BEFORE THE STATE OF WASHINGTON
ENERGY FACILITY SITE EVALUATION COUNCIL

In the Matter of: Application No. 2013-01 TESORO SAVAGE, LLC TESORO SAVAGE DISTRIBUTION TERMINAL	CASE NO. 15-001 SWORN PRE-FILED TESTIMONY OF GREGORY E. CHALLENGER, M.S.

I, Gregory E. Challenger, state as follows:

1. I declare under the penalty of perjury of the laws of Washington and the United States that the following statements are true and correct.

2. I am over eighteen years of age, have personal knowledge of the matters herein, and am competent to testify regarding all matters set forth herein.

I. INTRODUCTION, EDUCATION AND PROFESSIONAL BACKGROUND, AND OTHER QUALIFICATIONS

3. My name is Gregory E. Challenger, a Principal and Senior Scientist with Polaris Applied Sciences, Inc. at 12525 131st Ct, NE Kirkland, WA 98034; Office telephone 425-823-4841 and Mobile telephone 206-369-5686. I earned a Bachelor of Science degree in Biology in 1985 from the Florida Atlantic University, and a Master of Science degree in Science Education – Marine Ecology in 1990 from the Florida Institute of Technology. I have taught undergraduate coursework in organic chemistry, marine ecology and resource management.

4. I have over 25 years of experience in environmental resource management and marine and freshwater habitat impact assessment, mitigation and restoration. I have responded to approximately 70 oil and chemical spills from vessel, rail, and pipeline in the past 20 years, providing scientific support for response and Natural Resource Damage

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Assessment under the Oil Pollution Act, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as well as international pollution regulations. I am a Professional Wetland Scientist and have assessed wetland, marsh, and aquatic species impacts following crude and bunker oil spills including the M/V JULIE N (Portland Maine, 1996), M/V NEW CARISSA, (Coos Bay Oregon, 1999), M/V ATHOS (Delaware River 2001), M/V WESTCHESTER, (Mississippi River, 2003), M/V WESTWOOD ANETTE (Howe Sound British Columbia 2006), M/V COSCO BUSAN (San Francisco Bay, 2007), Burnaby, Westridge Pipeline (Dilbit spill in Burrard Inlet, Vancouver, British Columbia 2007), and Silvertip Pipeline (Yellowstone River, 2011). I participated as a lead scientist and co-author of dilbit fate and behavior studies in Gainford, Alberta Canada in 2013. I also was a technical advisor on shoreline response and a lead investigator for shoreline Natural Resource Damage Assessment (NRDA) injury investigations for BP during the Deepwater Horizon Oil Spill in the Gulf of Mexico. My Curriculum Vitae is attached hereto as Attachment A.

II. PURPOSE OF TESTIMONY

5. The purpose of my testimony is to address how the Vancouver Energy Project's Application for Site Certification (ASC) complies with the requirements of WAC 463-60-322, WAC 463-60-333, WAC 463-62-040, and WAC 463-62-050 and to address Adjudication Issues, including Issues 5-11, 17, 38, 41, 42, 44, 47-49, and 65, as identified in the Administrative Law Judge's Order Clarifying EFSEC's Process, Modifying Dispositive Motion Deadline, Summarizing Preliminary Issues, and Setting Hearing Dates (Feb. 3, 2016). My testimony does not address the likelihood of oil spills, only the environmental impact in the event that a spill occurs

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III. SCOPE OF ANALYSIS OF THE TERMINAL'S POTENTIAL IMPACTS ON NATURAL RESOURCES AT RISK

6. My familiarity with the Vancouver Energy Project is through work with Applicant Tesoro Savage Petroleum Terminal LLC, d/b/a Vancouver Energy and Oil Spill Response contractor personnel on a 2-day tabletop exercise in January 2016 to analyze the potential fate and behavior and spill response actions typical of the first 24-48 hours to worst-case discharges from the facility. The tabletop exercise considered Bakken crude and a spill of dilbit (Canadian oil sands product). I also reviewed the materials submitted for the ASC and the Preliminary Draft Environmental Impact Statement (PDEIS), reviewed the Draft Environmental Impact Statement (DEIS), and drafted comments to the portions of the DEIS concerning impacts to natural resources from a possible oil spill at the facility, or in the marine or rail corridors. Additional comment on this exercise is contained in the testimony of Dr. Elliott Taylor (Polaris Applied Sciences, Inc.).

7. I evaluated the potential impacts to natural resources resulting from the project's construction and operation, and potential adverse impacts from oil spill scenarios in the DEIS with the types of products proposed for the Terminal.

8. In addition to information gathered as part of my education and experience from my work in spill response and impact assessment, I have considered the following materials in forming my opinions and writing my declaration: ASC, PDEIS, and DEIS and appendices, DEIS comment, and site information relative to oil spill response.

IV. ASSESSMENT OF POTENTIAL IMPACTS

9. In general, oil spill impacts are not long term and permanent, but can be of high intensity in the vicinity of the most affected areas of the spill and in some instances persist for a number of years at reduced intensity pending recovery. For planning purposes, assessment of relative risks requires a scale to convey meaning to the reader, but

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the scale must be clear and non-subjective. For example, the DEIS includes categories of impact such as: "negligible," "minor," "moderate," and "major," defined as follows (Attachment B – DEIS at 4-55):

- **Negligible.** Impacts that are extremely low in intensity and often not measurable or observed.
- **Minor.** Impacts that are low in intensity, temporary, and local in extent, and do not affect unique/rare resources.
- **Moderate.** Impacts of moderate intensity independent of duration, with significant or unique resources potentially affected, on either a local or regional scale.
- **Major.** Impacts of high intensity and/or of long-term or permanent duration, of localized or regional extent, and/or impacts that affect culturally important, ecologically important, or unique/rare resources.

10. The scale is unclear, subjective, and therefore not helpful to understand the relative magnitude of risk of damage to natural resources in the event of an oil spill. Under such a scale, any impacts, no matter how inconsequential, could be considered "major" if the resource is deemed unique by criteria that may be viewed as subjective. In fact, major impacts are predicted to be possible all the way down to the smallest size spill in the final conclusions for natural resources for which I have reviewed (Attachment C). If impacts from a 20-2,500 bbl spill are potentially major for aquatic resources (Attachment C), impacts from a 192,000 -385,000 bbl spill must be substantially more than major. A scenario with an adverse effect to a resource that has little or no effect on the local population or ecology, and is NRDA compensable as discussed herein should not result in a finding of major impacts. Attachment C also contains an alternative ranking scale I created that, while qualitative, is a more reasonable comparison of spill scenarios with wide ranges in spill volumes, the smaller of which having reduced impacts compared to

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the larger scenarios, with major impacts reserved for spills that affect much larger areas for longer periods of time. It appears from the DEIS that conclusions of a major impact may occur to a small area or a small biota population, but overall the small "major" impacts would be minor or moderate on a regional level in my opinion. It is also important to note that all impacts would be mitigated and compensation under OPA 90 in the form of habitat and species restoration programs, which ultimately alter the conclusions of long term impacts in every category.

