3.7 FISHERIES

3.7.1 Affected Environment

The pipeline corridor would cross through several major watersheds between Woodinville and Pasco. These include (from west to east) the Sammamish, Snohomish, Snoqualmie, South Fork Snoqualmie, Yakima, and Columbia River Basins. The pipeline corridor ends at an existing terminal on the north shore of the Snake River.

OPL has identified 293 rivers, streams, and irrigation canals that the pipeline corridor would cross (see the EIS Map Supplement). Numerous small, intermittent or ephemeral channels with a defined bed and bank would also be crossed, many of which have not yet been cataloged because of their small size. The water courses crossed by the pipeline corridor support habitat for a number of fish species including salmon, steelhead, trout, warmwater gamefish, and non-game fish (Table 3.7-1). Crossings supporting fish and species present are listed in Appendix D. Some streams that the pipeline would cross do not support fish or provide only low-quality fish habitat, but they contribute to the water quality of fish-bearing waters downstream.

3.7.1.1 Threatened and Endangered Species

Several fish populations present in the area of the proposal are either listed as threatened or endangered, are proposed for federal listing, or are candidate species for federal listing under the Endangered Species Act (ESA). These listings and proposals are shown in Table 3.7-1.

On March 9, 1998, the National Marine Fisheries Service published a proposed rule to list the Puget Sound chinook salmon evolutionarily significant unit (ESU) as threatened, and to propose designation of critical habitat for this ESU (63 FR 11481). The Puget Sound chinook salmon ESU consists of all naturally spawned spring, summer, and fall runs of chinook salmon in the Puget Sound region from the North Fork Nooksack River to the Elwha River (inclusive). Within the project area, the Snohomish River mainstem, the Tolt River, and Cherry and Harris Creeks support Puget Sound chinook salmon.

On June 10, 1998, the USFWS listed the Columbia River population segment of bull trout as threatened (63 FR 31647) and proposed to list the Coastal Puget Sound population segment of bull trout as threatened (63 FR 31693). The Columbia River bull trout population segment occupies the Columbia River Basin, including the mainstem and all tributaries, to the U.S.-Canadian border (except the Jarbidge River population segment in Nevada). Within the project area, Keechelus Lake and many of its tributaries, and the Yakima River and many of its tributaries, support this bull trout population segment (see Appendix D). The Coastal Puget Sound population segment of bull trout encompasses all Pacific Coast drainages between the Columbia River and the Canadian border. Within the project area, bull trout occur in the Lake Washington and Snohomish River Basins.

Table 3.7-1. Presence and Status of Fish that Occur in the Proposal Areas

Common Name	Scientific Name	State & Federal Status[a]
Anadromous Fish		
Chinook Salmon (Upper Columbia River spring run ESU)	*Oncorhynchus tshawytscha*	PFE, K, 2, 3
Chinook Salmon (Puget Sound ESU)	*Oncorhynchus tshawytscha*	PFT, 2, 3
Chinook Salmon (Snake River, fall run ESU)	*Oncorhynchus tshawytscha*	FT, 2, 3
Chinook Salmon (Snake River, spring/summer run)	*Oncorhynchus tshawytscha*	FT, 2, 3
Chinook Salmon (other ESUs)	*Oncorhynchus tshawytscha*	S, 2, 3
Chum Salmon (Puget Sound/Straits of Georgia ESU)	*Oncorhynchus keta*	2, 3
Coho Salmon (all ESUs)	*Oncorhynchus kisutch*	FC, 2, 3
Pink Salmon (all ESUs)	*Oncorhynchus gorbuscha*	2, 3
Sockeye Salmon (Snake River ESU)	*Oncorhynchus nerka*	FE
Sockeye Salmon (all other ESUs)	*Oncorhynchus nerka*	2, 3, R, S
Cutthroat Trout (Sea-run)	*Oncorhynchus clarki*	FC, 3
Steelhead (Upper Columbia River ESU, above Yakima River)	*Oncorhynchus mykiss*	FE
Steelhead (Middle Columbia River ESU including Yakima River)	*Oncorhynchus mykiss*	PFT, S, K
Steelhead (Snake River)	*Oncorhynchus mykiss*	FT
Steelhead (Puget Sound ESU)	*Oncorhynchus mykiss*	3
Dolly Varden (anadromous form)	*Salvelinus malma*	3
Bull Trout (Coastal-Puget Sound population segment)	*Salvelinus confluentis*	PFT, 3
Resident Salmonids		
Rainbow Trout	*Oncorhynchus mykiss*	3, K
Native Redband Trout (interior Rainbow Trout)	*Oncorhynchus mykiss*	S,K
Coastal Cutthroat Trout	*Oncorhynchus clarki clarki*	3
Westslope Cutthroat Trout	*Oncorhynchus clarki lewisi*	3,K
Bull Trout (Columbia River population segment)	*Salvelinus confluentis*	FT, K, S
Eastern Brook Trout	*Salvelinus fontinalis*	
Brown Trout	*Salmo trutta*	
Kokanee Salmon	*Oncorhynchus nerka*	1
Other Species		
White Sturgeon	*Acipenser transmontanus*	2, 3
Green Sturgeon	*Acipenser medirostris*	2, 3
River Lamprey	*Lampetra ayresi*	R
Pacific Lamprey	*Lampetra tridentata*	R
Mountain Whitefish	*Prosopium williamsoni*	
Largescale Sucker	*Catostomus macrocheilus*	
Burbot	*Lota lota*	R
Shorthead Sculpin	*Cottus shotheus*	R
Torrent Sculpin	*Cottus confusus*	R
Sculpins (General)	*Cottus sp.*	
Northern Squawfish	*Ptychocheilus oregonensis*	
Speckled Dace	*Rhinichthys osculus*	
Longnose Dace	*Rhinichthys cataractae*	

