BEFORE THE STATE OF WASHINGTON
ENERGY FACILITY SITE EVALUATION COUNCIL

In the Matter of: Application No. 2013-01 TESORO SAVAGE, LLC VANCOUVER ENERGY DISTRIBUTION TERMINAL	NO. 15-001 COUNSEL FOR THE ENVIRONMENT'S PRE-FILED DIRECT EXPERT WITNESS TESTIMONY OF JAMES V. HOLMES

I. EXPERT QUALIFICATIONS

1. I am a Principal Associate/Scientist and Vice President at Abt Associates. I am co-director the environmental sciences and natural resource damage assessment (NRDA) practice in the Environment and Natural Resource Division of the company. I have an MS in earth sciences from Dartmouth College and a BA in environmental biology from Middlebury College. My resume is attached as Exhibit 1501 ENV.

2. I have worked on NRDAs, contaminant fate and transport analyses, surface and groundwater assessments, ecological effects assessments, and natural resource restoration planning since 1991. I have worked on assessments of petroleum discharges as an employee of Abt Associates and predecessor companies Stratus Consulting and Hagler Bailly. I have worked on all phases of NRDA, including pre-assessment screens, assessment plans, preliminary evaluations of injuries and damages, injury quantification, habitat and resource equivalency methods for estimating damages, and spatial analyses of adverse impacts. I have presented methods for evaluating natural resource injuries and damages at professional

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conferences, and I have taught NRDA methods to natural resource trustees in the U.S. and internationally. I have served as a testifying expert on NRDAs in federal court and in multiple New Jersey district court cases.

II. SUMMARY OF OPINIONS

3. The Tesoro Savage Petroleum Terminal LLC has submitted an Application for Site Certification to the Washington State Energy Facility Site Evaluation Council (EFSEC) to construct and operate the Vancouver Energy Distribution Terminal Facility at the Port of Vancouver in Vancouver, Washington. My colleagues and I at Abt Associates were tasked with estimating potential natural resource damages from two effective worst-case oil spill scenarios: a tanker grounding in the Columbia River near Vancouver, Washington, and a train derailment near the Bonneville Dam. The opinions in this proffer summarize work that I conducted with Abt Associates colleagues working under my direction. We presented the work in a report that we wrote with Dr. Eric English of Bear Peak Economics. That report is attached as Exhibit 1503 ENV.

4. The scope of this task was restricted to assessing the impacts in the Columbia River from these two scenarios; we did not evaluate potential impacts in the Pacific Ocean or along the Pacific Coast. We also did not separately assess how the public or Indian Tribes would value the potential losses to natural resources if either of these spills were to occur, although these values may be at least partly accounted for in the methods we used. Because of this limited scope of our work, my estimates of potential natural resource damages from these spill scenarios do not consider all potential damages.

5. Both of the oil spill scenarios that we evaluated would result in birds, fish, pinnipeds, and other biota being exposed to oil in the lower Columbia River, including to oil slicks on the river surface; stranded oil in sediments, along the banks, and in the floodplain; and polycyclic aromatic hydrocarbons (PAHs) in the water column.

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6. Oil exposure adversely affects birds. Data from the literature (including data from studies that Abt Associates managed as part of the *Deepwater Horizon* oil spill) suggest that most birds exposed to oil are impaired and may die from symptoms ranging from hemolytic anemia to hypothermia to heart failure. Oiled eggs rarely produce offspring, and oiled feathers impair flight behavior, which could lead to increased predation and decreased hunting and migration success.

7. Oil exposure also adversely affects fish. Recent literature and studies that Abt Associates managed or conducted as part of the *Deepwater Horizon* oil spill suggest that the concentrations of PAHs expected in the Columbia River from these spill scenarios could exceed thresholds for multiple toxic endpoints in early life-stage fish.

8. Recent literature also suggests that PAH exposure can reduce the physiological fitness of juvenile and adult fish. Physiological impairment of out-migrating salmon smolt and returning adults could adversely affect the ability of salmon to complete their life cycle and successfully migrate to spawning grounds.

9. To estimate potential natural resource damages, I used a habitat equivalency analysis (HEA). This is a commonly used technique where damages are based on the cost to restore habitat and/or natural resource services equivalent to those that were harmed by the oil.

10. In a HEA model, future adverse impacts and environmental gains from habitat restoration are discounted to a base year using a three percent discount rate to reflect a time preference reflected in social discount rates. This approach is standard practice in conducting HEAs in the U.S.