11. As shown in the graphic expression of injury categories in the DEIS attached hereto as Attachment B (DEIS Figure 4.10), the scale allows for an impact to be of low duration and low intensity in a relatively smaller area, while predicting a possible moderate or major overall impact. A spill of low duration and intensity may not impact any resource at measurable and observable levels. The Oil Pollution Act of 1990, 33 U.S.C. §§ 2701-2720 (OPA 90), indicates that oil on the water or even in tissues does not infer an impact. Instead, more detail in the impact definitions using a combination of potential impact indicators such as river miles (RM) affected/percentage of habitat estimated to be affected in the river segment/oil persistence factors/presence of threatened and endangered (T&E) species, recovery projections, restoration capabilities, etc. would have provided the reader with a better understanding of magnitude. The DEIS provides many of these metrics in terms of bbls spilled and river miles affected by various worst-case discharge (WCD) scenarios (DEIS, App. J), but other variables are not defined relative to the categories of impact which may lead to subjective and sometimes inconsistent conclusions between rail, facility, and vessel spills. A "large" spill is also defined differently for rail and vessel spills whereby a large rail spill would be a small to medium vessel spill, which may create some confusion in interpretation of the results.

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A. Assessment of oil spill impacts

12. As per the Environmental Protection Agency and Washington Department of Ecology policy and regulations, the worst-case spill or WCD release for the facility is considered the entire capacity of the largest storage tank (380,000 bbl) without regard to secondary containment or other engineering controls. 40 C.F.R. Part 112. In addition, for the purpose of this testimony, I used the various spill volume scenarios outlined in the DEIS based on the design and capacity of the facility. The Terminal spill scenarios considered in the DEIS were Bakken crude Effective WCD: of 2,626 bbl and diluted bitumen Effective WCD: of 2,287 bbl. DEIS at 4-27 (Table 4-5). Considering the risks of a WCD resulting from a massive seismic event causing shoreline liquefaction, the only type of event posited to have the potential to cause WCD at the facility itself, DEIS § 4.4.1, ecological impacts from the earthquake and liquefaction could be substantial, Urabe et al. (2013), and outweigh the oil. Indeed, little oil may be found in the aftermath of such an event. Given the low likelihood of such an event, the WCD proposed by the applicant is a more reasonable WCD scenario.

13. Assumptions of spill volumes for facility spill resource risk assessment in the DEIS are reported as 1RM extent for small to medium spill and a 7RM slick for a large spill corresponding to 2,000 and 20,000+ bbls. DEIS at 4-54 (Table 4-13); *id.*, App. J at 47 (Table 42). It is unclear whether this is intended as the full extent of the spill impacts or the length of the initial slick on the water in the assessment of resource risks in the DEIS. Relative to a large spill scenario from a vessel in the DEIS of 125 RM (DEIS Table 4.13, attached hereto as Attachment D), the 7 RM used for the facility large oil spill scenario is unlikely to have impacts that are major by comparison in any category. This represents a very small percentage of Columbia River habitats exposed to oil in comparison to a WCD large vessel spill scenario in the DEIS.

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14. I have assumed a WCD vessel spill volume not exceeding the design capacity of proposed facility vessels. In the marine vessel corridor, I assumed the WCD spill volume stated in the DEIS based on the design and capacity of the proposed vessel. The vessel corridor spill scenarios considered in the DEIS were approximately 55,000 – 192,000 bbls. DEIS at 4-55 (Table 4-14). Assumptions of spill volumes for vessel corridor spill resource risk assessment in the DEIS are reported as 2 RM extent for small to medium spill and a 125 RM slick for a large spill corresponding to 192,000 bbls. DEIS at 4-54; *id.*, App. J at 47-48 (Table 43).

15. A spill affecting habitats for the entire length of the river from Vancouver to the estuary would be an unexpectedly large area of exposure. In fact, response actions and containment of large amounts in some locations are likely to be effective at reducing spreading and exposure as compared to the trajectory assuming unimpeded movement, thereby mitigating impacts. Resources are available to meet the GRPs in the NWACP as discussed.

16. I assume a spill in the rail corridor would occur at the WCD stated volumes in the DEIS based on the design and capacity of the tank cars. The rail corridor spill scenarios considered in the DEIS were 100-20,000 bbls. DEIS at 4-55 (Table 4-14). Assumptions of spill volumes for rail corridor spill resource risk assessment in the DEIS are reported as 1 RM extent for small to medium rail spill and a 13 RM extent for a large rail spill. DEIS at 4-54 (Table 4-13).

17. Response actions are also likely to mitigate oil spill impacts in all three situations; rail, vessel, or facility. I participated in a January 2016 exercise held in Vancouver for a worst case oil spill scenario planning evaluation. The response team mimicked the desktop logistics of the first 48 hours of a worst-case incident originating near the facility but relevant for rail and vessel incident considerations. Standard ICS spill

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documentation was completed during the course of the exercise. The exercise was completed for both a worst-case release of Bakken crude oil and for diluted bitumen (dilbit). This exercise looked at average water current speed and anticipated trajectories, Geographic Response Plans (GRPs) for sensitive resources at risk and potential fate and behavior of the oil described below.

18. In the event that an oil spill results in a fire or explosion, the immediate impacts in the affected area can be of high intensity (e.g., affecting 100% of the biota within the footprint), but the extent of potential oil spill spreading to a larger geographic area is reduced in a fire since fuel is consumed at the incident site. Intentional controlled burning following a spill is often used as an effective response action to mitigate oil spreading and eventual impacts. U.S. Dep't of Commerce, Office of Response and Restoration, In Situ Burning, http://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/resources/in-situ-burning.html. Oil released directly to water with no response actions and no fire is typically a worst case scenario for potential oil exposure to habitats and aquatic species over a greater geographic range, while a fire or explosion is of higher intensity at the incident site and presents other health and safety risks in a reduced geographic area.

i. Oil fate and behavior

19. The two major types of crude oil being considered for the Vancouver Energy Terminal are Bakken crude and crude oil products exported from the Canadian Oil Sands region. Properties of these crude oils and comparison to other petroleum oils are provided in Attachment E.

20. Oil fate and behavior is driven by forces that modify the location, characteristics and properties and of spilled oil. A spill in water will spread on the water surface and can be transported by currents as it continues to spread and fragment. Spills

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on land also will spread and move down slope, but the process is much slower compared to what happens in water.

21. Once oil is spilled and exposed to the elements, it undergoes continuous compositional changes often termed weathering. Weathering processes that occur include evaporation, dissolution, emulsification, sedimentation, microbial degradation and photo-oxidation. Weathering changes the oil's physical and chemical toxicity properties. Fresh oil is more volatile, contains more water-soluble components, floats, is not very viscous and more readily disperses from the source. Weathered oil initially loses volatile components and the oil becomes more viscous and more likely to coagulate as opposed to spreading out in a thin film. Over time, weathering continues to change the composition of oil until it degrades in the environment, leaving behind only small quantities of residue (e.g., tar balls). Some of the oil (especially heavier oil) may mix with water and emulsify, forming a viscous mixture that is resistant to rapid weathering and more difficult to collect or treat.

