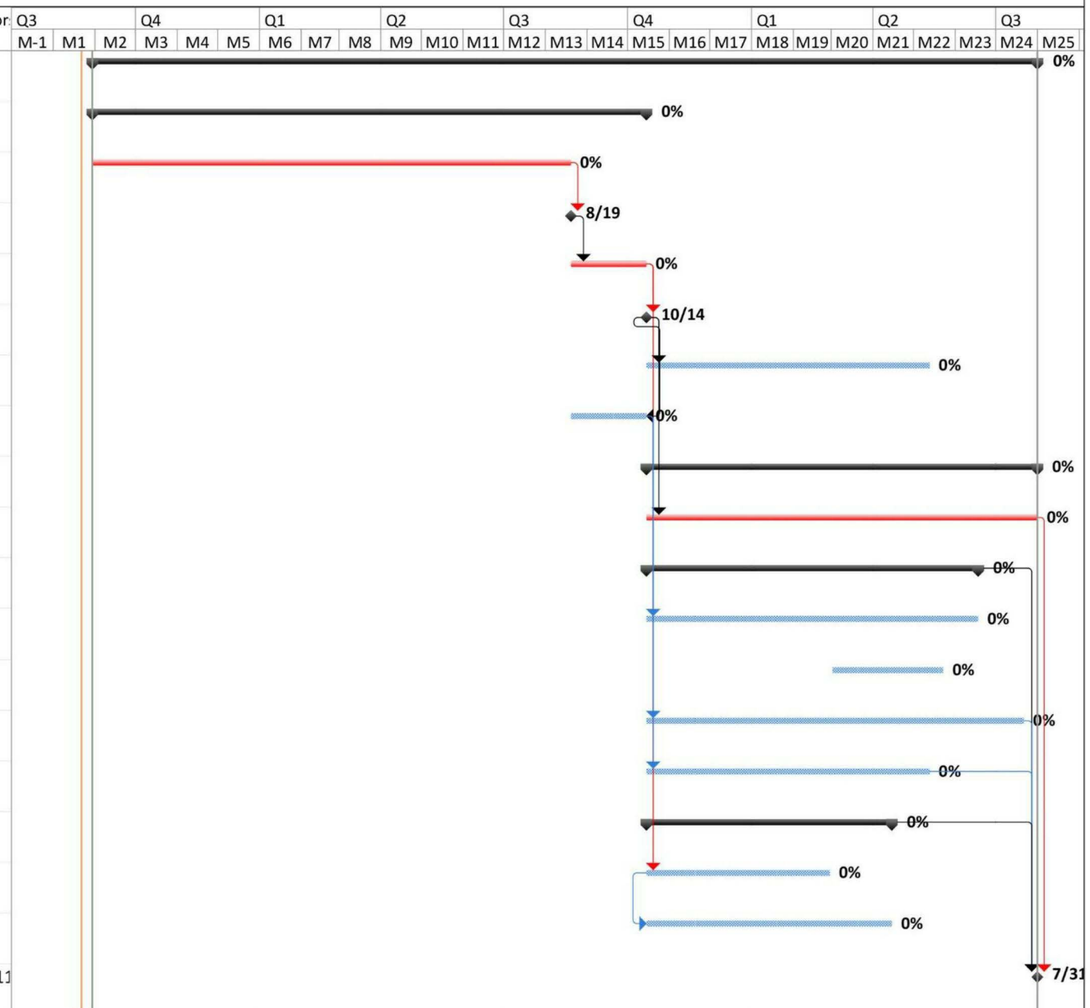
Port Of Vancouver Construction - EFSEC Submittal Rev2

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		**TSVEDT**	**501 days**	**Fri 8/30/13**	**Fri 7/31/15**	
2		**Permitting**	**293 days**	**Fri 8/30/13**	**Tue 10/14/14**	
3		EFSEC Review Process	253 days	Fri 8/30/13	Tue 8/19/14	
4		EFSEC Recommendation	0 days	Tue 8/19/14	Tue 8/19/14	3
5		Governor Review	40 days	Wed 8/20/14	Tue 10/14/14	4
6		Decision	0 days	Tue 10/14/14	Tue 10/14/14	5
7		Equipment Procurement/Fabrication	150 days	Wed 10/15/14	Tue 5/12/15	6
8		Bidding	40 days	Wed 8/20/14	Tue 10/14/14	6SF
9		**TSVEDT Construction**	**208 days**	**Wed 10/15/14**	**Fri 7/31/15**	
10		Site Work	208 days	Wed 10/15/14	Fri 7/31/15	6
11		**Unloading/Admin Area Facility**	**176 days**	**Wed 10/15/14**	**Wed 6/17/15**	
12		Unloading Area	176 days	Wed 10/15/14	Wed 6/17/15	8
13		Administrative Area	60 days	Mon 3/2/15	Fri 5/22/15	
14		Tank Farm	200 days	Wed 10/15/14	Tue 7/21/15	8
15		Pipelines	150 days	Wed 10/15/14	Tue 5/12/15	8
16		**Dock Construction Work**	**130 days**	**Wed 10/15/14**	**Tue 4/14/15**	
17		In Water	98 days	Wed 10/15/14	Fri 2/27/15	5
18		Above Water	130 days	Wed 10/15/14	Tue 4/14/15	17SS
19		Project Complete	0 days	Fri 7/31/15	Fri 7/31/15	16,15,14,11