11. Using this approach, the discounted losses and gains in each year were summed, creating an estimate of total natural resource injuries in units of discounted service acre-years (DSAYs), and an estimate of total restoration benefits in DSAYs per acre. Dividing the total injuries (DSAYs) by the benefits of restoration (DSAYs per acre) provides an estimate of the

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number of acres of marsh habitat restoration required to offset the estimated adverse effects from the hypothetical spill scenario.

12. I used HEA methods similar to those that natural resource Trustees (including the National Oceanic and Atmospheric Administration and the State of Washington) developed for NRDAs in Puget Sound (Commencement Bay/Hylebos Waterway, Elliot Bay/Duwamish River). In this model, restoration benefits are scaled using estuarine marsh habitat as the preferred restoration alternative. If oil caused harm (injury) to natural resource services in other habitats, those service losses were scaled to an amount of marsh habitat that provides equivalent services.

13. I estimated the service loss from oil exposure based on available data and knowledge from other spills. For this analysis, I estimated injury in terms of service losses to estuarine and freshwater marsh habitats both in the river channel and in the floodplain adjacent to the river channel. I assumed that these wetland habitats (as designed in the National Wetlands Inventory) provide equivalent services to restored estuarine marsh.

14. I also estimated injury in terms of service losses to riverine, subtidal, and other habitats in the river channel. I assumed these non-wetland river channel habitats provide 10 percent of the environmental services of an estuarine marsh, using scaling methods similar to those used in the Commencement Bay NRDA. The exception was a short 4.8-mile reach of river that includes protected spawning habitat downstream of the Bonneville Dam, for which I assumed services provided are equivalent to those of a restored marsh rather than being adjusted to only 10 percent of marsh habitat services.

15. For these scenarios, I assumed that the spill occurs in the spring of 2016 (present year, for discounting purposes) and that most of the service losses occur in 2016 and 2017. Complete recovery to pre-spill conditions occurs slowly thereafter until 2025.

16. I further assumed that marsh restoration required to offset these potential impacts would be completed in 2021. It would take 15 years for the marsh to become fully

established and provide 100 percent of marsh habitat services (Commencement Bay Natural Resource Trustees, 2002), and those restored services would be provided for 100 years. This provides 20.5 DSAYs of restoration credit per acre of marsh restored.

17. In reviewing the available information, I found a wide range of unit costs for restoring estuarine marsh habitat. Costs for marsh habitat restoration ranged from a few thousand dollars per acre for very simple projects such as breaching a dike to flood fields, up to more than $1 million per acre for more complex projects that involve purchasing land, removing and disposing of fill materials, regrading, and planting vegetation to create new habitat.

18. I used the recent Fir Island restoration in the Skagit Valley (WDFW, 2014) as a reasonable intermediate project for the basis of estimating average marsh restoration cost. This estuarine marsh restoration project provided new habitat for Chinook salmon, preserved habitat for waterfowl such as snow geese, and was accomplished at a unit cost lower than but close to average costs that I found for this type of restoration. The Fir Island project restored 130 acres of marsh habitat at a cost of $110,000 per acre.

A. Tanker Grounding Scenario

19. The "effective worst-case discharge" for a tanker grounding in the lower Columbia River is a spill of 189,845 bbls (about eight million gallons) of Bakken crude oil (EFSEC, 2015). Based on data from a 1984 oil spill in the river as well as models presented in the Draft Environmental Impact Statement (DEIS; EFSEC, 2015), oil would travel approximately 40 miles downstream from Vancouver to Longview (Reach 2) in one day. It would then travel slowly from Longview through the estuary to the mouth of the river (Reach 1) after an additional four days.

20. Assuming the spill occurs near Vancouver in the spring (mid-April to mid-May), an estimated 20,000 to 60,000 adult salmon adult salmon swimming upstream

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could be exposed in Reach 2, and an additional 45,000 to 70,000 could be exposed to the oil in Reach 1. These estimates are based on adult salmon counts from the Bonneville Dam.

21. An estimated 1.4 million to 1.6 million juvenile salmon (smolts) swimming downstream also could be exposed to the oil in the river over the approximately five days that the oil is in the river before discharging into the Pacific Ocean. This is based on average daily smolt counts at the Bonneville Dam between 2011 and 2015, as well as data from the literature that suggest that smolts linger in the estuary for several days before swimming out to sea. This estimate does not include any additional smolt recruitment that might occur from tributaries in the 40 river miles from the Bonneville Dam to Vancouver.