22. Based on the transport and weathering of spilled oil, spilled oil will evaporate to the atmosphere, strand on river banks, degrade to asphalts (such as through photo-oxidation), or biodegrade to simple compounds. Many of these are described in the DEIS and are modeled through trajectory and weathering models (ex., the National Oceanic and Atmospheric Administration's (NOAA) GNOME and ADIOS2).

23. The differences in the behavior and likely fate of each of the proposed oils are discussed in the Testimony of Dr. Elliott Taylor (Polaris Applied Sciences, Inc.) and summarized for purposes of natural resource injury discussions below.

a. Bakken crude oils

24. Bakken crude oil has a relatively narrow range of characteristics. Like other light shale oil produced across the US and internationally, Bakken crude contains a

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relatively higher quantity of light ends and has a relatively higher vapor pressure. They are more volatile compared to other crude oils, classed as Group 2 oils. A significant portion of Bakken oil will naturally evaporate when exposed to air. If reaching water, spreading will be more rapid and a small portion of the hydrocarbon may be expected to dissolve into the water column. A portion also may naturally disperse into the water column provided mixing energy or turbulence, creating water quality impacts.

25. Bakken crude may penetrate into sand, mixed sediment, or boulder/riprap bank materials, but is not retained effectively by the open pore space. Response measures of flushing with water and using containment and collection have been effective.

b. Oil sands crude oils

26. A major concern expressed with oil sands crude products arises from the component bitumen from which they are created. The crude oil products such as dilbit have substantially different properties from the raw bitumen, and reference to dilbit as "heavy" is too generalized, unless supported by reference to density. See DEIS §§ 4.5.3, 4.5.4, 4.5.5 (characterizing the densities of oil that the facility will handle as "heavy" without reference to density). Moreover, not all heavy oils sink. The project does not propose receiving oil with a density of $1.01 g/cm^3$. According to the documents and sources I reviewed, the maximum density of oils proposed is 0.946. Models developed by NOAA indicate this oil would not exceed freshwater density over a number of days, the time period within which response measures would be fully underway based on the drill in which I took part. In addition, the vast majority of floating or mobile oil would have stranded on shorelines in this time period in the river.

27. The natural evaporation of light end hydrocarbons from a dilbit will lead to a heavier (denser) residue. Meso-scale experiments conducted in Canada on natural weathering in tanks and flumes showed that of the dilbits tested, most do not reach

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densities exceeding that of freshwater and none exceed that of normal seawater (attached hereto as Attachment F).

28. Many oils and crude oil products with an API less than 22.3 API may be classified as "heavy" because of their density—but unless their API is equal to or less than 10 (1.01 g/cm^3), they do not sink in fresh water without invoking some other processes. Under appropriate conditions, a floating oil may become fragmented and vertical mixing and dispersion. Given sufficient energy and suspended particulates, the dispersed oil droplets may interact with suspended fine sediments (fines). The combined oil and sediment or organic matter, often referred to as OMA or OPA (oil mineral aggregates/oil particulate aggregates, may remain suspended in the water column or settle to the river bed depending on the aggregate density, water density, and local turbulence. Much of it may not be recoverable.

29. While oil weathering combined with suspended sediment interaction can lead to a limited portion of dilbit becoming submerged or sunken, in a worst-case spill of dilbit into fresh water, an estimated 15-18% of the spilled oil that entered the Kalamazoo River ended up estimated to become submerged, a significant portion released through agitation (poling, sparging), which caused it to refloat for containment and collection operations.

30. Oil is less likely to become submerged as it reaches the estuary with increasing water density (with salinity). In a 10-day study of two dilbit products (Access Western Blend, Cold Lake Blend), no sinking was observed in various wind and wave conditions in estuarine water salinity. See Taylor et al. (2014). The DEIS oversimplifies the processes that determine whether oil might submerge, and as a result may over-predict the amount of oil that would sink and the potential impacts.

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31. Dilbits are more viscous than Bakken crude oil and hence would have very limited penetration into sand but could penetrate into pebble and coarser materials. Ross (2012). Retention is expected to be greater for dilbit than Bakken, where it may penetrate into riverbanks. Coastal and Ocean Resources (2013) estimated dilbit penetration and retention on different substrates, assuming that weathered dilbit will: (1) have <1 cm of penetration in sands, < 5 cm in pebbles and < 10 cm in cobbles; (2) retention of 300 L/m3 for sand, 200 L/m3 for pebble and 100 L/m3 for cobbles; and (3) a layer of weathered oil above the sediments of 1 cm for rock, sand, pebbles and cobbles. See Coastal & Ocean Resources (2013); Harper & Kory (1995).

c. <u>Trajectory and mass balance analysis</u>

32. In accordance with the requirements of WAC 173-182, and WAC 173-182-315 in particular, the worst-case discharge (WCD) scenario is an unabated release over 48 hours. It is critical to note that such an approach does not take into consideration any source control measures that would be among the normal first steps in a spill situation. The trajectory also does not take into account containment or downstream boom operations that may divert oil to river bank collection points. As a result, the trajectory analysis in the DEIS was completed based on a 48-hour worst-case spill condition (the trajectory analysis report is provided in the DEIS Appendix H). The results of the analysis indicate that the geographic area of potential impact from an incident originating in Vancouver, Washington, within 48 hours of release is the Lower Columbia River from RM 105 (45°38'4.19"N, 122°42'10.55"W) to RM 47 (46° 8'40.52"N, 123°17'46.39"W), or approximately 125 river miles downstream from the terminal.

33. For the purpose of illustrating the fate and weathering of these two oils, a series of weathering models were completed assuming spills under the following conditions:

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- Assumed spill volume to water: 2500 bbl (maximum most probable for a vessel)
- Current speed: 1 kt
- Wind speed: 5kts
- Wind direction: NW
- Water temperature: 47F

34. ADIOS (The Automated Data Inquiry for Oil Spills), is a standard recommended tool for oil spill response modeling developed by NOAA. Its predictions are designed to help decision-makers develop cleanup strategies based on estimates of how long spilled oil will remain in the environment. The details of the model can be found online at http://response.restoration.noaa.gov/adios. ADIOS modeling results show volume losses, primarily through evaporation, and changes in viscosity and density of the remaining oil (see Attachment G). The most significant weathering changes for both crude types in the first 24 hours are similar to many other crude oils. More than 33% of the Bakken crude has evaporated compared to 24% for the CLB dilbit. In that first day, densities reach 890 (Bakken) and 979 mg/m^3 (CLB), both of which would remain floating on the fresh water unless entrained through turbulence or interaction with particulate matter (sediment adhesion or adsorption). Oil viscosities, which is a key factor for oil spreading and for skimmer and pump operations, increase minimally in the first 24 hours for Bakken crude to 33 cSt whereas a much more pronounced increase to over 3000 cSt occurs for dilbit.

35. General oil behaviors are compared between major oil types in Attachment H (modified from Polaris 2013).

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ii. Water quality and wetlands

36. "Injury" is defined under NRDA as an observable or measurable adverse change in a natural resource or impairment of a natural resource service. Injury may occur directly or indirectly to a natural resource and/or service. 15 C.F.R. § 990.30. To demonstrate injury, a pathway of exposure and demonstration of injury are required. Consequently, a spill presents the possibility of exposure and impact, but no certain impacts.

