ENERGY FACILITY SITE EVALUATION COUNCIL

In the Matter of Application No. 96-1, OLYMPIC PIPE LINE COMPANY CROSS CASCADE PIPELINE PROJECT.	NO. **PREFILED TESTIMONY OF : GREG RUGGERONE** **ISSUES: FISH AND FISH HABITAT, ESA, COMPARATIVE RISK TO RESOURCES** **SPONSOR: COUNSEL FOR THE ENVIRONMENT**

Q. Please state your name and employment position.

A. My name is Greg Ruggerone. I am a salmon scientist and vice-president at Natural Resources Consultants, Inc. (NRC). My business address is 4055 21st Avenue West, Suite 100, Seattle, WA 98199.

Q. What is your educational and employment background?

A. Ph.D. Salmon Ecology and Management, University of Washington, 1989.

M.S. Salmon Ecology and Management, University of Washington, 1981.

B.S. Biological Sciences, University of California, Irvine, 1978.

1993-present Vice-President, Fisheries Scientist, Natural Resources Consultants, Inc.

1993-present Affiliated Research Scientist, Alaska Salmon Program, School of Fisheries, University of Washington.

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1990-1993. Principal Fisheries Biologist. University of Washington, Fisheries Research Institute. Project Leader/ Co-PI, Alaska Salmon Program.

1989-1990. Senior Fisheries Biologist. University of Washington, Fisheries Research Institute. Project Leader for the Alaska Salmon Program.

1984-1989. Predoctoral Research Associate. University of Washington, Fisheries Research Institute. Project Leader for the Chignik Lakes Salmon Research Program.

1982-1984. Fisheries Biologist. Jones & Stokes Associates, Inc.

1982. Consultant. BioSonics, Inc.

1979-1981. Research Assistant. University of Washington, Fisheries Research Institute.

1978-1979. Biologist. California Department of Fish and Game.

1979. Biologist. University of California, Irvine. Dept. of Ecology and Evol. Biology.

Q. In general, how did you prepare the testimony you are giving to the Council?

A. I reviewed fisheries reports prepared by Dames & Moore (1997) regarding the proposed pipeline, the OPL draft and revised Application, the preliminary draft and draft EIS for the pipeline. I also reviewed fishery documents such as Williams et al. 1975, Myers et al. (1998), Washington State Salmon and Steelhead Stock Inventory (WDF/WDW 1993), Stock Summary Reports for Columbia River Anadromous Salmonids (BPA 1992). I also reviewed portions of the depositions of Olympic's witnesses Bill Mulkey and Katy Chaney.

I was a participant on the NRC site visit of the proposed pipeline route. I also met with an OPL Engineer, Dames and Moore biologist and several agency personnel during a pipeline stream crossings site visit east of North Bend. During the past year or more, I have participated in discussions with biologists on the NRC Team. I participated in the development of the NRC

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matrix, Exh. SEH-T and Exh. SEH 1-16, and reviewed the Comparative Risk Analysis prepared by Dr. Wes Miller, Exh. JWM-1.

Q. What topics is this direct testimony intended to cover?

A. First, I will explain my experience in assessing potential impacts to fish from proposed land use activities and project developments, and actual impacts to fish from spills of crude oil and refined petroleum products.

Second, I will summarize my review of Olympic's Application with respect to fish and fish habitat, with a special emphasis on fish and fish habitat in eastern Washington.

Third, I will discuss my observations and conclusions regarding the potential impacts to streams and fish along the proposed pipeline route.

Fourth, I will discuss the status of fish stocks under the Endangered Species Act along each of the transport routes within the three Scenarios identified by Dr. Wes Miller.

Fifth, I will discuss the potential impacts from the proposed Cross Cascade Pipeline on recovery efforts pursuant to the state Salmon Recovery Bill and the Governor's Statewide Salmon Recovery Plan.

Finally, I will discuss the comparative risks to natural resources posed by the Scenarios developed by Dr. Miller.

Q. Please explain your experience in assessing potential impacts to fish from proposed land use activities or project developments.