Table 3.7-1. Presence and Status of Fish that Occur in the Proposal Areas

Common Name	Scientific Name	State & Federal Status[a]
Bridgelip Sucker	*Catostomus columbianus*	
Yellow Perch	*Perca flavescens*	
Walleye	*Stizostedion vitreum*	3
Largemouth Bass	*Micropterus salmoides*	3
Smallmouth Bass	*Micropterus dolomieui*	3
Brown Bullhead	*Ictalurus nebulosus*	
Pumpkinseed	*Lepomis gibbosus*	
Pygmy Whitefish	*Coregonus clupeaformis*	1, 2, R
Carp	*Cyprinus carpio*	
Black Crappie	*Pomoxis nigromaculatus*	
Western Brook Lamprey	*Lampetra richardsoni*	
Bluegill	*Lepomis macrochirus*	
Three Spined Stickleback	*Gasterosteus aculeatus*	
Goldfish	*Carassius auratus*	
Redside Shiner	*Richardsonius balteatus*	
Leopard Dace	*Rhinichthys falcatus*	
Mountain Sucker	*Catostomus platyrhynchus*	
Longnose Sucker	*Catostomus catostomus*	
Peamouth	*Mylocheilus caurinus*	
Lake Chub	*Couesius plumbeus*	
Chiselmouth	*Acrocheilus alutaceus*	
Channel Catfish	*Ictalurus punctatus*	3
Sandroller	*Percopsis transmontana*	2
White Crappie	*Pomoxis annularis*	

Source: WARIS (WDFW 1995)

[a] State priority designations: 1 = listed and candidate species, 2 = vulnerable aggregations, 3 = important recreational or commercial species.

FC = federal candidate
FE = federally listed as endangered
FT = federally listed as threatened
PFE = proposed for federal listing as endangered
PFT = proposed for federal listing as threatened
S = sensitive species (USFS, BLM)
K = listed as key salmonid by the Interior Columbia River Basin Ecosystem Management Project (ICRBEMP)
R = listed as narrow endemic or special status fish by ICRBEMP

The middle Columbia River steelhead ESU was proposed for listing as threatened on March 10, 1998 (63 FR 11797). The middle Columbia River steelhead ESU occupies the Columbia River Basin and tributaries above (but excluding) the Wind and Hood Rivers upstream to and including the Yakima River. Within the project area, the Yakima River mainstem and Cabin, Big, Little, and Swauk Creeks support middle Columbia River steelhead.

The upper Columbia River steelhead ESU was listed as endangered on August 18, 1997 (62 FR 43937). The upper Columbia River steelhead ESU occupies the upper Columbia River Basin from (but excluding) the Yakima River upstream to the U.S.-Canadian border. Within the project area, the Columbia River mainstem and Getty=s Cove support upper Columbia River steelhead.

The upper Columbia River spring-run chinook salmon ESU was proposed as endangered on March 9, 1998. Although this ESU occupies areas upstream of the project area (above Rock Island Dam), upper Columbia spring-run chinook salmon would use the mainstem Columbia River in the project area as a migration corridor. The mainstem of the Columbia River, including reaches in the project area, has been proposed for designation as critical habitat for this ESU.

The Snake River steelhead ESU was listed as threatened on August 18, 1997 (62 FR 43937). The Snake River steelhead ESU occupies all of the Snake River Basin. Within the Snake River Basin, the Snake River fall-run chinook salmon (threatened), the Snake River spring/summer-run chinook (threatened), and the Snake River sockeye salmon (endangered) ESU have been also been listed (57 FR 14653, 57 FR 14653, and 56 FR 58619, respectively). Within the project area, the mainstem Snake River near the Pasco Terminal is known to support these ESUs.

Several additional fish species could be listed or proposed for listing within the operational time frame of the proposal. These include coho salmon, sea-run cutthroat trout, and westslope cutthroat trout.

3.7.1.2 Priority and Sensitive Species

Most Washington Priority Species that utilize the proposal area are game or commercial species with locally healthy populations. Sandroller, sturgeon, and pygmy whitefish may form vulnerable aggregations during spawning. However, green sturgeon are unlikely to form these aggregations in the proposal area. Additionally, pygmy whitefish is a relict species found in a few deep glacial lakes in the state, such as Keechelus Lake; the species is protected because of its spotty distribution.

The Northwest Forest Plan has identified a number of salmon, steelhead, and trout populations within the proposal area which are considered species at risk of extirpation. These include chinook salmon, sockeye salmon, steelhead, and bull trout. Bull trout has also recently been identified as a regional sensitive species in the USFS Pacific Northwest Region. The Mt. Baker-Snoqualmie National Forest Plan (USFS 1990a) identifies chinook, coho, pink, and chum salmon, steelhead, searun cutthroat trout, and rainbow, cutthroat, and bull trout as management indicator species (MIS). The Wenatchee National Forest Plan (USFS 1990b) identifies redband trout as sensitive, and westslope cutthroat as an MIS.