37. Potential adverse effects to water quality and wetlands/vegetated shorelines could occur if exposed in the event of a release large enough to escape containment and reach water from the facility terminal. The magnitude of those effects can vary widely dependent on spilled petroleum characteristics, exposure magnitude and duration, response actions, seasonality and other factors. In the OPA 90 rulemaking, NOAA recognized that the "mere presence of oil" may not cause injury to a resource. Natural Resource Damage Assessments, 61 Fed. Reg. 440, 472 (Jan. 5, 1996) ("Finally, because the rule requires a measureable or observable adverse change in a natural resource or service be documented in addition to exposure, the 'mere presence' of oil will not constitute an injury under the rule.").

a. Applicable standards

38. Standards for oil spill natural resource assessment can be found in:

- Oil Spill Natural Resource Damage Assessment, WAC 173-183. This rule establishes procedures for convening a resource damage assessment (RDA) committee and pre-assessment screening of resource damages resulting from oil spills to determine which damage assessment methods to use and how to apply them.

- The Oil Pollution Act of 1990 (OPA 90), 33 U.S.C. §§ 2701-2720. OPA 90 authorizes Trustees (representatives of federal, state, and local government entities with jurisdiction over the natural

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> resources in question) to assess the damages to natural resources resulting from a spill, and to develop a plan for the restoration, rehabilitation, replacement or acquisition of the equivalent, of the natural resources. The types of damages that are recoverable include the cost of replacing or restoring the lost resource, the lost value of those resources if or until they are recovered, and any costs incurred in assessing the harm.

39. There are numerous chemical and analytical standards for water quality and soils for the protection of aquatic and human health, some of which can be found in:

- WAC 173-340-900. This regulation establishes cleanup levels for petroleum in groundwater and soils for the specific petroleum compounds meant to be protective of aquatic species and human life.
- WAC 173-204. This regulation provides standards to reduce adverse effects on biological resources and significant health threats to humans from surface sediment contamination and decision process for the cleanup of contaminated sediments.
- WAC 173-340-720. This regulation establishes standards for drinking water beneficial uses.
- Clean Water Act, 33 U.S.C. § 1314 (Section 304). This federal law establishes water quality criteria based on the protection of aquatic organisms (acute and chronic criteria) and human health.
- National Toxics Rule, 40 C.F.R. Part 131. This federal regulation establishes water and organism concentrations protective of human health for some petroleum compounds.
- NOAA SQUIRT (Screen Quick Reference Tables), meant to provide screening values for the protection of aquatic resources. http://response.restoration.noaa.gov/sites/default/files/SQuiRTs.pdf
- WAC 173-201A. Water Quality Standards for Protecting Human Health (Fish consumption).

40. Potential response actions for a surface spill are unique. In certain situations, there may be no spill response action that will remove a water concentration or

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sediment concentration to levels below chemical criteria without causing undo harm or having limited effect. Shoreline and on-water treatment recommendations are driven by the Net Environmental Benefit (NEB) of reducing the contamination to the point that accelerates recovery. If recovery may be impeded by further response actions, natural attenuation may be favorable. In this regard, the applicable standard or end goal of a response or intervention may be measured differently than the use of a chemical standard. For purposes of NRDA, biological criteria in conjunction with water analytical chemical results may be used to infer injury.

41. Washington code and federal law allow for concentrations that do not exceed natural background levels or the practical quantitation limit, whichever is higher, for the substance in question. Following the exhaustion of practical and effective response actions using a NEB approach, the endpoint standard applied to ecological injury for damages is typically considered rehabilitation, replacement or acquisition of the equivalent of the lost natural resources and their services pending full recovery. Recovery is often linked to the baseline condition.

b. Methodology and basis for assessment

42. Assessment of risk to water quality considers the range of potential impacts and injury pathways to a number of aquatic receptors. Criteria-based standards meant to be protective of water supply, aquatic and terrestrial species and human receptors that consume potentially contaminated fish or otherwise become exposed to contamination are also considered.

43. The assessment is based on the oil fate and behavior discussed above, resources at risk, literature studies of petroleum hydrocarbon effects to relevant resources, spill drill experience to assess available containment and response resources, and case

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studies of assessments from other oil spills that may have relevance in terms of spilled material or types of habitats or species potentially affected.

44. The assessment is also based on water use, described in WAC 173-201A-602. Natural Resource uses include salmonid spawning and rearing, recreation, and a variety of wildlife habitat.

c. Assessment of potential impacts to water quality, wetlands and vegetation

45. The Columbia River basin has extensive and diverse riparian floodplains and shorelines with cottonwood, willow, sedge, rush and other vegetation communities. Wetlands by Environmental Sensitivity Index Ratings make up an estimated 27% of the Lower Columbia River (Attachment I). According to Michel & Rutherford (2014), wetland/marsh impacts from large spills have been reported to range between one to two years until recovery to up to 40 years in some cases such as the Gulf War. Of note, roughly 4,000,000 bbl of oil spilled in the Gulf, more than 10 times the WCD for the facility. Attachment J shows assessed recovery times of oiled marsh in the study, most of which occurs within several years. In the Columbia River and estuary, the physical actions of river flow, sedimentation, and other weathering processes are likely to result in most properly treated affected wetlands recovering within a few years.

46. Response actions are likely to mitigate much of the assumptions of exposure and injury in the DEIS to wetlands, water resources, and riverine vegetation. Even in remote locations, BNSF has response plans and I have personally witnessed BNSF response in adverse conditions.

47. Conditions at the time of a spill such as river flood stage, water velocity, time of year, sediment loading, etc. can affect resource injury potential to water and vegetation on rivers. While adverse effects and longer term response and injury

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considerations exist, large spills on rivers do not always result in major water and wetland impacts as they are defined in the DEIS (M/V Westchester, Mississippi River 2000, M/V Eagle Otome, Sabine River, Texas 2010). Michel et al. (2002).

48. The Damage Assessment Restoration Plan (DARP) for the Enbridge pipeline spill in 2012 estimated 5-15 years for recovery of instream habitats and weeks to years for floodplain habitats, consistent with the findings and conclusions in Michel & Rutherford (2014). See Attachment J.

49. Impacts to wetlands can also vary depending on the level of oiling and response actions. For many crude oil spills, recovery can occur within one to two growing seasons, even in the absence of treatment. In a report of oil spill assessments and field studies, oil spill recovery was longest for spills in cold climate, sheltered setting, thick oil on the marsh surface, light refined products with heavy loading, oils that formed persistent thick residues and intensive treatment. The above conditions are possible for both oils proposed at the facility under certain circumstance, but would not likely be the dominant conditions. Recovery of less than five years is typical for wetlands and marshes in most instances when good response decisions are undertaken. Limited tidal action, the slope of the river banks and limited duration of initial exposure and stranding would also limit oil to a narrow fringe of riverine vegetation in many instances, with the exception of high river stage and flooding conditions. The NWACP and GRPs identify areas with hydrologic connection and prescribe preventative response measures. The river opens to wider marshes in the lower estuary.