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A. Most of my research during the past 20 years has involved the evaluation and quantification of factors that influence the survival of salmon; I continue my research into salmon run size forecasting with the University of Washington. Presently, I am developing photographic documentation of stream scour and sedimentation effects on coho and chinook salmon redds (nests) in tributaries of the lower Columbia River. The scour and sedimentation impacts are related to land use practices, soil types and flood events. I have classified habitat types of 100 miles of forest streams in the Mount-Baker Snoqualmie Nation Forest, including unlogged and logged areas. I evaluated impacts on salmon of the proposed construction of a hydroelectric dam on Susitna River, Alaska. More recently, I reconstructed the historical salmon runs to a major tributary of the Snake River in an effort to evaluate the impact of two dams built in the early 1900s.

Q. Please explain your experience in assessing natural resource damages caused by spills of crude oil and refined petroleum products.

A. I have conducted a variety of studies involving the impacts of the *Exxon Valdez*, *Glacier Bay*, and *Braer* oil spills, and participated in field research on the effects of crude oil on intertidal communities. The *Exxon Valdez* and *Glacier Bay* spills were spills of Alaska North Slope crude oil. The *Braer* oil spill was a spill of light crude, which is closer in its properties to refined product than to heavy crude. I was the primary author of a report that evaluated the impacts of the *Braer* oil spill on marine fishes, farmed salmon, and shellfish. This spill in the Shetland Islands was considerably larger than the *Exxon Valdez* spill.

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I recently completed a study of juvenile salmon growth affected by large spawning escapements caused by *Exxon Valdez* oil spill and evaluated the effects of the oil spill on salmon growth in the marine environment. Kodiak Island and Cook Inlet rivers experienced larger than normal escapements caused by the presence of oil on fishing grounds that led to fishery closures. This study demonstrated that the large spawning escapements to Kodiak Island and Cook Inlet rivers led to reduced growth of sockeye salmon for several years after the spill. The lake systems continue to show signs of instability in that juvenile growth can be exceptionally small after a moderate spawning escapement. These studies demonstrate that oil spills may impact the environment in unexpected ways. For both the *Exxon Valdez* and *Glacier Bay* oil spills, I provided expert witness testimony on lost salmon harvests caused by the presence of oil on the fishing grounds. At Coal Oil Point, Santa Barbara, I participated in a rocky intertidal study to evaluate the impact of crude oil on this intertidal community.

Q. Have you reviewed the discussion of fish and fish habitat in Olympic's Revised Application and technical reports?

A. Yes. I reviewed Olympic's Revised Application and the technical report titled, Fisheries and Aquatic Resources, and I have prepared a report that focuses on the fish issues east of the Cascades. The report is attached to my testimony as Exh. GTR-1. Kurt Nelson of the Tulalip Tribes made a similar review with respect to fish issues west of the Cascades. See Exh. KDN-T and attached exhibits.

Q. Please summarize the conclusions reached in your report.

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A. The Fisheries section of the Revised Application (Section 3.4.4) used agency documents to characterize fish and fish habitat throughout the state. These documents lack the detailed site-specific information necessary to characterize fish use and habitat at each stream crossing.

The Application concludes that potential impact to fishes and their habitat as a result of pipeline construction is small and limited in area. The analysis leading to this conclusion is incomplete. The Application also describes the impacts of a product spill as small and limited in area. However, no toxicological data, spill volume data, or estimates of potential hydrocarbon concentrations in streams following a spill are provided.

The Application needs to identify salmon and trout spawning habitat in the vicinity of stream crossings, and characterize the habitat in terms of area, gravel composition, and current use by salmonids during each life stage (juvenile rearing, juvenile migration, adult holding, adult migration, spawning). The relative importance of these areas to each species population should be described. This is critically important for ESA salmonids such as summer steelhead proposed as threatened in the middle Columbia River basin area, bull trout listed as threatened in the Columbia River basin, endangered upper Columbia River steelhead trout and upper Columbia River spring chinook salmon proposed as endangered. The Application incorrectly describes the classification of salmon protected under ESA.