22. Other natural resources likely to be exposed to oil in the lower Columbia River and estuary include other anadromous fish (i.e., shad, green sturgeon), resident fish (including white sturgeon), pinnipeds (i.e., Steller sea lions, California sea lions, harbor seals), thousands of birds across a wide range of guilds, and other aquatic biota.

23. Based on the likelihood that exposure to oil would cause a suite of adverse impacts to fish and birds exposed to oil in river channel habitats, I estimated a 90 percent service loss in Reach 2 and 75 percent service loss in Reach 1 in 2016, with both reaches recovering to 10 percent service loss in 2017 and no service loss in 2025. Using data in a geographic information system (GIS), the total area of the river channel from Vancouver to the mouth is 16,152 acres of wetland habitats and 91,579 acres of riverine/subtidal habitat. I calculated 21,276 DSAYs of natural resource injury (HEA "debit") for these habitats.

24. With 21,276 DSAYs of debit and 20.5 DSAYs per acre restored, the total quantity of restoration required to offset injuries to river channel habitats is 1,040 acres. At a cost of $110,000 per acre, the total damages for injuries to the river channel habitats would be about $114.4 million.

25. Wetlands in the 100-year floodplain that are not in the designated river channel could be directly exposed to oil if the river stage is high, they could have stranded oil on the

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margins, and the birds residing in the wetlands could be exposed to surface oil on the river channel. I assumed that these floodplain wetlands would suffer service losses because of the oil spill as well.

26. For floodplain wetland habitats, I estimated a 25 percent loss in Reaches 1 and 2 in 2016, recovering to a five percent service loss by the end of 2017, and reaching pre-spill conditions by 2025. For the 29,867 acres of floodplain wetland habitat in these two reaches, the total HEA debit is 10,580 DSAYs.

27. With a total calculated debit of 10,580 DSAYs and a credit of 20.5 DSAYs per acre of marsh restored, the total quantity of restoration required is 517 acres. At a cost of $110,000 per acre, the total damages would be about $56.9 million.

28. The total estimated damages based on the HEA approach for river channel habitats and wetland habitat in the adjacent floodplain is $114.4 million + $56.9 million = $171.3 million. This estimate does not include natural resources damages from potential oil impacts in the Pacific Ocean, along the Pacific Coast, or in the Willamette River. It also does not include an analysis of the value that the public and Indian Tribes place on natural resources in the lower Columbia River. It is likely that this is an underestimate of damages.

B. Train Derailment Scenario

29. According to the DEIS, the effective worst-case discharge for a train derailment is a spill of 20,000 bbls (840,000 gallons) of Bakken crude oil (EFSEC, 2015). The worst-case scenario would be for the oil spill to occur immediately upstream of the Bonneville Dam, with most of the oil going through the spillway and mixing into the water column. This could potentially expose white sturgeon (and other resident aquatic species) to highly elevated PAH concentrations in their protected spawning grounds in the 4.8-mile reach immediately downstream of the Bonneville Dam (Reach 4), in addition to exposing adult salmon migrating upstream to spawn and smolts migrating downstream to the Pacific Ocean.

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30. An estimated 2,000 to 9,000 adult salmon swimming upstream could be exposed to the oil in Reach 4 immediately below the Bonneville Dam, based on 2011-2015 average daily adult salmon counts from the dam in mid-May. Data from the literature suggest that migrating salmon take up to three weeks to travel from the mouth of the river to the dam; all of these daily cohorts of adult salmon could potentially be exposed to PAHs in the water, with lower concentrations with distance from the dam.

31. In mid-May between 2011 and 2015, the daily smolt count at the dam ranged from 27,000 to 220,000. A daily cohort of smolts going downstream with the oil could be exposed to the oil in the river over the approximately five days that the oil is in the river before discharging into the Pacific Ocean. Data from the literature suggest that smolts remain in the estuary for several days before swimming out to sea, potentially exposing additional daily cohorts of smolts to the oil in the estuary.

32. Based on the potential for adverse impacts to fish and birds exposed to oil in the river channel, I estimated a 90 percent loss of habitat services in Reach 4, a 50 percent loss in Reach 3 (which extends to Vancouver), and a 15 percent loss in Reaches 2 and 1 in 2016. I assumed that Reaches 4 and 3 would recover to a 10 percent service loss by the end of 2017 and to pre-spill conditions by 2025. I further assumed that Reaches 2 and 1 would recover to a five percent service loss by the end of 2017 and to pre-spill conditions by 2025.