Critical		Split		Finish-only		Baseline Milestone		Manual Summary		Inactive Task	
Critical Split		Task Progress		Duration-only		Milestone		Project Summary		Inactive Milestone	
Critical Progress		Manual Task		Baseline		Summary Progress		External Tasks		Inactive Summary	
Task		Start-only		Baseline Split		Summary		External Milestone		Deadline	

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Figure 14 – Detailed Permitting & Construction Schedule

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Attachment 3
Plant Species Tables

Vegetation Type	Rail Corridor Acreage[a]	Marine Corridor Acreage[b]
Rocky Mountain Alpine-Montane Wet Meadow	11.6	--
Rocky Mountain Subalpine-Montane Mesic Meadow	151.9	--
Rocky Mountain Subalpine-Montane Riparian Shrubland	4.0	--
Temperate Pacific Freshwater Emergent Marsh	397.3	400.3
Temperate Pacific Freshwater Mudflat	148.4	5,498.1
Temperate Pacific Tidal Salt and Brackish Marsh	-	31.2
Willamette Valley Upland Prairie and Savanna	-	16.4
Willamette Valley Wet Prairie	-	6.4
Grand total	**182,600.3**	**72,846.7**

Source: USGS (2011)

[a] Calculated within 0.5 mile of the rail corridor.

[b] Calculated within 0.25 mile of the Columbia River shoreline.

-- Indicates that there is no vegetation of that type within the defined area.

Special Status Species

Within Washington State, special status species include federally listed threatened, endangered, and proposed species, as well as state-listed threatened and endangered species. A summary of special status species known or likely to occur within the Washington rail and marine corridor is provided in Table 5.6-2. Additional information can be found in Appendix I.

Table 5.6-2. Special Status Plant Species and Their Potential to Occur within the Railroad and Marine Corridor in Washington

Species	Federal	State
	ESA Listing Status[a]	State Listing Status[b]
Oregon bolandra (*Bolandra oregana*)	None	SS
Dense sedge (*Carex densa*)	None	ST
Golden paintbrush (*Castilleja levisecta*)	FT	SE
Tall bugbane (*Cimicifuga elata*)	FSC	SS
Few-flowered collinsia (*Collinsia sparsiflora* var. *brucea*)	None	SS
Clackamas corydalis (*Corydalis aquae-gelidae*)	FSC	SS
Oregon coyote-thistle (*Eryngium petiolatum*)	None	ST

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Species	Federal	State
	ESA Listing Status[a]	State Listing Status[b]
Western wahoo (*Euonymus occidentalis*)	None	ST
Western sweetvetch (*Hedysarum occidentale*)	None	ST
Water howellia (*Howellia aquatilis*)	FT	ST
Nuttall's quillwort (*Isoetes nuttallii*)	None	SS
Smooth goldfields (*Lasthenia glaberrima*)	None	SE
Torrey's peavine (*Lathyrus torreyi*)	FSC	FT
Bradshaw's lomatium (*Lomatium bradshawii*)	FE	SE
Branching montia (*Montia diffusa*)	*None*	SS
California broomrape (*Orobanche californica* ssp. *grayana*)	None	X
Western yellow oxalis (*Oxalis suksdorfii*)	None	ST
Western false dragonhead (*Physostegia parviflora*)	None	SS
Wheeler's bluegrass (*Poa nervosa*)	None	SS
Great polemonium (*Polemonium carneum*)	None	ST
Idaho gooseberry (*Ribes oxyacanthoides* ssp. *irriguum*)	None	ST
Soft-leaved wouldow (*Salix sessilifolia*)	None	SS
Hairy-stemmed checkermallow (*Sidalcea hirtipes*)	None	ST
Western ladies tresses (*Spiranthes porrifolia*)	None	SS
Hall's aster (*Symphyotrichum hallii*)	None	ST
Small-flowered trillium (*Trillium parviflorum*)	None	SS
California compassplant (*Wyethia angustifolia*)	None	SS

Source: WNHP (2012), USFWS (2014).