The Interior Columbia Basin Ecosystem Management Plan (CBEMP), sponsored by the USFS and BLM, lists all interior Columbia Basin stocks of chinook salmon, rainbow trout and steelhead, bull trout, and westslope cutthroat trout as key salmonids. The scientific assessment for the CBEMP also lists a number of species found in streams along the pipeline corridor as narrow endemic and special-status fish species. Key salmonids, and narrow endemic and special-status fish, are listed in Table 3.7-1.

3.7.1.3 Fish Habitats and Utilization

This section describes conditions and species habitat present within major river drainages within the proposal area. Information provided in the ASC and used for this analysis was obtained from Dames & Moore (1997) WDFW (WARIS), Washington Department of Natural Resources (Data96), and USFS (GIS) databases; stream surveys conducted by OPL; literature sources; and agency contacts. Maps identifying crossing locations are provided in the EIS Map Supplement, and fish utilization at crossings is detailed in Appendix D. The crossing numbers for crossings discussed below are identified in parenthesis.

Sammamish River Basin. The pipeline corridor crosses six channels (1 to 6) within the Sammamish River Basin (a tributary to Lake Washington) including Little Bear Creek (a tributary stream to the Sammamish River) and five unnamed tributaries to Little Bear Creek. The Little Bear Creek crossing (1) provides spawning habitat for coho salmon and summer rearing habitat for coho, chinook, and sockeye salmon, and cutthroat trout. An unnamed tributary crossing (4) provides spawning habitat for coho and rearing habitat for salmon and trout. The other crossings in the basin are not known to support fish. All crossings within the Sammamish River Basin are within the BPA electric transmission line corridor.

Snohomish River Basin. Two stream crossings are proposed in the Snohomish River drainage: Anderson Creek (7) and an unnamed tributary to Anderson Creek (8). A number of barriers and disturbance from construction of the Echo Lake Golf Course likely limit fish use at these crossings. Both streams were dry at the proposed crossing locations during late summer surveys conducted by Dames & Moore.

Snoqualmie River Basin. The Snoqualmie River Basin within the proposal area includes the area drained by the mainstem Snoqualmie River and tributaries, between its confluences with the Snohomish and South Fork Snoqualmie Rivers. Within this basin, the Snoqualmie River and its tributaries can be divided into three subbasins: lower (9 to 21), middle (22 to 27), and upper (28 to 39).

The lower section of the Snoqualmie River includes the lower 19.3 km (12 miles) of the river and its tributaries, from a few kilometers above the City of Duvall to the confluence with the Skykomish River. The proposed crossings within this reach include Ricci Creek (9), the mainstem Snoqualmie River (11), four unnamed tributaries to the Snoqualmie River (10, 10A, 12, and 13), Peoples Creek (14 and 15), two unnamed tributaries to Peoples Creek (14A and 16), the North Fork Cherry Creek (19), two unnamed tributaries of the North Fork Cherry Creek (17 and 18), Cherry Creek (20), and an unnamed tributary to Cherry Creek (21). Except for the approach and departure from the High Bridge mainstem Snoqualmie River crossing, this segment of the pipeline corridor lies within the BPA transmission line corridor.

The lower Snoqualmie River is a migration corridor for chinook, coho, pink, and chum salmon and steelhead (Williams et al. 1975). Only limited spawning habitat is available; however, the Cherry and Peoples Creek drainages support good to excellent salmonid spawning habitat in their lower reaches.

The pipeline would cross the headwaters of Ricci (9) and Peoples (14) Creeks. These small first- and second-order streams are characterized by small, incised footslope channels, moderate gradients, boulder and cobble substrates, and dense stands of riparian vegetation. These stable streams are lacking winter habitat for salmonids but have some summer rearing habitat and patches of spawning gravel. The crossing sites for these streams are not accessible to anadromous salmonids.

The pipeline would cross five streams in the Cherry Creek Basin. The unnamed tributary to the North Fork Cherry Creek would be crossed twice (17 and 18). The stream at the proposed upstream crossing (17) is a moderately steep, confined channel with a baseflow of approximately 0.03 cubic meter per second (m^3/s) (1 cubic foot per second [cfs]). The small, stable stream is dominated by boulders and large cobble substrates and would favor resident salmonid usage. The dense vegetative canopy shades approximately 80 percent of the stream and is dominated by alder and various shrubs. The Cherry Creek channel at the proposed downstream crossing site (18) is a much lower gradient (1.5 percent), moderately confined channel that is dominated by cobble and gravel substrates. This well-shaded stream segment has a bankfull width of approximately 3 m (10 feet) and supports anadromous salmonids. Juvenile coho salmon were observed during the Dames & Moore survey. Chinook, pink, and chum salmon, steelhead and sea-run cutthroat, resident cutthroat, and rainbow trout also use this reach of Cherry Creek.

The North Fork Cherry Creek was dry at the proposed crossing site (19) during summer surveys. Coho and pink salmon use the lower portion of the creek. The proposed crossing site is a wetland and likely provides winter habitat for salmonids.