The ESA section of the Application failed to mention that NMFS has proposed that many freshwater habitats occupied by listed salmon are proposed for critical habitat designation under the ESA. Proposed critical habitat includes all potential habitat occupied by steelhead in the Columbia River basin, including the Yakima River and its tributaries (64 FR 5740). Most

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of the streams on the east side crossed by the pipeline directly or indirectly support salmonids listed as threatened or endangered under the Endangered Species Act.

The Application failed to quantify stream scouring depth and total meandering stream width at specific stream crossings. This is a serious error because stream scour and lateral channel movement are major factors leading to increased risk of pipeline failure and release of toxic hydrocarbons into streams.

The Application failed to adequately identify mass wasting potential and the effect this may have on pipeline safety. The proposed pipeline route appears to have been selected based on the desire to minimize construction costs; protection of the environment was secondary. Alternative pipeline routes such as that proposed by King County in their comments on the DEIS need to be evaluated.

The Application is severely deficient in its analysis of impacts to fish resources east of the Cascade mountains. Essentially no information related to potential impacts due to pipeline leaks is presented. The application is overly optimistic about the frequency and volume of pipeline spills, especially given the special environmental conditions that may increase pipeline failure, such as stream scour and mass wasting of slopes. Impacts associated with construction activities are lacking or tend to be overly optimistic. Site-specific data needed to evaluate fish impacts by construction activities is lacking. The Application failed to describe potential impacts of construction activities to salmon enhancement programs conducted by the Yakama Indian Nation and other organizations.

A pipeline leak into the Yakima drainage could be devastating to fish populations. The pipeline would cross 157 tributaries of the Yakima River having direct access to fish resources.

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Each crossing has the potential to transport oil product considerable distances downstream, thereby impacting a major portion of the habitat and fish populations. Little opportunity would be available to recover spilled oil in many of these areas. While stronger populations might recover after years or decades, it is possible that some evolutionary significant units (ESUs) within this drainage could be severely damaged.

Q. Have you viewed the route for the proposed Cross Cascade Pipeline?

A. Yes. On October 21 and 22, 1997, I was among the NRC team members who toured the route by car in order to further identify potential impacts that might be associated with construction and operation of the pipeline. Prior to departure, the team identified the pipeline route and key areas of concern on maps together with specific natural resources or geological features which we planned to evaluate on a site by site basis. Although significant portions of the pipeline route were not readily accessible by car especially in Western Washington, we did manage to visit many areas of concern. In all we visited twenty-seven sites during the two day tour.

Q. Did you identify any areas west of the Cascades where, in your opinion, there is a higher probability of pipeline failure?

A. Yes. Two segments of the pipeline contain such areas: Tolt River and North Bend to Snoqualmie Pass.

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Q. What problems did you identify in the Tolt River that cause concern regarding potential pipeline failure?

A. The Cross Cascade Pipeline is proposed to cross the Tolt River at approximately RM 2.8. This flood plain area has extensive areas of shifting gravel and side-channels, and the river crossing here is of great concern. There was extensive evidence of significant lateral channel movement. A primary concern is that the pipeline may not be buried deep enough in the flood plain area adjacent to the primary stream channel. The applicant has provided no scour analysis which would allow a determination of how deep the pipe must be buried. The screening level scour analysis that was conducted was inadequate because it failed to account for site-specific conditions that might influence scour such as land use practices, soil type and actual stream flow data. Potential for impacts due to spills are great in this location.

The lower 6 miles of the Tolt River is one of the primary spawning areas for chinook and pink salmon, and steelhead. This fall, chinook were observed spawning in the vicinity of the pipeline crossing. Testimony of Kurt Nelson, fisheries biologist for Tulalip Tribe, Exh. KDN-T. The lower Tolt River also provides rearing habitat for steelhead, chinook, coho and cutthroat trout. Chinook salmon in the Snoqualmie River basin, including the Tolt River, will likely be listed in March 1999 as threatened under the Endangered Species Act. This means that chinook have a high risk of becoming endangered in the near future and strict regulations will be developed to protect this important resource. Bull Trout are proposed as threatened in the Puget Sound basin and these fish are known to inhabit the Snoqualmie River basin.