[a] ESA Classifications: FE = federal endangered; FT = federal threatened low – no suitable habitat on site; FSC = species of concern; FP = federal proposed; FC = federal candidate.

[b] State Status: SE = state endangered; ST = State threatened; SS = State Sensitive; X = possibly extinct or extirpated.

Noxious Weeds

The Washington Department of Agriculture is responsible for listing noxious weed species within the state. The Washington Noxious Weed Control Board maintains the official list and provides updates as warranted. Currently, there are 142 species on the list classified as A, B, or C according to its presence and distribution within the state (WDOA 2014). It is likely that some or all of these species are present along or in proximity to the rail corridor.

Vegetation Types	Idaho	Montana	North Dakota	Total
Western Great Plains Sand Prairie		1,766.8	131.3	1,898.2
Total	**62,521.9**	**413,304.3**	**14,337.3**	**490,162.6**

Source: USGS (2011)

Special-Status Species

Outside of Washington State, special status species include only the federally listed threatened, endangered and proposed species. A summary of special status species known or likely to occur within the rail and marine corridor outside of Washington State is provided in Table 5.6-4.

Table 5.6-4. Federally Listed Threatened and Endangered Plant Species Potentially occurring within Rail Corridor outside Washington

Common Name	Scientific Name	Status	ID	MT	ND
Spalding's catchfly	*Silene spaldingii*	T	X	X	
MacFarlane's four-o'clock	*Mirabilis macfarlanei*	T	X		
Water howellia	*Howellia aquatilis*	T		X	
Ute ladies'-tresses	*Spiranthes diluvialis*	T	X	X	
Western prairie fringed orchid	*Platanthera praeclara*	T			X

Source: USFWS (2014)

Status: T- Federal Threatened
'X' denotes presence within the state.

Noxious Weeds

Each of the states outside Washington maintains a list of designated noxious weed species that are updated as needed. Table 5.6-5 summarizes each state's approach to listing noxious weeds.

Table 5.6-5. State's Approach to Listing Noxious Weeds

State	No. of Species	Summary
Idaho	64	Idaho uses 3 designations, Early Detection Rapid Response (EDRR), Control, and Containment.
Montana	32	Montana uses 5 categories to designate weeds in terms of priorities; 1A, 1B, 2A, 2B, and 3.
North Dakota	11	North Dakota lists a total of 11 species, with no specific designation.

Sources: Idaho Department of Agriculture (2014), Montana Department of Agriculture (2014), North Dakota Department of Agriculture (2014)

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Attachment 4
Special Status Species

2.0 LITERATURE AND REFERENCE MATERIAL REVIEW

Information regarding the potential presence of special status plant species was obtained from the US Fish and Wildlife Service (USFWS) web site (USFWS 2013), and from a review of the Washington Natural Heritage Program (WNHP) database (WNHP 2011). A list of species documented as occurring within the project vicinity, or with the potential to occur, was generated based on the potential presence or absence of appropriate habitat for each species.

Information regarding the potential presence of special status fish and wildlife species was obtained from the USFWS web site (USFWS 2013) and the National Marine Fisheries Service (NMFS) web site (NMFS 2013) on June 26, 2013. Additional information came from data from the Washington Department of Fish and Wildlife (WDFW) two on-line databases, Priority Habitat and Species (PHS) on the Web (WDFW 2013a) and Salmonscape (WDFW 2013), as well as from the 2008 PHS list (WDFW 2008).

3.0 SPECIAL STATUS SPECIES

The following sections document those Special Status Species that are known, suspected, or that have the potential to occur within the project study area. Special status species are defined for purposes of this report as those identified for protection under federal or state laws. They are either (1) listed, proposed for listing, or identified as a candidate species or species of concern under the federal Endangered Species Act of 1973 (ESA), or (2) are plant species identified as endangered, threatened or sensitive by the Washington Natural Heritage Program (WNHP), or (3) are identified as PHS, species of concern (SOC), or species of greatest conservation need (SGCN) by WDFW.

3.1 Special Status Plant Species

This section evaluates the potential for special status plant species to occur within the project area. A review of the WNHP database did not identify any documented occurrences of any special status plant species within the township/range/sections in which the project site is located (WNHP 2011). The potential for these species to occur at the project site was evaluated based on the presence or absence of appropriate habitat for each species. Table 3-1 lists the special status plant species known to occur within Clark County, and which could potentially occur within the project site or vicinity (WNHP 2012).