The mainstem of Cherry Creek is an excellent stream with a good balance of pool-riffle-run habitat types. Cherry Creek is a moderately confined, moderate gradient (2 percent) channel with overhead cover provided primarily by mature alder trees in the fairly wide riparian zone. There is a good mixture of stream substrate sizes. Suitable spawning gravels were located on gravel bars, which would favor use by winter-run steelhead. Other species that utilize the area include coho, pink, and chinook salmon. Summer rearing habitat for anadromous salmonids was observed where the pipeline corridor would cross the mainstem of Cherry Creek (20).

The middle subbasin of the Snoqualmie River includes an 8 km (5-mile) section from Harris Creek to the Tolt River. This reach of the Snoqualmie River provides a migration corridor, areas for adult holding, and rearing habitat for anadromous fish. Chinook, coho, chum, and pink salmon spawn and rear in the mainstem Snoqualmie near Carnation. The section of the Snoqualmie River at the mouth of the Tolt is a primary spawning area for chinook and pink salmon and steelhead (Nelson 1997). Coho and chum also utilize Harris Creek, with chum spawning in the lower 1 km (0.6 mile) (Williams et al. 1975). Harris, Cherry, and Griffin Creeks are highly productive coho streams. Chinook, coho, chum, and pink salmon utilize the lower Tolt River, with chinook and coho salmon and steelhead ascending higher in the watershed to spawn. With the exception of the proposed crossing of the Tolt River, the pipeline corridor lies within BPA and road corridors.

Harris Creek and the Tolt River are the largest tributaries to the mainstem Snoqualmie River that the pipeline would cross between the Cities of Duvall and Carnation. At the proposed Harris Creek crossing (22), the creek is a low-gradient, meandering channel in a wet meadow. The stream is almost completely shaded by alder, dogwood, grasses, and shrubs. The stream substrate is almost entirely sand/silt and summer baseflow was approximately 0.04 m^3/s (1.5 cfs). This small stream has summer and winter rearing habitat and is utilized by coho salmon and cutthroat trout.

The lower Tolt River is utilized by chinook, coho, chum, and pink salmon and steelhead. At the proposed crossing locations of the Tolt River (26 and 27), the river splits into two distinct channels around an island. The right bank (facing downstream) has been riprapped to protect the county road and private residences during flooding. These moderately confined, high-energy channels are dominated by boulders and cobbles, but spawning gravel was observed on midstream bars. The Tolt River also provides summer rearing habitat for salmon, steelhead, and trout.

The upper Snoqualmie River subbasin includes the mainstem Snoqualmie River and its tributaries from the City of Carnation to its confluence with the South Fork Snoqualmie River. The pipeline would cross several streams in the Griffin Creek (28 to 31) and Tokul Creek (32 to 34) watersheds and the mainstem Snoqualmie River (35 to 39). With the exception of the proposed crossing of Tokul Creek, the crossings would lie within existing BPA, road, and trail corridors.

Chinook, coho, chum, and pink salmon utilize the mainstem Snoqualmie River within this section for migration, spawning, and rearing (Williams et al. 1975). Chinook spawning is intense downstream of Fall City, and some pink and chum salmon also utilize that area. Coho mainly utilize the tributaries, especially Griffin Creek.

In Griffin Creek, the main coho salmon spawning occurs between river miles 3.0 and 5.0. The pipeline corridor would include a crossing of Griffin Creek (28), at river mile 4.3, where the main coho spawning in the stream occurs. The stream is a moderately confined, moderate gradient, footslope channel. Stream substrate is predominantly gravel and cobble, and summer baseflow was approximately 0.04 m^3/s (1.5 cfs). The stream had a bankfull width of about 4.7 m (15.5 feet). Unlike most proposed stream crossings, Griffin Creek has a good amount of large woody debris (LWD) that provides excellent winter habitat for coho salmon and cutthroat trout. The good mixture of pool-riffle-run stream habitats also provides excellent summer and winter rearing habitat for fish.

The pipeline corridor would also cross the headwaters of several small tributaries to Griffin Creek and Tokul Creek (29 to 31 and 32 to 33 respectively), which have summer baseflows less than 0.006 m^3/s (0.2 cfs). At the proposed point of crossing, these tributaries provide little or no fish habitat.

Tokul Creek at the proposed crossing location (34) is a large stream with highly fluctuating flows and heavy bedload movement. The river has a moderate gradient, good pool-riffle-run balance, and suitable substrates for anadromous fish. However, a waterfall located a short distance downstream of the proposed stream crossing location blocks upstream migration of fish. The proposed crossing location provides summer and winter rearing habitat for cutthroat and eastern brook trout. Streambanks are moderately unstable and mature trees are falling into the stream channel. The riparian corridor overstory is dominated by alder and cedar trees. Stream substrate is primarily rubble and cobble, but some spawning habitat was observed by Dames & Moore. WDFW manages a fish hatchery near the mouth of Tokul Creek, approximately 1.6 km (1 mile) downstream of the proposed crossing site. The hatchery water intake is in the Tokul River at that point.

The proposed crossing of the Snoqualmie River (38) would occur approximately 2 km (1.2 miles) above Snoqualmie Falls. Snoqualmie Falls is a barrier to upstream migration of anadromous fish. At the proposed crossing location, the stream provides limited summer rearing habitat for resident fish, primarily rainbow and cutthroat trout.