50. The majority of area exposed in an oil spill is typically subject to lesser degrees of oiling than the heaviest oil categories (as defined by Shoreline Cleanup Assessment Technique - SCAT). Hence, the majority of habitats exposed experience

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lesser impacts and more rapid recovery, with a smaller percentage of exposed habitats subject to greater exposure and longer term recovery.

51. A diluted bitumen spill occurred in 2007 from a pipeline operated by Kinder Morgan into Burrard Inlet, Burnaby, B.C. Approximately 15,000 m of shoreline were affected by the spill. An assessment of the spill clean-up and environmental impacts were reported five years after the spill by Stantec Consulting Ltd. (2012). The study indicated that spill response operations were effective at removing oil from the environment and in limiting the short- and long-term effects of the spill. Oil was recovered by skimming and booming, as well as by flushing and removal from the affected shorelines. Though shoreline intertidal zones were oiled, most marine sediments had only a small increase in measured PAH concentrations, with 20 of 78 monitored sites exceeding water quality guidelines). Levels of extractable hydrocarbons and PAHs for surface water quality requirements were met in 2007. Subtidal marine sediments were monitored through 2011, with most samples having levels of PAHs below the water quality requirements. Those subtidal sediment samples that did exceed the maximum regulated PAH levels appeared to be caused by sources other than the spill. Based on these observations, only trace amounts or less of oil from the 2007 spill appear to have remained in the marine harbor sediments.

52. While the DEIS indicates that on sandy beaches oil can penetrate up to 2 meters (Mosbech 2002). There is no evidence resented regarding this depth of penetration or the types of oils considered. Heavier crude oils generally do not penetrate deeply into fine sediments. Bakken crude oil could penetrate more easily than dilbits, but neither are likely to penetrate 2 meters. Both may become buried by other processes if not removed.

53. There is no evidence provided for long term moderate or major impacts to riverbed sediments, DEIS at 4-58, given that it is unlikely a large portion of the oils as

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described would sink. The presence of a small portion of spilled oil with limited bioavailability adsorbed onto sediment may not result in measurable or observable effects to many resources through NRDA study.

54. Water quality exposure is temporary with basic differences in the two products is that Bakken crude has greater potential for dissolved fractions of petroleum as with a gasoline spill and can result in acute toxicity to animals present within a certain area for a short period of time, while diluted bitumens have low toxicity but can persist longer on shoreline and incorporated in sediments.

55. The water column will return to baseline relatively quickly in a riverine spill with either product given flow volumes of the Columbia River and the weathering of potentially dissolved fractions of petroleum in the water column. Volatile components evaporate and heavier components are less bioavailable in the water column. Over 60 water samples collected after the 1000 bbl Silvertip Pipeline of tar sands crude oil on the Yellowstone River in 2011 in high flow conditions found no hydrocarbon constituents and resulted in discontinued sampling. Arcadis (2014). Very few dead fish (approximately 45) were found during intensive searches during the response to the Enbridge spill of over 25,000 bbls of diluted bitumen in the Kalamazoo River. See DARP. It is not known if the dead fish found were spill-related. There is a potential for chronic exposure to aquatic organisms via several pathways in pockets of trapped oil or oil adsorbed onto particulate material and sediment; however, water column concentrations will likely return to baseline in days to weeks in most of the river following a spill. Other aspects such as habitat and species impacts and shoreline response would likely continue for longer.

56. Restoration actions under OPA 90 are meant to restore, rehabilitate, replace, or acquire the equivalent of the affected natural resources and their services pending full recovery following an oil spill. While the first priority is to avoid an adverse

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impact, there are many positive results of early restoration, emergency restoration, and longer term habitat improvement projects that shorten the duration and severity of predicted spill impacts and bring about a return of services through completed restoration projects in addition to response. This process is required by federal and state law and guarantees the public that estimated future loss of natural resources and their services will be compensated, typically with habitat restoration, fisheries enhancement and other projects that are often identified by local or regional planning authorities, but not yet permitted or constructed.

57. Wetlands would be restored or replaced at ratios meeting or exceeding the standards in WAC 463-62-050. Even no permanent wetland loss would occur, mitigation wetlands are likely to be enhanced, restored, or created for interim service losses.

58. ESI mapping indicates a small linear or aerial extent of wetlands within the estimated 7 RM downriver of a WCD Facility spill, explosion, or fire. The conclusion of impacts of major impacts to wetlands for most facility spills is likely overstated. There is a control facility for Vancouver Lake and wetlands on the river mainstem in the downstream areas are limited for approximately 10 miles. Some upstream flow could occur and there are vegetated shorelines in Oregon.

59. Impacts from oil that spreads only 7 RM as considered in the DEIS for the facility is substantially less geographic extent of exposure in comparison to vessel scenarios and would likely result in fewer, if any, measurable and observable ecological impacts on a population level for many Lower Columbia River species. The large facility and rail spills are not comparable to the large vessel spill WCD and may create some confusion for the reader interpreting conclusions of impact, which appear overstated relative to other scenarios.

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60. For surface water quality impacts, the DEIS assumes a large spill during vessel loading (of between 1,152 to 2,626 bbl) could produce longer-term moderate to major impacts to surface water quality, even though the DEIS recognizes that such effects would be temporary. On page 4-60 the DEIS states "A spill reaching the Columbia River would temporarily impair water quality within the boomed area, or if outside of containment, within a relatively short upstream and potentially longer downstream distance (including the opposite bank at Hayden Island)." Degradation of surface and water column water quality would occur under the DEIS scenarios above. Temporary short term effects for a short distance upstream and longer downstream should translate to surface water impacts from the spill volumes of minor to moderate even under the subjective criteria defined in the DEIS, given their ephemeral nature.

61. The likelihood of a large rail spill affecting significant portions of the assessed mile-wide rail corridor or reaching water would be lower than a direct WCD in the vessel corridor because the WCD volume is much lower and oil on land moves slowly and without the aid of wind or water currents. A rail spill is likely to affect a smaller area and fewer resources than a similarly sized vessel spill since it is more likely to occur on land. Impacts from rail spills are not likely to be "major." Similar conclusions of major surface water and aquatic resource impacts from rail relative to vessel scenarios are not warranted.

62. Potential adverse effects to water and wetlands/vegetated shorelines could occur in the event of a release of oil in the rail corridor. The magnitude of those effects can vary widely dependent on spilled petroleum characteristics, exposure magnitude and duration, response actions, seasonality and other factors. As mentioned, oil travels more slowly and does not spread on land like water, which should reduce risk and magnitude of

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exposure well below what can be expected from a WCD in the vessel corridor directly to the Columbia River.

63. In the event that an oil spill results in a fire or explosion, the immediate impacts to water, wetlands and adjacent terrestrial vegetation in the affected area can be of high intensity but limited extent as discussed previously. Fire may delay, reduce or even prevent oil from reaching water. A fire or explosion would be unlikely to have major effects outside of immediate vicinity of the fire or explosion. An explosion that results in an oil release to the environment would have the same anticipated effects as an oil spill from any other cause.