State listed threatened or endangered plant species are not protected by state legislation or regulation, but are listed as threatened or endangered to assist with agency management and decision-making. The WNHP also places a management priority on the preservation of high-quality native plant communities; however, no high-quality native plant communities exist on the property.

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Table 3-1. Special Status Plant Species and Their Potential to Occur within the Project Site or Vicinity

Species	Federal	State	Potential for Occurrence	
	ESA Listing Status[a]	State Listing Status[b]	Project Site	Project Vicinity
Oregon Bolandra (*Bolandra oregana*)	None	SC	Low – no suitable habitat on site	Low – riparian species requiring deep shade
Dense Sedge (*Carex densa*)	None	ST	Low – no suitable habitat on site	Low – peripheral species of intertidal marshlands
Golden Paintbrush (*Castilleja levisecta*)	FT	SE	Low – no suitable habitat on site	Low – rare species of open grasslands in Puget trough on glacial outwash
Tall Bugbane (*Cimicifuga elata*)	FSC	SS	Low – no suitable habitat on site	Low – understory species of lowland forests
Few-Flowered Collinsia (*Collinsia sparsiflora* var. *brucea*)	None	SS	Low – no suitable habitat on site	Low - thin soils over basalt on a variety of slopes in Columbia Gorge.
Clackamas Corydalis (*Corydalis aquae-gelidae*)	FSC	SS	Low – no suitable habitat on site	Low – mid-elevation riparian species of hemlock and fir forests
Oregon Coyote-Thistle (*Eryngium petiolatum*)	None	ST	Low – no suitable habitat on site	Moderate – rare species of wet prairies and low ground
Western Wahoo (*Euonymus occidentalis*)	None	ST	Low – no suitable habitat on site	Low – shaded forest understory species
Western Sweetvetch (*Hedysarum occidentale*)	None	ST	Low – no suitable habitat on site	Low – high elevation species
Water Howellia (Howellia aquatilis)	FT	ST	Low – no suitable habitat on site	Moderate – aquatic species of small vernal ponds
Nuttall's Quillwort (Isoetes nuttallii)	None	SS	Low – no suitable habitat on site	Low – Terrestrial species of wet ground, seeps, and in mud near vernal pools
Smooth Goldfields (*Lasthenia glaberrima*)	None	SE	Low – no suitable habitat on site	Moderate – rare species of wet streambanks and vernal pools.
Torrey's Peavine (*Lathyrus torreyi*)	FSC	FT	Low – no suitable habitat on site	Low – open areas within Douglas fir-dominated sites
Bradshaw's Lomatium (*Lomatium bradshawii*)	FE	SE	Low – no suitable habitat on site	Moderate – wet, seasonally flooded prairies and grasslands near creeks and small rivers.
Branching Montia (*Montia diffusa*)	*None*	SS	Low – no suitable habitat on site	Low – moist Douglas fir forests
California Broomrape (*Orobanche californica ssp. grayana*)	None	X	Low – no suitable habitat on site	Low – thought to be extirpated from WA
Western Yellow Oxalis (*Oxalis suksdorfii*)	None	ST	Low – no suitable habitat on site	Low - meadows and moist woods, rare in Clark County

Species	Federal	State	Potential for Occurrence	
	ESA Listing Status[a]	State Listing Status[b]	Project Site	Project Vicinity
Western False Dragonhead (*Physostegia parviflora*)	None	SS	Low – no suitable habitat on site	Low – wet to mesic prairies, damp thickets, and banks of streams and ponds
Wheeler's Bluegrass (*Poa nervosa*)	None	SS	Low – no suitable habitat on site	Low - rock outcrops, cliff crevices, and occasionally in talus
Great Polemonium (*Polemonium carneum*)	None	ST	Low – no suitable habitat on site	Low - woody thickets, open and moist forests, prairie edges, roadsides, fence lines
Idaho Gooseberry (*Ribes oxyacanthoides* ssp. *irriguum*)	None	ST	Low – no suitable habitat on site	Low – streams and canyons in eastern WA
Soft-leaved willow (*Salix sessilifolia*)	None	SS	Low – no suitable habitat on site	Moderate – Variety of lowland riparian habitats
Hairy-Stemmed Checkermallow (*Sidalcea hirtipes*)	None	ST	Low – no suitable habitat on site	Moderate – prairie fragments along fencerows and openings along drainages
Western Ladies Tresses (*Spiranthes porrifolia*)	None	SS	Low – no suitable habitat on site	Moderate – Wet meadows, along streams, in bogs, and on seeps. Have previously been found on the Port's Parcel 3
Hall's Aster (*Symphyotrichum hallii*)	None	ST	Low – no suitable habitat on site	Moderate – dry to moist prairies in valleys and plains
Small-Flowered Trillium (*Trillium parviflorum*)	None	SS	Low – no suitable habitat on site	Moderate – moist forested habitats dominated by hardwoods
California Compassplant (*Wyethia angustifolia*)	None	SS	Low – no suitable habitat on site	Moderate – grasslands, meadows, and other open habitats