The pipeline corridor would follow the existing railroad grade and cross Meadowbrook Slough (39) and two unnamed tributaries (40 and 41) to the upper Snoqualmie River. The slough is an old, shallow oxbow of the Snoqualmie River and may support warmwater fish populations. The tributaries are very confined channels that had summer baseflows of approximately 0.03 m^3/s (1 cfs). The streams are almost completely choked with grasses and alders, but could support cutthroat trout.

South Fork Snoqualmie River Subbasin. The South Fork Snoqualmie River subbasin encompasses the area within the South Fork Snoqualmie River drainage to the Snoqualmie Tunnel; it includes 50 proposed stream crossings (40 to 84). The proposed stream crossings within this subbasin generally lie within existing corridors including existing bridges on the South Fork Snoqualmie River, the Cedar Falls Trail, the John Wayne Trail, Homested Valley Road, and Tinkham Road. Portions of the alignment in this subbasin lie within BLM and USFS lands including two stream crossings on BLM lands and 20 stream crossings in the Mt. Baker-Snoqualmie National Forest (see Appendix D for federal ownership at crossings).

This section of the pipeline corridor lies entirely above Snoqualmie Falls which blocks upstream migration of anadromous salmonids. No natural utilization by anadromous salmonids occurs within this section.

The pipeline corridor would cross the mainstem of the South Fork Snoqualmie River twice (42 and 43). Rainbow and cutthroat trout are present in the river at both proposed crossing locations. Both sections of the river provide some trout rearing habitat. At the lower crossing (42), the channel also appears to have some suitable trout spawning habitat.

After crossing the South Fork Snoqualmie River, the pipeline corridor would follow the left bank of the river and cross 48 named and unnamed tributaries. The following discussion of streams at the proposed crossings progresses upstream (easterly) toward Snoqualmie Pass.

The proposed crossing of Boxley Creek (44) would occur approximately 1.3 km (0.8 mile) upstream from its confluence with the South Fork Snoqualmie River. Boxley Creek is an excellent stream for resident trout. Stream habitat types are well balanced, and LWD has created good summer and winter rearing habitat for cutthroat trout. Stream substrate is predominantly gravel, but large amounts of sand/silt were also observed. This may be due to a landslide that enters the creek upstream of the proposed crossing.

East of Boxley Creek, the pipeline corridor crosses 47 first- and second-order streams (named and unnamed) that drain generally northward to the South Fork Snoqualmie River (45 to 84). Most crossings occur within 601 m (2,000 feet) of the South Fork Snoqualmie River mainstem. Most of these streams have very similar habitat characteristics at the proposed crossing locations.

Most of the unnamed tributaries in the South Fork subbasin that would be crossed are small (less than 0.03 m^3/s or 1 cfs), steep drainages, with slopes of 7 to greater than 20 percent. Some provide limited trout rearing habitat at proposed crossing locations and all contribute to water quality in the mainstem.

The named tributaries to the upper South Fork Snoqualmie River include Change (52), Hall (53), Mine (57), Wood (59), Alice (60), Rock (66), Harris (67), Carter (72), Hansen (75), Humpback (78), Olallie (82), and Rockdale (84) Creeks. These streams are quite similar in habitat characteristics, generally steep (5 to 10 percent slopes), and variably incised into unstable glacial till deposits. These channels have naturally unstable banks and high bedload transport rates. Extensive upslope timber harvesting probably has exacerbated these unstable conditions.

Bankfull width ranges from 6 to 9 m (20 to 30 feet). Most of these streams are usually aggraded where the pipeline would cross; however, some streams that have steeper gradients, such as Humpback (78) and Olallie (82) Creeks, appear to be degrading at the proposed crossing locations. Substrates in the South Fork Snoqualmie River tributaries are dominated by large boulders and cobbles, and the summer baseflows are low or intermittent. Riffle is the dominant habitat type.

During past surveys, only a few tributaries to the upper South Fork Snoqualmie River were noted to contain fish (WDFW 1995). However, data collected by the USFS indicate that most if not all of the smaller streams crossed in this section provide some resident trout rearing habitat at or downstream of proposed crossing sites (Paterson pers. comm.).

The mainstem South Fork Snoqualmie River provides rearing and some spawning habitat for rainbow and cutthroat trout. Primarily due to the high gradient, the spawning gravels and bed sediments in this reach of the South Fork Snoqualmie River show little indication of embedded sediments from sediment loading. The primary factor impacting this section of the mainstem river has been the intentional removal of LWD, which accelerates sediment transport to downstream habitats and reduces the number and size of pools and holding water (Pfeiffer 1997).

Yakima River Basin. The pipeline would follow the Yakima River through the middle and upper sections of the basin. The creeks in the Kittitas/Ellensburg area (middle Yakima River) drain irrigated pasturelands and are mixed with numerous irrigation canals and ditches. The creeks draining into the upper Yakima River, including tributaries to Keechelus Lake, are more typical of channels draining forested hillsides. Portions of the alignment in this basin lie within BLM and USFS lands including two stream crossings within BLM lands and 10 stream crossings in the Mt. Baker-Snoqualmie National Forest (see Appendix D for federal ownership at crossings).

Prior to Euroamerican development in the Yakima Basin, anadromous salmonid returns were estimated to have approached 1 million adults annually (Tuck 1994). By 1905, the annual returns had decreased to an estimated 50,000 adults. Although logging, grazing, mining, and other development bear some of the responsibility for this decline, the development of irrigated agriculture was the primary cause.