64. Impacts from a fire or explosion that involve contaminants in Waters of the US such as a wetland would involve compensatory mitigation under applicable federal and state law, including OPA or WAC 173-183.

iii. Biota/aquatic and terrestrial species

65. In addition to aquatic invertebrates, fish and amphibians that require the aquatic environment for part or all of their life cycle, there are numerous reptiles, birds, and mammals that use the river as habitat and could become exposed to oil by direct contact or prey ingestion and subject to a variety of effects.

a. <u>Overview of major species at risk</u>

66. Numerous species groups associated with the aquatic environment of the Columbia River may be impacted by an oil spill.

(I) Fish

67. Important species in the Columbia River include Sturgeon, Shad, Salmonids such as Chinook, Coho and Steelhead, smelt, lamprey among others. The Columbia River estuarine environment is important habitat for salmonids in their transit to the ocean. The Upper Columbia River spring-run Chinook salmon (*O. tshawytscha*) is

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listed as federally endangered. Numerous threatened species including certain ESUs of chum salmon (*Oncorhynchus keta*), steelhead (*O. mykiss*), Chinook salmon (*O. tshawytscha*), coho salmon (*O. kisutch*), snake river sockeye salmon (*O. nerka*) and the Green Sturgeon (*Acipenser medirostris*) may occur in the river at certain times of the year. A number of other marine fish species also use the estuary but are not likely at risk from a facility release.

68. Hatchery Chinook salmon passing through estuaries with larger proportions of intact habitat survived to adulthood at higher rates than those that transit degraded estuaries with less pristine. Higher proportions of intact estuary habitat were found to be associated with higher returns of adult salmon, indicating that estuary habitat confers an important advantage in terms of survival. Magnusson & Hilborn (2003). Other important habitats include vegetated shorelines that support salmonid during transiting periods and support a food base for salmonids. Benthic gravel areas support in-river spawning in some locations. Salmonid eggs and developing larvae are among the more sensitive receptors to PAH contamination. Incardona et al. (2015).

69. Numerous species of estuarine fish including flounder, sole, herring, perch, shad and others use the estuary. Estuary Partnership. Lower Columbia Estuary Partnership, http://www.estuarypartnership.org/learn/river-species. Other marine mammals and sea turtles also occur outside of the Columbia River in the Pacific.

(II) Mammals

70. Marine mammals that can be found in the river include pinnipeds such as Pacific harbor seals, California sea lions and Steller sea lions. NOAA, Seal & Sea Lion Facts of the Columbia River & Adjacent Nearshore Marine Areas (2006), http://www.westcoast.fisheries.noaa.gov/publications/protected_species/marine_mammals/pinnipeds/sea_lion_removals/seal_and_sea_lion_facts_of_the_columbia_river_adjacent_

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nearshore_marine_areas.pdf. During May, approximately 3,000 Pacific harbor seals, 1,000 Steller sea lions, and 800 California sea lions can be observed resting on haul-out sites (such as jetties) in the Columbia River estuary. As many as 300 seals and sea lions are known to feed in these upriver areas as far as the Bonneville Dam. Fewer marine mammals would be at risk from a spill at the Terminal and from upriver rail incidents because the Terminal design, containment, and response capabilities, combined with the movement of oil over land to reach the waterway, all would result in substantially less oil reaching the waterway than in the event of a spill in the river itself.

71. Other mammals that frequent the aquatic environment along the Columbia River include river otter, nutria, and American beaver. Many other terrestrial mammals occur along the river with a comprehensive list available from the Lower Columbia River Estuary Partnership. Lower Columbia Estuary Partnership, http://www.estuarypartnership.org/learn/river-species#mammals.

(III) Benthic invertebrates

72. Benthic invertebrates such as amphipods are primary prey for many fishes. The health of benthic invertebrate populations in the Columbia River is important. Common taxa found in the river include flatworms (*Turbellaria*), the freshwater worms (*Oligochaeta*), the bivalve clam (*Corbicula fluminea*), the amphipod (*Corophium salmonis*) and several important aquatic insect larvae McCabe et al. (1997). Benthic invertebrate densities vary substantially spatially and temporally. While it is difficult to predict impacts, a community with short lifespans or generation times typically rebounds rapidly. The estuary contains a wider variety of benthic invertebrates including crustaceans, copepods and marine amphipods, all important prey items for fish, birds and other species.

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(IV) Birds

73. Over 175 species of birds utilized areas within the Lower Columbia River Basin for food and habitat. Jerrick (1999). The Lower Columbia River is located along the Pacific Flyway for migrating shorebirds, with peak counts in the estuary of almost 150,000 birds. Wintering water-foul populations in the lower Columbia area reach peak of more than 200,000 birds. The Lower Columbia River also provides important migratory and breeding habitat for a variety of other neo-tropical migrant bird species.

74. The vessel corridor includes estuarine and marine bird species at the mouth of the Columbia River not at risk for the Terminal scenarios. In the Lower Columbia River Estuary high numbers of seabirds use the area occupied by the Columbia River Plume. Strong salinity gradients at the mouth of the Columbia River attract Sooty Shearwaters and Common Murres as the dominant seabird species. California Gulls, Brown Pelicans, Caspian Terns, Heerman's Gulls, DC Cormorants, Pelagic Cormorants, and Brandt's Cormorants also use the areas in spring, summer and fall. Marbled Murrelet and Rhinoceros Auklet are occasionally observed in the plume. Common Murres, Double-crested Cormorants, Pacific Loons, Red-throated Loons, and Western Grebes also use the area. The western extent of the Columbia River Estuary is a designated Western Hemisphere Shorebird Reserve Network site.

(V) Reptiles and amphibians

75. Many species of frogs, lizards, snakes, and turtles live in the nearshore environment of the Columbia River. The Oregon Spotted frog can occur in the Columbia Gorge and is endangered. The western pond turtle is a Washington State Species of Concern.

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b. Methodology and basis for assessment

76. The basis for the assessment is the oil fate and behavior discussed above, resources at risk, literature studies of petroleum hydrocarbon effects to relevant resources, and case studies of assessments from other oil spills that may have relevance in terms of spilled material or types of habitats or species potentially affected.

c. Assessment of potential impacts on biota/aquatic and terrestrial species

77. There have been large crude oil spills in rivers with little evidence of pathway and exposure to some species and habitats and no evidence of significant effects. A spill of 14,000 bbl of Nigerian crude oil into the Mississippi River in 2000 resulted in shoreline contamination along 35 km of one bank of the river. An estimated 50 percent of the spilled oil was recovered during on-water operations. Impacts to fish and wildlife were reported to be minimal. Michel et al. (2002). A riverine spill in a large river system can be ephemeral in terms of duration of exposure with the continual movement of water through the affected area. As we have seen in the Kalamazoo River, response challenges and environmental conditions can lengthen the exposure and potential for adverse impacts. A spill during some times of the year or some environmental conditions such as a flood stage can lessen the injury in several ways. Some salmonid species will not be in the area at all times of the year.

78. There are a wide range of potential impacts and some resource categories such as fish, mammals or wetlands may or may not experience measurable and observable long-term impacts. Impacts to fish in some instances are not anticipated based on limited oil dissolution and bioavailability. Helton et al. (1995). In situations where the oil is viscous and may present limited bioavailability and toxicity risk to aquatic species, physical fouling may affect birds and result in losses for a number of years. Nixon et al.