Source: (WNHP 2012)

[a] ESA Classifications: FE = federal endangered; FT = federal threatened low – no suitable habitat on site; FSC = species of concern; FP = federal proposed; FC = federal candidate.

[b] Washington State Status: SE = state endangered; ST = State threatened; SS = State Sensitive; X = possibly extinct or extirpated;

At the federal level, a listing of species of concern is for advisory and management purposes only, as there may be insufficient information to support listing. The category of threatened is applied to plants that are likely to become endangered within the near future if factors contributing to its population decline, or habitat degradation or loss, continue. Plants listed as federally threatened or endangered are protected under the ESA, which is regulated by the USFWS.

Summaries of the habitat requirements for each species and its likelihood of occurrence within the project site or vicinity are presented below.

Oregon Bolandra (*Bolandra oregana*)

This species occurs along the Columbia River drainage mostly at low elevations; it is usually found near streams and moist, rocky places in deep shade. Associated species include shooting star (*Dodecatheon dentatum*), western saxifrage (*Saxifraga occidentalis*), streambank spring beauty (*Montia parviflora*), and clasping arnica (*Arnica amplexicaulis*). This species grows in a variety of habitats. Although it usually is found in moist, shady, wooded areas on cliffs near waterfalls, it has also been found in open, rocky areas and on steep, grassy, semi-open slopes (WNHP 2013). Documented sightings in the region are limited to East Clark County, near the entrance to the Columbia River Gorge.

This species is not documented or expected to occur at the project site or within the vicinity.

Dense Sedge (*Carex densa*)

This is a peripheral species in Washington, known from only a few documented sightings. The primary habitat in Washington is eroding hummocks in intertidal marshland (WNHP 2013). The species has been reported from small cutbanks along rivers and shaded springs at high elevations (WNHP 2013). Associated species include coyote willow (*Salix exigua*), riverbank wormwood (*Artemisia lindleyana*), Columbia coreopsis (*Coreopsis atkinsoniana*), sneezeweed (*Helenium autumnale*), awned flatsedge (*Cyperus aristatus*), and conyza (*Conyza* sp.).

This species is not documented or expected to occur at the project site or within the vicinity.

Golden Paintbrush (*Castilleja levisecta*)

This species occurs in open grasslands in the Puget Trough. The preferred substrate is generally composed of glacial outwash or depositional material. The species prefers sun and can tolerate partial shade, but will not tolerate a closed canopy. The most common associate is, depending on the site, variously Idaho fescue (Festuca idahoensis) or red fescue (*Festuca rubra*). Many weedy species also occur as associated species, as most of these areas have suffered from past disturbances (WNHP 2013). There are no recent documented occurrences of golden paintbrush in Clark County.

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The project site and vicinity do not provide suitable habitat for golden paintbrush, and this species is not documented or expected to occur at the project site or within the vicinity.

Tall Bugbane (*Cimicifuga elata*)

This species is a tall understory plant of lowland forests. In Washington, it occurs in the Western Cascades, Puget Trough, Olympic Peninsula, and Southwest Washington physiographic provinces (WNHP 2013). The species grows in or along the margins of mixed, mature or old growth stands of mesic coniferous forest, or mixed coniferous-deciduous forest. Associated species include Douglas fir (*Pseudotsuga menziesii*), western red cedar (*Thuja plicata*), bigleaf maple (*Acer macrophyllum*), red alder (*Alnus rubra*), vine maple (*Acer circinatum*), oceanspray (*Holodiscus discolor*), hazelnut (*Corylus cornuta*), sword fern (*Polystichum munitum*), and snowberry (*Symphoricarpos albus*).

The project site and vicinity do not provide suitable habitat for this species, and it is not documented or expected to occur at the project site or within the vicinity.