Traditional water management practices in the Yakima Basin produce extreme low flows in the lower 160 km (100 miles) of the Yakima River. Combined with the elevation of instream temperatures and the loss of juveniles and adult fish in a poorly screened system of irrigation canals and ditches, the impacts of irrigated agriculture have diminished the river=s anadromous fisheries.

Sockeye, summer chinook, and coho salmon are extinct in the Yakima Basin (Tuck 1994). Today, the anadromous salmonid runs consisting of spring chinook and summer steelhead total less than 5,000 adults returning annually. There are currently a number of collective efforts underway to restore conditions for chinook salmon and steelhead in the Yakima Basin.

Upper Yakima River. After passing under Snoqualmie Pass via the railroad tunnel, the pipeline corridor follows an existing railroad grade (John Wayne Trail) that crosses 15 tributaries on the west side of Keechelus Lake (85 to 99). Mill (86) and Cold (88) Creeks have similar habitat characteristics. Both streams have concrete arch culverts that are upstream passage barriers for fish. The streams are moderately confined channels with a 2.5 percent gradient. Stream substrate is predominantly cobble and boulder, with small patches of suitable spawning gravel for resident fish. Both streams have fairly heavy bedload movement under higher flows. Riffle is the dominant habitat type, and the proposed crossing areas provide summer rearing habitat for trout and other fish. Under higher flows, fish would not be able to utilize these areas because of high water velocities and the lack of LWD that would create lower velocity winter habitat.

Roaring (97) and Meadow (99) Creeks are also tributaries to Keechelus Lake, and provide more fish habitat than Mill and Cold Creeks. The moderate gradient channels have a good mix of habitat types where the channels are less confined as they approach the lake. Riffle is the dominant habitat type. Cobble is the dominant stream substrate, but suitable spawning gravel is also present.

Cold, Mill, Roaring and Meadow Creeks are accessible from Keechelus Lake, and stream-spawning fish could utilize these areas. The streams are known to contain resident bull trout and westslope cutthroat trout. Keechelus Lake also contains an adfluvial population of bull trout (they rear in lakes and spawn in streams) and westslope cutthroat trout that utilize these streams for spawning. The bull trout population in this lake drainage is considered depleted and is part of the population that has been recently federally listed as a threatened species. Additionally, the lake contains kokanee salmon and a relict population of pygmy whitefish (WDFW priority 1 and 2 species). Both of these fish could use the creeks for spawning. There is no evidence that the pygmy whitefish population in the lake is currently threatened, but the population is isolated. Overall, the proposed stream crossing sites of Keechelus Lake tributaries have summer and winter rearing habitat and fall and spring spawning habitat.

Below Keechelus Lake, rainbow trout were observed in Mosquito Creek (103). Although it appears to have little spawning habitat, the creek provides both rearing and winter refuge for salmonids.

Stampede Creek (104) is mostly a marshy wetland immediately upstream of the railroad grade. The culvert allows water passage only at high flows. The creek provides considerable spawning and rearing habitat for trout below this marshy area and provides good habitat for rainbow trout.

Several unnamed tributaries (105 to 116) which drain to the mainstem of the Yakima River between Stampede (104) and Cabin (117) Creeks appear to have little fish habitat at the proposed crossing locations, but they contribute to water quality in the mainstem.

The pipeline corridor would cross Cabin Creek along the John Wayne Trail. At the proposed crossing location (117), Cabin Creek is a low-gradient footslope channel dominated by cobble/rubble substrates. The creek is downcutting and has a heavy bedload movement during high flows. The creek lacks woody debris and overhead cover. The streambanks are sparsely vegetated by cottonwood and alders, and most vegetation is outside the bankfull channel. The mainstem of Cabin Creek has summer rearing and marginal spawning habitat for resident and anadromous salmonids at and downstream of the proposed pipeline crossing. Cabin Creek also has extensive upstream spawning habitat and provides valuable winter refuge for salmonids, including spring chinook salmon, summer steelhead, bull trout, and rainbow, westslope cutthroat, and eastern brook trout.

An unnamed tributary to Cabin Creek flows out of an old beaver dam pond that is adjacent to the John Wayne Trail, which is at the proposed pipeline crossing location (118). The pond contains excellent habitat for fish. Floating and submerged woody debris, standing snags, and floating and emergent aquatic vegetation provide cover habitat for adult trout. The pond is surrounded by alder and conifer trees. The pond outlet follows the railroad grade, turns downstream under the Cabin Creek Bridge, and enters Cabin Creek approximately 60 m (200 feet) downstream. The pond and outlet creek provide summer and winter rearing habitat.

The pipeline would cross three unnamed tributaries (120 to 122) to the upper Yakima River between Cabin and Tucker Creeks. These small first-order streams have little summer or spawning habitat value, but they contribute high-quality water to the Yakima River and provide winter refuge for trout.

Tucker Creek (124) is a moderately confined, low-gradient channel dominated by gravel substrate. The creek is actively downcutting due to removal of LWD and riparian vegetation associated with residential property clearing. The water temperature was warm (63EF, 17^{o}C) in August 1995. During normal years, an upstream water user diverts the entire flow of the creek. There is spawning and limited summer rearing habitat for rainbow trout at the proposed crossing site.

The pipeline would cross Main Canal twice (123 and 125), on either side of Tucker Creek. Although it contains a few salmonids that enter through poorly screened irrigation diversions, no spawning or rearing habitat exists in the canal.