33. According to data compiled in GIS, the total area of the river channel from the Bonneville Dam to the mouth is 16,687 acres of wetland habitat and 110,316 acres of riverine/subtidal habitat. Assuming the service losses above (and assuming that riverine habitat in Reach 4 provides the equivalent of 100 percent of estuarine marsh services), I calculated 10,135 DSAYs of natural resource injury (HEA debit).

34. With 10,135 DSAYs of debit and 20.5 DSAYs per acre restored, the total quantity of restoration required to offset injuries to river channel habitats is 495 acres. At a

cost of $110,000 per acre, the total damages for injuries to the river channel habitats would be about $54.5 million.

35. Consistent with the methods for the tanker grounding, I assumed that floodplain wetlands would have service losses because of the oil spill. I assumed a 75 percent loss of floodplain wetland habitat services in Reach 4, a 25 percent loss in Reach 3, and a 10 percent loss in Reaches 2 and 1 in 2016. Reach 4 would recover to a 25 percent service loss by the end of 2017 and to pre-spill conditions by 2025. Reach 3 would recover to a 10 percent service loss by the end of 2017 and to pre-spill conditions by 2025. Reaches 2 and 1 would recover to a two percent service loss by the end of 2017 and to pre-spill conditions by 2025.

36. Based on GIS calculations, there are 32,055 acres of wetlands in the floodplain downstream of the Bonneville Dam. Assuming the service loss to these habitats in each reach as described above, I calculated 5,643 DSAYs of natural resource injury (HEA debit).

37. With a total debit of 5,643 DSAYs and a credit of 20.5 DSAYs per acre of marsh restored, the total quantity of restoration required is 276 acres. At a cost of $110,000 per acre, the total damages would be about $30.4 million.

38. The total estimated damages based on the HEA for the river channel and adjacent floodplains is $54.5 million + $30.4 million = $84.9 million.

C. Comparison with Other Spills

39. These estimates of natural resource damages are considerably less than major oil spill settlements such as *Exxon Valdez* or *Deepwater Horizon*. Although damages to natural resources are not scalable based on the volume of oil discharged and vary based on the specifics of each spill, prior oil spill settlement can provide some illustrative context. My review of such settlements suggests that the damage estimates I developed for the hypothetical spill scenarios are generally consistent with other large oil spills.

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III. REFERENCES CITED IN TEXT

Commencement Bay Natural Resource Trustees. 2002. Hylebos Waterway Natural Resource Damage Settlement Proposal Report. Public Review Draft. March 14.

EFSEC. 2015. Tesoro Savage Vancouver Energy Distribution Terminal Facility, Draft Environmental Impact Statement. State of Washington, Energy Facility Site Evaluation Council, Olympia, WA. November.

WDFW. 2014. Skagit Wildlife Area, Fir Island Farms Reserve Unit: Fir Island Farms Final Design Project. Washington Department of Fish and Wildlife. Available: http://wdfw.wa.gov/lands/wildlife_areas/skagit/final_restoration_study.php. Accessed 5/2/2016.

IV. EXHIBITS

Exhibit 1501 ENV: Resume of James V. Holmes

Exhibit 1503 ENV: Potential Fishing Impacts and Natural Resource Damages from Worst Case Discharges of Oil on the Columbia River: Report in the Matter of Application No. 2013-01, Vancouver Energy Distribution Terminal, EFSEC Case Number 15-001. Prepared for Matt Kernutt, Washington Attorney General's Office. Prepared by Abt Associates and Bear Peak Economics. May 6, 2016.

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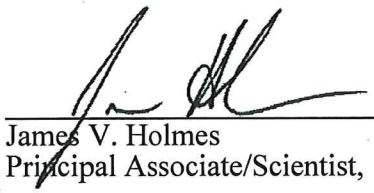
I declare under the penalty of perjury under the laws of the state of Washington that the foregoing is true and correct.

DATED this 12th day of May, 2016.

Abt Associates Inc.



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May 13, 2016

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Re: **Tesoro-Savage Vancouver Energy**
No. 15-001

Dear WEFSEC:

Enclosed for filing please find an original and one copy of the Counsel for the Environment's Pre-Filed Direct Expert Witness Testimony of Eric P. English, Counsel for the Environment's Pre-Filed Direct Expert Witness Testimony of James V. Holmes, and Certificate of Service. Copies have been sent to the parties electronically.

Sincerely,

Meaghan Kohler
Legal Assistant to
Matthew R. Kernutt
Assistant Attorney General

:mlk
Enclosures

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