Few-Flowered Collinsia (Collinsia sparsiflora var. bruceae)

In Washington, this species occurs in thin soils over basalt on a variety of slopes, from almost flat to rather steep, generally south-facing, at elevations ranging from 200 to 1000 feet. The microsites are generally quite open, but may be adjacent to or found within open stands of ponderosa pine (*Pinus ponderosa*) and Oregon white oak (*Quercus garryana*) (WNHP 2013).

This type of habitat does not occur at the project site or within the project vicinity.

Clackamas Corydalis (*Corydalis aquae-gelidae*)

This species is a regional endemic species to Clackamas and Multnomah counties in Oregon, and Clark and Skamania counties in Washington. The species occurs primarily in western hemlock (*Tsuga heterophylla*) and Pacific silver fir (*Abies amabilis*) forest habitats at elevations ranging from 2500 to 3800 feet. It is found growing in or near cold flowing water, including seeps and small streams, often occurring within the stream channel itself (WNHP 2013).

These habitats do not occur at the project site or within the project vicinity.

Oregon Coyote-Thistle (*Eryngium petiolatum*)

This species occurs from the Willamette Valley of Oregon to the eastern end of the Columbia Gorge in Washington and Oregon. In Washington, the taxon is restricted to a very small area within western Klickitat and Clark counties. It occurs in wet prairies and low ground, especially in places submerged in the spring and drier in the summer (WNHP 2013).

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There is no potentially suitable habitat at the project site. The greater Vancouver Lake Lowlands, particularly the seasonally inundated habitats south of Vancouver Lake and within the CRWMB may provide potentially suitable habitat for Oregon coyote-thistle. However, this species is rare in Washington, and has not been documented in the vicinity.

Western Wahoo (*Euonymus occidentalis*)

This species grows in woods on the west side of the Cascade Mountains. It is often found in shaded, moist draws and ravines. In the Puget Trough area it associated with remnant oak savannah. This species prefers moist, wooded/forested areas but is sometimes found in grassy areas with some trees (WNHP 2013). These habitats do not occur at the project site or within the project vicinity.

Western Sweetvetch (*Hedysarum occidentale*)

This species is found in meadows, shrubfields, bare rock outcrops, boulder-fields, and talus-slopes at elevations between approximately 3150 and 6500 feet in Washington. These habitats are not present at the project site or within the project vicinity.

Water Howellia (*Howellia aquatilis*)

This species is a regional endemic species that occurs in low elevation minerotrophic wetland habitats, particularly small vernal ponds. The species apparently requires exposure to air to germinate and inundation for growth in the spring. This restricts the species to the zone within wetlands that is seasonally inundated, but which dries out in late summer or early fall (WNHP 2013). Documented occurrences in Clark County are located downstream of the project area, in the vicinity of the Ridgefield National Wildlife Refuge.

There is no potentially suitable habitat at the project site. The seasonally inundated habitats south of Vancouver Lake and within the CRWMB may provide potentially suitable habitat for water howellia. However, this species has not been documented in the vicinity of the project.

Nuttall's Quillwort (*Isoetes nuttallii*)

This species is currently known from Cowlitz, San Juan, and Thurston counties in Washington, but its range may extend into Clark County. It is an inconspicuous plant found from low to middle elevations in wet ground or seepages and in mud near vernal pools. It is known from only a few recent sites. However, it can be rather inconspicuous and may be somewhat more widespread than the data currently suggest (WNHP 2013).

There is no potentially suitable habitat at the project site. The seasonally inundated habitats south of Vancouver Lake and within the CRWMB may provide potentially suitable habitat for Nuttall's quillwort. However, this species has not been documented in the vicinity of the project.

EX-0005-000212-PCE

Smooth Goldfields (*Lasthenia glaberrima*)

This species is typically found on wet stream banks and in vernal pools. It is a rare species in Washington, known only from one historical occurrence from Clark County and one recent occurrence from Klickitat County. Very little information is known about this species (WNHP 2013). All moist areas, vernal pools, and wetlands in Clark and Klickitat Counties are considered potentially suitable habitat.

There is no potentially suitable habitat at the project site. Wetlands throughout the Vancouver Lake Lowlands represent potentially suitable habitat for smooth goldfields, particularly the seasonally inundated habitats south of Vancouver Lake and within the CRWMB. However, this species has not been documented in the vicinity of the project.

Torrey's Peavine (*Lathyrus torreyi*)

This species is rare in Clark County, known only form one historic occurrence in the County (WNHP 2013). It was thought to have been extirpated from Washington as recently as 1994.The only known extant occurrences in WA are within somewhat open areas within Douglas fir dominated sites. These habitats are not present at the project site or within the project vicinity.