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Q. What areas did you identify in the North Bend to Snoqualmie Pass area that cause concern regarding potential pipe failures?

A. In the area of Twin Falls State Park the pipeline route follows the road to the south of the South Fork Snoqualmie River on steep slopes drained by numerous high gradient streams. Although anadromous fish are blocked by Snoqualmie Falls, the Forest Service has identified cutthroat trout in these tributaries. The Applicant proposes to cross most of the streams underground rather than by bridge. Floods in the area have wiped out several bridges, including an old railroad bridge. Sediment and large woody debris coming down slope during a storm event has removed many bridges along this stretch and it is likely this will occur again in the future. Some of the tributaries have significant scouring, which may exceed 8 feet according to West Consultants. The NRC team has concerns about the geological instability and mass wasting due to major timber cutting in the area and the presence of steep slopes. Up-slope timber cuts have caused mass wasting events in the past and could easily do so in the future. The Applicant has made no real attempt to assess such cumulative impacts. Pipeline construction could destabilize these channels, some of which are already highly unstable as demonstrated by the braided channel through the forest. The impacts of a spill may become more severe in a watershed where the resources are already stressed from other impacts.

One of the creeks in this area was highly unstable. Several stream channels meandered through the forest until meeting the road. These steep braided channels suggest the main channel could shift in the future, thereby exposing the pipeline that was not properly buried. These steep gradient streams require a highly qualified stream hydrologist to evaluate potential stream scour and stream meandering during a 50 to 100 year period.

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Another site of concern is Hansen Creek. The bridge construction date is 1994, indicating the old bridge washed out in 1993. The creek shows evidence of major flows, with only large boulder sized rocks visible. The NRC team is concerned about channel instability that might be caused by future timber harvests or flood events in the upper watershed. This again points out the need for an adequate cumulative impacts study before the potential impacts from the proposed Cross Cascade Pipeline can be fully assessed. Up to 15 feet of gravel deposits have been scoured from the existing channel. If stream scour uncovered the pipeline during a major storm or debris flow event, the pipeline could easily rupture and oil would go directly into the South Fork of the Snoqualmie River. The Snoqualmie River above the falls (MP 34 to MP 57) provides habitat for rainbow and cutthroat trout. Other resident fish species include sculpins, longnose dace, mountain whitefish, and large-scale sucker. See testimony of Kurt Nelson, Exh. KDN-T.

Q. Did you make similar findings of locations on the Eastside where you expect a greater likelihood of pipeline failure?

A. Yes. We identified Keechelus Reservoir, Yakima River crossing and Swauk Creek crossing as areas of concern. The pipeline route runs very close to the south side of Keechelus Reservoir and any leakage along this stretch would likely enter the Reservoir. Water from the reservoir is used primarily for irrigation in the Kittitas and Yakima valleys. It also provides instream flows to support anadromous fish pursuant to the treaty rights of the Yakama Indian Nation. Anadromous salmon have access up to the dams that form Kachess and Keechelus reservoirs. Summer steelhead are known to spawn in the mainstem Yakima just below the confluence with the tributary draining Kachess reservoir. Steelhead in the Yakima basin are

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proposed to be listed as threatened under the Endangered Species Act. Limited surveys suggest that 65% of Yakima River spring chinook spawn between Ellensburg and Easton. A spill into the reservoir that migrated out and downstream could have significant impacts on the anadromous fish downstream depending on the time of year the spill occurred.

The issue at the Yakima River crossing is the steep slopes leading up and away from the river. The issue of the steep slopes (~500-1,000 feet) raises questions about the location of pumping stations and cut-offs for keeping large volumes of product from escaping into areas like the Yakima River.

At the crossing location for Swauk Creek, the east facing slope displayed some major slumping where some soil disturbance activity had taken place. These slopes are very steep. The soil type and geologic stability should be carefully examined for this area. We also observed mass wasting of a slope near the confluence of Swauk Creek and the Yakima River.