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(2008). In the 1984 residual fuel oil spill of approximately 200,000 gallons (1,000 bbl) on the Columbia River, 450 oil birds were treated with over 250 released with an estimated 2-9 times more birds affected that were uncaptured. Speich & Thompson (1987). Mammals such as river otters are also unlikely to be adversely affected unless they come in direct contact with oil. Harwell & Gentile (2014). Some literature suggests spills affect only a small number of marine mammals having low vulnerability due in part to their ability to detect and avoid spilled materials. Smith et al. (1983); St. Aubin et al. (1985). Their insulation is not compromised by spilled fuel similarly as birds, they do not ingest contaminated water and their skin is nearly impermeable to components of oil. Sometimes, "hazing" methods are used to deter mammals from the area of the spill. Nonetheless, exposure and Inhalation of some fuel oil vapors has been reported lead to pneumonia and other complications. Given the shortened exposure period created by river flow and oil movement, the predicted ability of marine mammals to avoid oil, and the lower number of mammals near the facility than in the estuary, there is a lower likelihood of a substantial impact.

79. Pre-existing contamination from background sources as opposed to short-term events such as oil spills may present a larger concern for salmonids using the Willamette River and Lower Columbia River where polycyclic aromatic hydrocarbons (PAHs) in the food chain from background contamination are reported to be a potential source of injury. Yanagida et al. (2012). It is likely that some fish will be exposed in a WCD. In 1984, more than 170,000 gallons of oil (>4,000 bbl) were spilled into the Columbia River. Metabolites of aromatic compounds were found in the bile of white sturgeon captured 57 miles downstream from the spill were significantly higher than those of sturgeon caught upriver. Krahn, Kittle & MacLeod (1986). However, exposure is not always injury and population effects are not always a result. Sublethal impacts to fish have

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been reported in developing embryos and juveniles. Incardona et al. (2015). While increases in fish bile PAH metabolites and cytochrome P450 system responses can be sensitive indicators of PAH exposure after an oil spill, there is little unequivocal evidence to suggest a linkage to higher order biological effects. Lee & Anderson (2005). The typical persistence of elevated waterborne concentrations is limited in a river spill with the continual influx of upstream water and comparisons to literature toxicity values and exposure assumptions should be carefully considered.

80. A number of other benthic aquatic organisms provide impact and recovery understanding. Some species are more resilient than others and many metabolize oil at different rates. The estimates of impacts should be based on likelihood of exposure and reported ranges of adverse effects if exposed. Results of studies suggest that oil in streams and rivers has a relatively short- term negative effect on the benthic community. Effects of a 28,000 bbl crude oil spill on the benthic macroinvertebrate community of the Gasconade River in Missouri found elevated PAHs and population changes that returned to background conditions rapidly in moving water with backwater areas recovering in an estimated 18 months after the spill. Poulton et al. (1997).

81. The benthic macroinvertebrate fauna of smaller streams following spills indicate similar results. Monitoring of a small stream in Missouri following a 13,000 bbl domestic crude oil spill indicated widespread initial loss of aquatic insects, crustaceans, segmented worms, roundworms, flatworms, snails, freshwater mussels and other benthic organisms in the oil impacted area but recovered to typical values in approximately 11 months. Crunkilton & Duchrow (1990). The most apparent factors controlling the recovery were the total volume of water passing through the contaminated area and the occurrence of scouring flood. In another study in a river in Northern Alberta, Canada, the effect of synthetic crude oil and its major components (naphtha, kerosene and gas/oil)

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upon the benthic community was tested under circumstances replicating a short catastrophic synthetic crude oil spill and was found to have a negligible effect upon benthic communities in stream riffles. Lock et al. (1981).

82. While the DEIS and comments by some party opponents suggest any size spill could result in moderate to major impacts to aquatic and terrestrial species, some scenarios are relatively small and limited in extent. While a moderate and major (long-term and widespread) effects to aquatic species and other biota that use the river may be possible to some individuals, such impacts are not supported with relevant examples on a regional or population level.

83. Claims of moderate to major long-term, widespread impacts do not consider restoration actions under NRDA whose purpose are to restore, rehabilitate replace or acquire of the equivalent of the affected natural resources and their services pending full recovery. While it is always preferable to avoid an adverse impact, there are many positive results of early restoration, emergency restoration, and longer term habitat improvement projects that shorten the duration and severity of predicted spill impacts and bring about a return of services more quickly.

84. As an example of early restoration, a 1999 pesticide spill in Fifteenmile Creek at The Dalles Dam resulted in steelhead and lamprey mortality in a quarter mile section of the creek. During the response, barriers to migration were removed immediately upstream of the spill site to improve future habitat use. Many miles of stream were made available to steelhead spawning with demonstration of fish passage in year one, helping to avoid potentially significant impacts to steelhead with possible net gains. Regulation such as NRDA under OPA 90 directs natural resource Trustees to seek restoration of equivalent resources, to avoid long term impacts in many instances.

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85. In the event that an oil spill results in a fire or explosion, the immediate impacts to biota, both terrestrial and aquatic in the affected area can be of high intensity but limited extent as discussed previously. Fire may delay, reduce or even prevent oil from reaching water. A fire or explosion would be unlikely to have major effects outside of immediate vicinity of the fire or explosion, while it may reduce the geographic spread of exposure and potential adverse impacts. An explosion that results in an oil release to the environment would have the same anticipated effects as an oil spill from any other cause.

86. I believe the characterization of impacts to aquatic and terrestrial biota species as moderate and major is overstated in some instances in the DEIS with reference to the rail corridor scenarios. The rail spill scenarios are smaller than vessel and facility scenarios and more likely to occur on land and spread more slowly. The oil will not likely persist in extensive areas with long term bioavailability to the biotic community.

87. In my opinion, the characterization of impacts to aquatic species as moderate and major is overstated in some instances in the DEIS with reference to the impacts of a potential oil spill in the vessel corridor scenarios. The oil will not likely persist over extensive areas (the originally exposed area) and be bioavailable in the long term. Temporary contribution to background contamination would become indistinguishable in sediment samples. As a result, impacts are expected to be largely temporary, and more significant impacts will be localized.

D. <u>ESA and other special-status species</u>

88. A number of species along the Columbia River corridor have protected status. The US Fish and Wildlife Service (USFWS), State of Oregon, and State of Washington have numerous sources of information on listed species as described below.

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89. A summary of the threatened and endangered or candidate species of concern along the Columbia River near Vancouver, WA is shown in Attachment K. The area was divided into the Lower Columbia River stretching from the Pacific Ocean through Clark County (Vancouver) and its counterpart across the river in Oregon (Multnomah); and the Upper Columbia River for those counties east of Vancouver and stretching to where the border of WA and OR is no longer the river. While many of the counties bordering the Columbia River along the area of interest contain numerous federal and state species of concern, only a portion of them are associated with the river itself and thus at less of a risk to exposure in the event of a release. Particularly vulnerable are anadromous fish (those born in fresh water which spend most of their lives in the sea and return to fresh water to spawn: includes salmon, smelt, shad, striped bass and sturgeon) or birds and mammals which either breed or feed on the banks or directly in the mainstem itself.