Bradshaw's Lomatium (*Lomatium bradshawii*)

This species is endemic to the southern portion of western Washington in the Puget Trough physiographic province and to the central and southern portions of the Willamette Valley physiographic province in western Oregon. The species occurs in remnant fragments of the once widespread low elevation grasslands and prairies. The habitat type is described as wet, seasonally flooded prairies and grasslands common around creeks and small rivers. Associated species include tufted hairgrass (*Deschampsia cespitosa*), slender rush (*Juncus tenuis*), sawbeak sedge (*Carex stipata*), and one-sided sedge (*Carex unilateralis*).

There is no potentially suitable habitat at the project site. Wetlands throughout the Vancouver Lake Lowlands represent potentially suitable habitat for smooth goldfields, particularly the seasonally inundated habitats south of Vancouver Lake and within the CRWMB. However, this species has not been documented in the vicinity of the project.

Branching Montia (*Montia diffusa*)

This species occurs in moist forests in the lowland and lower montane zones. It is occasionally located in xeric soil or disturbed sites. Associate species include Douglas fir (*Pseudotsuga menziesii*), ocean-spray (*Holodiscus discolor*) and miner's lettuce (*Montia perfoliata*) (WNHP 2013). These habitats are not present at the project site or within the project vicinity.

EX-0005-000213-PCE

California Broomrape (*Orobanche californica* ssp. *grayana*)

This species is a parasitic plant that is native to coastal moist meadows/stream bank, primarily in California in the San Francisco Bay area, northern Sierra Nevada, and the Modoc Plateau. It is thought to be extirpated from Washington. Suitable habitat does not occur at the project site or within the project vicinity, and this species is unlikely to be present.

Western Yellow Oxalis (*Oxalis suksdorfii*)

This species ranges from the western slopes of the Cascades to the Pacific Coast from southwestern Washington to northwestern California. It is usually found growing in meadows and moist woods and sometimes on dry open slopes (WNHP 2013). There has been only one documented historic occurrence in Clark County.

There is no potentially suitable habitat at the project site. Moist meadow habitat in the adjacent Vancouver Lake Lowlands may provide potentially suitable habitat for western yellow oxalis, but its presence within the project vicinity is unlikely.

Western False Dragonhead (*Physostegia parviflora*)

The WNHP has little information on this species. Its habitat consists of wet to mesic prairies, damp thickets, and banks of streams and ponds. There is no published information about its distribution in Washington, but it appears to be known only from historic records in Washington. It is described in *Flora of the Pacific Northwest* (Hitchcock and Cronquist 1973), as occurring primarily east of the Cascades. There is no habitat for this species at the project site, and it is unlikely that this species occurs within the project vicinity.

Wheeler's Bluegrass (*Poa nervosa*)

This species is a regional endemic species. In Washington, it has been documented in Clark and Cowlitz counties in the Puget Trough physiographic province. Its habitat consists of rock outcrops, cliff crevices, and occasionally in talus near the base of cliffs or outcrops. It occurs on sparsely and well vegetated outcrops, although it is more abundant in sparsely vegetated site (WNHP 2013). These habitats do not occur at the project site or within the project vicinity, and this species is unlikely to be present.

Great Polemonium (*Polemonium carneum*)

This species occurs on the western side of the Cascade Mountains in northwestern Washington, south to San Francisco Bay, California. It grows in the lowlands of mountain ranges and in prairies, to moderate elevations in the mountains. It has been documented in Lewis, Clallam, Grays Harbor, Clark, Skamania, and Pacific counties in Washington, though it is known only from historic occurrences in Clark County (WNHP 2013). It is commonly found in woody thickets, open and moist forests, prairie edges, roadsides, and has been extensively documented along fence lines (WNHP 2013).

EX-0005-000214-PCE

There is no potentially suitable habitat at the project site. Moist meadow habitats, roadsides, and fences in agricultural lands in the adjacent Vancouver Lake Lowlands may provide potentially suitable habitat for great polemonium, but its presence within the project vicinity is unlikely.

Idaho Gooseberry (*Ribes oxyacanthoides* ssp. *irriguum*)

This species occurs in north-central Idaho, western Montana, Oregon, and Washington. In Washington, the taxon is currently known from Asotin, Spokane, and Ferry counties in the Columbia Basin and Okanogan Highlands physiographic provinces. There are historical records of the species from Whitman, Stevens, and Clark counties. The historic Clark County record is considered suspect, given the significant disjunction from all other known locations of the taxon (WNHP 2013). Habitat for this species does not occur at the project site or within the project vicinity, and it is unlikely to be present.