Q. What conclusions did the NRC team draw from the site visit?

A. The team is especially concerned about several unstable stream crossing areas that could lead to pipeline failures. At a minimum, the following stream crossings should be evaluated for unique environmental problems that might lead to pipeline failure: Tolt River, tributaries of the South Fork Snoqualmie River leading up to the Pass, Swauk Creek and Yakima River. Instability of stream channels is caused by extensive stream scouring and/or lateral movement of the stream channel. Potential scouring and lateral stream movement will likely be influenced and exacerbated by future land development activities, including timber harvests. The Applicant should be required to perform an adequate cumulative impact assessment for this project. The

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NRC team believes that it is imperative that qualified stream hydrologists examine stream crossings and conduct in-depth analyses in order to make site-specific recommendations regarding the safest means to cross streams. The in-depth analysis should incorporate the effects of future land development activities that might alter the characteristics of stream flow and the stream channel.

Furthermore, if the Cross Cascade Pipeline is approved, the team believes that independent construction monitors should be hired to insure that the construction crews follow the prescribed construction guidelines during all phases of construction. Scour chains should be used to monitor scour depth and the chains should be monitored after each large storm event. The stability of steep slopes, especially as the route approaches Snoqualmie Pass, should be evaluated to insure that mass wasting or major ground movements do not affect the pipeline. Future land development activities, especially logging, should be incorporated into this analysis.

Q. Has the Applicant conducted a scour analysis sufficient to determine the required burial depth for the pipeline stream crossings?

A. No. The Applicant, through Dames & Moore, contracted with West Consultants to do a scour study of streams and rivers where the pipeline would cross. The agencies have rejected the study as inadequate. Exh GTR-2, Deposition of Katy Chaney, p. 295, l. 23-p. 297, l. 10; p. 311, l. 3- l. 24. The Applicant does not intend to do further scour analysis until after EFSEC makes its decision on site certification. Exh. GTR-1; Deposition of Katy Chaney, p. 410, l. 12-p. 411, l. 20. This is unacceptable. A scour analysis is critical to determining whether the pipeline route is feasible, and whether proposed burial depths are adequate to protect the pipeline. The total

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meandering width of the stream channel must also be evaluated; this is especially important for rivers such as the Tolt. Not only must a scour analysis be done, but additional monitoring of actual scour depth must be designed. The Applicant's existing north/south pipeline was exposed by scouring where it crosses the Green River. It required Olympic to directionally drill under the Green River and install a new section of pipe. Exh. GTR-3, Deposition of Bill Mulkey, p. 364, l. 12-p. 365, l. 1. The Green River is a relatively low gradient river compared to the streams and rivers in the Snoqualmie Pass area.

Q. What are the potential effects of an inadequate scour analysis?

A. An inadequate scour analysis will lead to pipeline failure if the pipeline is buried too shallow. Storm events would uncover the pipeline and expose it to tremendous forces. If the pipeline company detects the exposed pipeline, they would need to replace the pipeline, thereby causing additional construction related impacts. Greatest stream scour occurs during peak storm flows. Actual scour depth can be difficult to identify without adequate tools because the scoured stream bed can rapidly fill with gravel as the high water level declines.

Q. In addition to streams, do wetlands play a role in providing fish habitat?

A. Yes. Wetlands connected to stream channels can provide rearing habitat for salmon. They are also a source of food production. Wetlands may help minimize the adverse effects of flood events. Off-channel habitats are important wintering habitats, especially during flood events.

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Q. Would construction of a pipeline across wetlands potentially impact their suitability as fish habitat?

A. The actual impacts will depend on site-specific conditions. Construction activities may result in reduced habitat quality caused by removal of vegetation that provide cover for fish. Construction activities could also isolate side channel habitat from the stream, if not constructed properly. Construction activities could also impact water quality through sedimentation.

Q. Would a spill from the pipeline into a wetland impact fish and fish habitat?

A. Yes, there may be a direct impact if the fish and their prey such as aquatic insects are killed. There may be an indirect effect on the growth rate of fish if oil remained in the substrate over time or if the prey species took an extended time to recover.