Big (127) and Little (129) Creeks have been affected by the clearing of vegetation under the electric transmission lines. The channels are actively moving laterally and/or downcutting in the vicinity of the proposed crossings. Big Creek is a moderate gradient, moderately confined channel dominated by cobble substrates. Little Creek is moderately confined, but has a higher gradient channel (6 percent). The streambanks are dominated by shrubs and small trees such as alder, cottonwood, willow, and vine maple. Both streams lack LWD and instream cover is low. Both creeks provide spawning and summer rearing habitat for salmonids. Spring chinook salmon, summer steelhead, rainbow trout, and westslope cutthroat trout are present in both streams.

Downstream of Little Creek, the pipeline corridor would cross several small tributaries of the Yakima River within or immediately adjacent to the BPA corridor before the pipeline would cross the mainstem. These tributaries are Peterson (130), Granite (131), Spec Arth (132), Tillman (133), and Thornton (143) Creeks and 11 small unnamed drainages (134 to 142, 144, and 145). These first- and second-order streams have predominantly sand substrates. Streambank vegetation is primarily grasses and emergent aquatic plants, with some small trees and shrubs. During the Dames & Moore surveys, the streams either had low baseflow, less than 0.03 m^3/s (less than 1 cfs), or were dry. They have limited fisheries value but contain resident rainbow trout and provide winter refuge habitat.

At the proposed crossing location of the Yakima River (147), the bankfull width is approximately 60 m (200 feet). The well-confined channel was near bankfull during the Dames & Moore field surveys. The 1 percent gradient, meandering channel has a good mixture of stream substrates and is predominantly riffle habitat. Boulder and cobble substrates dominate the center of the channel. The stream margins have mainly rubble, gravel, and sand substrates. Streambanks are lined with willow, alder, and cottonwood trees. The upper Yakima River is an important spawning and rearing area for anadromous and resident salmonids and provides habitat for spring-run chinook salmon, summer-run steelhead, bull trout, and rainbow, westslope cutthroat, eastern brook, and brown trout.

Middle Yakima River. The creeks in central Kittitas County drain flood-irrigated pasturelands and are intermingled with numerous irrigation canals/ditches. The creeks are heavily channelized, frequently culverted, regularly excavated, and often turbid. The riparian areas are very narrow to non-existent. These creeks are managed primarily for water conveyance.

Despite these limitations, some of the creeks the pipeline would cross have fisheries value. The areas above the proposed pipeline crossings and the irrigation diversions usually contain good populations of resident westslope cutthroat trout. The lower reaches near the Yakima River contain fishable populations of rainbow trout with over-wintering and limited trout spawning occurring. However, only a few fish are found in the creek midsections where the pipeline would cross.

Swauk Creek (151) is a low-gradient, moderately confined channel dominated by gravel substrates. The valley bottom width is greater than 150 m (500 feet). The channel is unstable and shows signs of dramatic channel shifts and downcutting, due in part to historic upstream mining activity, and heavy livestock grazing along the streambanks. The channel lacks LWD and overhead cover. Sideslopes are steep, composed of sand/silt sediments, and sparsely vegetated. Although in degraded condition, portions of Swauk Creek provide rearing habitat for spring chinook salmon, and spawning and rearing habitat for summer steelhead, bull trout, and rainbow, westslope cutthroat, and eastern brook trout.

The pipeline would cross Dry Creek four times (156, 157, 160, and 161). Dry Creek is a moderately confined, unstable channel. The substrate is dominated by cobbles. Willows and grasses dot the streambank. The creek was dry during the Dames & Moore survey and provides little if any summer rearing habitat. This watershed is subject to winter flooding and probably contributes heavy sediment loads to the Yakima River. It is possible that the lower reaches of Dry Creek provide winter refuge for salmonids.

Wilson (187) and Naneum (190 and 193) Creeks both provide habitat for rainbow trout. Wilson Creek is a low-gradient, meandering, floodplain channel. The substrate is cobble dominated. Grasses, cottonwoods, and willows provide relatively wide, stable riparian areas. Grasses line moderately stable streambanks.

Naneum Creek (190 and 193) and the unnamed tributary to Naneum Creek (192) are cobble-dominated channels, with moderate gradients and confinement. The grass-lined streambanks are moderately stable. The creek is lined by intermittently spaced willows and cottonwoods. Both streams have high water temperatures, limited summer rearing and spawning habitat for salmonids, and serve as winter refuge for juvenile salmonids.

Parke Creek (201, 205, 206, and 1-A), Coleman Creek (196), Currier Creek (180), and Reecer Creek (166) provide poor habitat conditions for salmonids in the proposal area. These creeks are highly channelized with little riparian vegetation or overhead cover. The warm water often runs turbid and near bankfull with irrigation water. These creeks have limited rearing and spawning habitat for rainbow trout, but provide some winter refuge for juvenile chinook salmon and rainbow trout.

Columbia River Basin. Within the Columbia River mainstem area, the proposal includes crossings of streams and irrigation canals within the Ryegrass Coulee, Rocky Coulee, mainstem Columbia River, and lower Crab Creek watersheds.

The Ryegrass and Rocky Coulee drainages are not known to support significant fish populations.