Soft-Leaved Willow (*Salix sessilifolia*)

This species is distributed from British Columbia to Washington, Oregon and northern California. In Washington it has been found in Cowlitz, Klickitat, Wahkiakum, Skagit, and Whatcom counties. It has been found in a number of lowland habitats: a riparian forest, in dredge spoils, and on a silty bank at the upper edge of an intertidal zone. Associated species at one or more sites include: Sitka willow (*Salix sitchensis*), heartleaf willow (*Salix rigida*), black cottonwood (*Populus trichocarpa*), red alder (*Alnus rubra*), big-leaf maple (*Acer macrophyllum*) and red-osier dogwood (*Cornus stolonifera*) (WNHP 2013). It is known from less than 10 occurrences, and has not been documented in Clark County, but Clark County is thought to be within its potential range.

Riparian habitat at the project site and throughout the Vancouver Lake Lowlands may provide potentially suitable habitat for Soft-leaved willow, though its presence is unlikely. Soft-leaved willow has not been documented in Clark County, and riparian habitat within the project vicinity is limited in quantity and quality. The riparian forest habitat on Parcel 3 likely provides the highest quality potential habitat for soft-leaved willow in the vicinity.

Hairy-Stemmed Checkermallow (*Sidalcea hirtipes*)

This species is a regional endemic to Clark, Lewis, and Wahkiakum Counties in Washington, and Clatsop, Lincoln, and Tillamook counties in Oregon. Its habitat includes remnant prairie fragments along fencerows and openings along drainages. Some occurrences are in fairly mesic habitats associated with creeks and streams. Associated species include, large-leaved lupine (*Lupinus polyphyllus*), woolly vetch (*Vicia villosa*), bracken fern (*Pteridium aqualinum*), large-leaved avens (*Geum macrophyllum*), trailing blackberry (*Rubus armeniacus*), and oxeye daisy (*Chrysanthemum leucanthemum*) (WNHP 2013). There are currently only five known occurrences in Washington, and documented occurrences in Clark County are primarily in the eastern portion of the County (WNHP 2013).

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Western Ladies Tresses (*Spiranthes porrifolia*)

This species occurs sporadically from Southern Washington to Southern California. In Washington, it has been documented in Chelan, Kittitas, Klickitat, Lincoln, Okanogan, and Skamania counties. It has not been documented in Clark County, but it is considered to be within its range. Its habitat includes wet meadows, areas adjacent to streams, bogs, and seepage slopes. A variety of associated species have been documented depending upon location (WNHP 2013).

Wet meadow habitat throughout the adjacent Vancouver Lake Lowlands may provide potentially suitable habitat for western ladies-tresses, but its presence within the project vicinity is unlikely due to the fact that it has not been documented within the County. However, western ladies-tresses have been identified previously by Port staff at Parcel 3.

Hall's Aster (*Symphyotrichum hallii*)

This species is rarely documented in Washington. It is known from two documented occurrences in Washington. Little is known about this species. Its habitat consists of mostly dry, open places in valleys and plains, but it has also been documented in a wet remnant prairie in a floodplain. There is no potentially suitable habitat at the project site. Given the potential habitat variability of this species, the remnant meadows and seasonally flooded habitats south of Vancouver Lake may provide potentially suitable habitat for this species.

Small-Flowered Trillium (*Trillium parviflorum*)

The species is a regional endemic, occurring from Pierce and Thurston counties southward into Lewis and Clark counties, Washington and into the Willamette Valley, Oregon. It is an uncommon species of very local distribution with few, widely scattered populations (WNHP 2013). It occurs in association with moist areas dominated by hardwoods, most commonly Oregon ash, but sometimes red alder or even Garry oak.

There is no potentially suitable habitat at the project site. Hardwood-dominated forest habitat within the adjacent Vancouver Lake Lowlands, including forested riparian habitat on Parcel 3, and forested habitats at the Parcel 2 and Parcel 1A wetland mitigation sites may provide potentially suitable habitat for small-flowered trillium.

California Compassplant (*Wyethia angustifolia*)

The WNHP has little information on this species. It is a relatively widely distributed plant in Oregon and California, but it is rarely observed in Washington. Its habitat includes grasslands, meadows, and other open habitats.

There is no potentially suitable habitat at the project site. Most of the open meadow habitat within the adjacent Vancouver Lake Lowlands is likely too wet to provide suitable habitat for California compassplant; however, where dry open habitats occur, these may provide potentially suitable habitat. Given the relative rarity of this species in Washington, its presence is considered unlikely.

EX-0005-000216-PCE