Q. Briefly describe the status of fish stocks in Washington State relative to the Endangered Species Act?

A. Many genetically discrete salmon, steelhead and cutthroat trout populations (or Evolutionary Significant Units (ESU)) have been petitioned for listing and protection under the Endangered Species Act (ESA). Salmon ESUs have been described as species for the purposes of ESA. As of August 1998, the National Marine Fisheries Service (NMFS) had listed two ESUs in Washington State as endangered or threatened under ESA. (Dr. P. Dygert, NMFS, Pers. Comm. 1998). Endangered species means any species which is in danger of extinction throughout all or a significant portion of its range. Threatened species mean any species which is likely to become an endangered species within the foreseeable future throughout a significant portion of its range.

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In addition to salmon ESUs that have been listed for protection, NMFS has proposed that another eight salmon and steelhead ESUs be considered for protection under ESA. The proposed listing status means that NMFS will decide whether or not to list the species within approximately a one year period. Three ESUs are identified as candidates for proposed listing under ESA. The candidate status means the NMFS is reviewing the biological status of the species and will make a determination in the near future.

Q. What is the ESA status of fish stocks in rivers and streams along the pipeline route?

A. Chinook salmon in Puget Sound, including the Snoqualmie River basin, will likely be listed as threatened in March 1999. Bull trout in the Puget Sound basin rivers is proposed as threatened. Coho salmon in Puget Sound are candidates for listing and a decision on coho status is due in the near future. In the Yakima River basin, bull trout are threatened and summer steelhead are proposed as threatened. Pygmy whitefish are a state protected species in the Yakima basin. In the Columbia River reach near the proposed crossings, upper Columbia River steelhead are classified as endangered and upper Columbia River spring chinook are proposed as endangered.

Q. What is the ESA status of fish stocks along the barge route out the Straits of Juan de Fuca and down the outer coast of Washington?

A. In Puget Sound, chinook salmon will likely be listed as threatened in March 1999. Summer chum salmon in Hood Canal are proposed as threatened and a final determination is due

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March 1999. Ozette Lake sockeye are proposed as threatened. Cutthroat trout in southwestern Washington are proposed as threatened.

Q. What is the ESA status of the fish stocks in the Columbia River from the mouth to Pasco?

A. Chinook Salmon

Lower Columbia River chinook:	Proposed threatened
Upper Willamette River chinook:	Proposed threatened
Upper Columbia River spring-run:	Proposed endangered
Snake River fall-run:	Threatened
Snake River spring/summer:	Threatened

Steelhead

Upper Columbia River:	Endangered
Snake River Basin:	Threatened
Lower Columbia River:	Threatened
Middle Columbia River:	Proposed Threatened
Upper Willamette River:	Proposed threatened

Sockeye Salmon

Snake River:	Endangered

Chum Salmon

Lower Columbia River:	Proposed Threatened

Cutthroat trout

Southwestern Washington	Proposed Threatened

Q. In your opinion, where would a spill of a given quantity of refined petroleum product present the greatest risk to ESA fish stocks?

A. The Yakima River basin salmon and steelhead are probably at greatest risk because threatened steelhead are present in this system year round. Water volumes in the river and

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tributaries are relatively low and concentrations of oil would be relatively great. A pipeline rupture at the Columbia River crossing could cause significant impact to ESA salmon if it occurred when endangered steelhead and chinook adults or juveniles were present, although the large water volume would reduce oil concentration compared to spills in smaller streams. A spill into the Tolt River or other tributaries, such as Cherry Creek or Griffin Creek, could be damaging to chinook salmon (proposed threatened), which inhabit the streams as spawning adults, incubating eggs and alevins, and briefly as fry in the spring. All of these locations are along the route of the proposed Cross Cascade Pipeline.

ESA salmon and steelhead stocks are at greater risk from spills in streams compared to spills in the marine environment because in streams the oil concentration would be greater, the density of fish is greater, more life stages are exposed, fish are more confined and less likely to avoid the spill, the egg and alevin stages are immobile, and the habitat (substrate, woody debris, prey species) would be directly impacted for a longer period of time.

Q. Are you familiar with the state Salmon Recovery Act and the Governor's recently announced Statewide Salmon Recovery Plan ?

A. Yes.

Q. In your opinion, is the proposed Cross Cascade Pipeline consistent with the goals and objectives of the Act and the Plan?