90. The USFWS Environmental Conservation Online System provides every federally listed species for the counties of interest. Habitat ranges were compared to the area of interest along the mainstem Columbia River. Species listed at the state but not federal level were then added to this list to capture all threatened, endangered or candidate species of concern, state or federal for the counties upstream and downstream of Vancouver, WA.

ii. Risks to ESA and other special-status species

91. Risks to T&E species are no different than those for all biota discussed previously. The potential for a spill is low, with no previous record of significant spills since 1984. If a spill occurred, T&E species would also be subject to the same NRDA regulations requiring replacement of lost services including interim lost use. Some

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impacts could occur but in the absence of a project, and assuming the rail will still transport oil to west coast refineries, the risks with and without the project are similar.

92. To my knowledge, there are no records of local extirpation of species from an oil spill in spite of frequent concerns and extensive study following many incidents.

E. <u>Mitigation of impacts</u>

93. Avoidance is the best means of mitigation. Preparedness requirements and best practices for industry in preparation for an unlikely event are the most prudent measures for avoidance. Dr. Elliott Taylor in his testimony discusses these measures in greater detail.

94. Prevention and response measures, including primary containment at the facility, the region response capabilities and BNSF ability to respond in remote locations mitigates impacts. A percentage of the oil assumed in the DEIS scenario trajectories would be collected or diverted into areas for containment and recovery that would meaningfully alter the unabated impacts. Dr. Elliott Taylor provided testimony relative to response adequacy.

95. The DEIS does not include consideration of the federal and state regulatory requirements to replace or acquire the equivalent of lost services believed to occur because of the spill. If long term significant effects are believed possible, emergency and early restoration options exist with approaches commonly used in past recent spills.

96. Pursuant to OPA 90, NOAA developed regulations and guidance pertaining to NRDA in 1996. Huguenin et al., Injury Asessment: Guidance Document for Natural Resource Damage Assessments Under the Oil Pollution Act of 1990 (1996) https://darrp.noaa.gov/sites/default/files/Injury%20assessment.pdf. Natural resource damages that are compensable may include both losses of direct use and passive uses. Direct use value may derive from recreational (e.g., boating), commercial (e.g., fishing),

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or cultural or historical uses of the resource. In contrast, a passive-use value may derive from preserving the resource for its own sake or for enjoyment by future generations. 15 C.F.R. § 990.30 (definition of "value"). NRDA examines effects to habitats, fish, wildlife, public lands, water bodies, groundwater, recreational, cultural and archaeological resources. The damages are compensatory, not punitive. Collected damages cannot be placed into the general Treasury revenues of the federal or state government, but must be used to restore or replace lost resources. 33 U.S.C. § 2706(f); Brighton (2006). NOAA's regulations focus on the costs of primary restoration or returning the resource to its baseline condition and compensatory restoration which is providing for interim losses of resources and their services.

97. The OPA regulations and NRDA guidance do not mandate that results of injury assessments meet any predetermined level of statistical significance. Valid injury determination requires only the use of accepted scientific practices by competent investigators so that the results clearly an adverse change in a resource or service. Therefore, injuries that are not ecologically significant in a statistical or measurable extent, they may be deemed biologically important. For example, bird populations may not be affected by most spills, but compensatory restoration will still be required by the Trustees since they demonstrate adverse effects to birds and other organisms found with oil on their feathers or skin. In this way, NRDA compensates for all injuries, including those that are not statistically significant and may have no effect on wildlife population levels or local ecology.

98. In Washington State (WAC 173-183), NRDA rules were established for oil spills that establish an RDA committee that utilizes a screening process to determine whether a detailed resource damage assessment should be conducted or whether a compensation schedule (mathematical formula) authorized under RCW 90.48.366 and

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90.48.367 will be used to assess damages for each oil spill into state waters. The compensation schedule is typically used for small spills where assessment of damages could be costly and unlikely to provide a definitive result. There is a spill compensation schedule for the Columbia River estuary and rivers in general. WAC 173-183. Projects can be offered lieu of compensation. Funds collected are used for projects meant to restore affected public resources. Depending on a number of factors, the state or federal NRD process may be followed in Washington, although the state process is often used for smaller spills.

99. The goal of NRDA when conducting an assessment for medium to larger sized spills is to establish the cost of restoration, rehabilitation, and replacement of equivalent services as those that are presumed lost, but for the incident. The value is established through analysis of diminution in value and interim lost use of the resource pending recovery to baseline or reference condition. This goal meets "no net loss" criteria in WAC 463-62-040 for fish and wildlife habitat.

100. Examples of successful restoration projects implemented throughout the country include the addition of habitat to Refuges, National Parks, state parks and tribal lands; invasive species control; fish passage; construction of bird nesting islands; wetland, saltmarsh, and eel grass bed restoration; fisheries regulatory changes and endangered mussel reintroductions.

101. Given the analyses that predict the very low likelihood of spills, and the information suggesting that the rail traffic will exist regardless of the project, it follows that the addition of cumulative impacts would be few to none. Nonetheless, the NRDA approach considers all impacts "but for the spill," which includes cumulative effects.

102. The state and federal trustees are entitled to reasonable costs to assess damages described above. This burden is not borne by the public.

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V. ATTACHMENTS

103. I have attached the following Attachments to my testimony:

Attachment A:	Gregory Challenger Curriculum Vitar
Attachment B:	Impact Risk Category Chart
Attachment C:	DEIS Conclusion Summary Table
Attachment D:	Event Scenarios Used in Impact Analysis
Attachment E:	Oil Properties
Attachment F:	Oil Evaporation and Density Changes
Attachment G:	ADIOS Model Results
Attachment H:	Summary of oil properties and adverse effects
Attachment I:	ESI Shoreline Types
Attachment J:	Marsh recovery Studies
Attachment K:	T&E Species Summary Information
Attachment L:	Bibliography

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DATED this 12th day of May, 2016.

[signature]

Gregory Challenger, Declarant

STATE OF WA)
)
COUNTY OF King)

Gregory Challenger, being duly sworn upon oath, deposes and says: The foregoing testimony is true, correct and complete to the best of my knowledge, information and belief and is given subject to the laws of perjury in the State of Washington.

GIVEN under my hand and official seal this 12th day of May, 2016.

SHEREE NEAL NOTARY PUBLIC STATE OF WASHINGTON COMMISSION EXPIRES 12-08-17

NOTARY PUBLIC in and for the State of: Washington

Residing at: Redmond, WA

My Commission Expires: 12-08-17

Printed Name of Notary: Sheree Neal

[signature]

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BEFORE THE STATE OF WASHINGTON
ENERGY FACILITY SITE EVALUATION COUNCIL

In the Matter of: Application No. 2013-01 TESORO SAVAGE, LLC TESORO SAVAGE DISTRIBUTION TERMINAL	CASE NO. 15-001 SWORN PRE-FILED TESTIMONY OF GREGORY CHALLENGER

LIST OF ATTACHMENTS

Attachment A: Gregory Challenger CV

Attachment B: Impact Risk Category Chart

Attachment C: DEIS Conclusion Summary Table

Attachment D: Event Scenarios Used in Impact Analysis

Attachment E: Oil Properties

Attachment F: Oil Evaporation and Density Changes

Attachment G: ADIOS Model Results

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