A. No, not as described in the Application. The goal of the Plan is to restore salmon, steelhead and trout populations to healthy, harvestable levels and improve those habitats on which

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the fish rely. Pipeline spill analyses show that oil spills will occur along the pipeline route, if the pipeline is constructed. See Exhibit 1 to testimony of Dr. Wes Miller, Exh. JWM-1. Oil spills in streams may kill salmon and would damage salmon habitat. Construction activities could be damaging to spawning and rearing habitat. The proposed pipeline runs counter to the Salmon Recovery Plan. The pipeline could negate the tremendous expense and effort underway to recover depleted salmon stocks. NRC (1992) estimated that approximately $208 million dollars per year were spent in support of chinook and coho salmon recovery and production efforts in Washington, Oregon, and Idaho during 1987-1990. This expense has likely increased in recent years and will continue to increase once stocks are listed under the ESA and the Salmon Recovery Strategy is implemented.

Q. What experience do you have with oil spills on land?

A. During late November 1998, I visited Avila Beach, California, where a UNOCAL pipeline had ruptured beneath the city. This pipeline leak reportedly went undetected under the city for approximately 10 years. Although some city residents complained of petroleum odors, no response was given until the pipeline exploded. Demolition of much of the city and cleanup of contaminated sediments under city buildings began in late November. UNOCAL has agreed to spend approximately $12 to $18 million on the cleanup effort, which includes several hundred yards of ocean beach. Sheet pile will be used to contain the contaminated sediments. Obviously, the small community of Avila Beach has been devastated by this pipeline leak. This example highlights the difficulty of cleaning up oil spills on land. (Project Avila Resource Manual; Project Avila Update, Vol. 2, 1998; Unocal 76 Public Health Studies of Avila Beach

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Contamination.)

Q. You and Steve Hughes were the primary authors of the Matrix developed to compare impacts to natural resources and habitats from oil projected to spill over the 50 years following construction of the pipeline under each of the three scenarios developed by Dr. Wes Miller. Based upon the matrix analysis, in your opinion what are the comparative risks among the three scenarios?

A. Wes Miller's spill analysis shows that the Cross Cascade Pipeline will spill approximately 1.8 times more oil than the existing pipeline, barge and truck transport method (Status Quo). Exh. JWM-1. A new north/south pipeline would spill approximately the same amount of product as the Cross Cascade Pipeline; approximately 1.6 times the Status Quo. Because Miller's analysis was based on average historical spill values, we believe the Cross Cascade Pipeline would likely spill even more oil compared to Status Quo because of natural hazards such as stream scour in tributaries near the Snoqualmie Pass and mass wasting of steep sided-slopes in the region. Furthermore, pipelines may be more susceptible to failure caused by large earthquakes compared to barging and trucking.

The matrix analysis indicates the oil spill risk to natural resources by the Cross Cascade Pipeline scenario is approximately twice that of the Status Quo scenario. The New North/South Pipeline scenario also presents a greater risk to natural resources compared to the Status Quo scenario. The matrix analysis indicates salmon and aquatic communities are at greatest risk compared to other species groups or communities. These resources are highly valuable in the geographic areas spanned by the Cross Cascade Pipeline; any spill into a stream would be carried downstream, thereby impacting a relatively large area of stream habitat.

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Furthermore, species and communities along pipeline routes (as compared to barge and truck routes) are more vulnerable to spills because pipeline leaks can go undetected for long periods, access to the spill site for clean up can be difficult especially during winter, cleanup on land and streams would be more difficult compared to cleanup on navigable waterways and highways, oil concentrations and toxic effects are higher in smaller water bodies, and many species groups are immobile (e.g., wetlands).

These vulnerability factors and the increased likelihood of spill events along the Cross Cascade Pipeline route were not quantified in the matrix evaluation. Additionally, construction related impacts were not considered by the matrix analysis. Thus, the relative risk to natural resources caused by the Cross Cascade Pipeline scenario is considerably greater than indicated by the matrix. Finally, the Cross Cascade Pipeline puts at risk resources that are now not at risk from oil spills.

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