The proposed Columbia River crossing would be located just downstream of Wanapum Dam (223). This area is influenced by dam discharges and the backwatering effects of Priest Rapids Lake. The streambanks are composed of cobble and gravel substrates and have little vegetation. Because of dam discharges, the stream habitat is primarily run and riffle. The proposed crossing site probably provides spawning and summer rearing habitat for anadromous salmonids, especially fall chinook salmon. Other species of anadromous salmonids, including summer/spring chinook and summer steelhead, migrate past the crossing site. Other salmonids including bull trout and rainbow trout are also present at the crossing location. Other important species that may occupy this reach of the Columbia River include bass, walleye, white sturgeon, and sandrollers. These species could also be present in Getty=s Cove.

OPL is also considering four other alternative crossings of the Columbia River including dredging a crossing north of I-90, attaching the pipeline to the I-90 Bridge, crossing Wanapum Dam, or attaching the pipeline to the Burlington Northern Beverly Railroad Bridge. A number of salmonid and non-salmonid fish species could be present at alternative Columbia River crossing locations, including spring, summer, and fall chinook salmon; steelhead; bull trout; rainbow trout; largemouth and smallmouth bass; walleye; catfish; white sturgeon; sandroller; and numerous other resident fish species.

The proposed crossing sites on lower Crab Creek (244) and its unnamed tributaries (230 to 232, 234, and 236 to 243) are near the Columbia National Wildlife Refuge (crossing 241 is on Refuge land). The streams drain adjacent crop/rangeland and are managed for water conveyance. These low-gradient, meandering channels are dominated by sand substrate (assumed from streambank composition) and have little habitat diversity. The streambanks are dominated by grasses and are stable. The creek does not provide habitat for salmonids in this area, but it provides a winter refuge for salmonids downstream near its confluence with the Columbia River. Historically, lower Crab

Creek provided habitat for interior rainbow (redband) trout and steelhead, but it is doubtful if any native fish still exist in the watershed.

At various times, hatchery steelhead have been planted in Crab Creek. A trout hatchery exists on Rocky Ford Creek in the headwaters of Crab Creek above Moses Lake. Rocky Ford Creek at one time had a variety of cutthroat trout that is now extinct. Rocky Ford Creek and Crab Creek below Potholes Reservoir have spawning populations of introduced rainbow and brown trout.

Crossings of lower Crab Creek that were added as part of the proposal to avoid the Corfu Landslide (H26-c, H26-d, and H26-e) are close enough to Marsh Units 1 and 2 in the Columbia National Wildlife Refuge that rainbow and brown trout stocked in the units find their way down to the creek in the vicinity of these proposed crossings.

The pipeline corridor would cross 38 large and small irrigation canals in this area. Some of the large canals include Main (123 and 146), North Branch (174), Cascade (194 and 203), Highline (207), Royal Branch (233 and 235), Wahluke Branch (258), Eltopia Branch (274), and Esquatzel Diversion (283). Some are lined with concrete, especially where the crossing is near an existing road. These waterways have limited salmonid value. The various canals, ditches, and coulees are warmwater environments that have supported yellow perch, black crappie, pumpkinseed, brown bullhead, largemouth bass, sculpin, and bluegill. Occasional stocked trout from pothole lakes are found in the canals, but reproducing populations of trout do not exist in any of the canals. The straight, featureless canal channels have smooth bottoms and elevated water temperatures. Riparian vegetation along the canals is usually sparse or non-existent due to canal maintenance. These characteristics result in poor habitat in most cases for any kind of fish.

Eagle Lake and Esquatzel Coulee are natural, though modified, water bodies that do not contain salmonids. Eagle Lake drains into the Columbia River, and the Ringold Hatchery is located at the confluence. Most of the flow of Esquatzel Coulee is diverted into the Esquatzel Diversion Channel upstream of the proposed pipeline crossing location.

3.7.2 Environmental Consequences

3.7.2.1 Proposed Petroleum Product Pipeline

Fisheries could be directly or indirectly affected by construction or operation of the proposal. Potential impacts on fish habitat and populations range from physical or chemical changes in water quality, to changes in flow or access, to loss or degradation of physical fish habitat.

Construction Impacts. Construction activities could cause a variety of impacts, including increased turbidity and sedimentation, physical disturbance of fish habitat, effects from hydrostatic test water discharge, accidental spills of drilling muds or hazardous materials, blasting (if required), and blockage of fish migration. Potential construction impacts, including possible effects on special-status species, are described in detail in the following sections.

Turbidity and Sedimentation. Construction of the pipeline would result in increased sediment loading to surface waters crossed or adjacent to the pipeline corridor. The sources of sediment would include in-channel trenched crossings and surface runoff from disturbed upland and riparian areas. Overall, sediment transport to streams during construction of the pipeline is expected to result in a minor, temporary impact to fish from turbidity (lasting hours to days), and a moderate, short-term impact to fish and their habitats from sedimentation (lasting less than 3 years).

Increased sediment loading could affect aquatic biota through increases in turbidity associated with the transport of fine-grained material in the stream, and through deposition of sediment in downstream areas resulting in reduced habitat value for fish and their prey. Suspended sediments, if concentrated, could cause mortality or injury of fish, temporarily reduce feeding efficiency, and/or reduce prey availability. Of particular concern is sedimentation of suspended material within spawning areas. Sedimentation in spawning areas could smother fish eggs or larvae (if present at the time of construction), or lower the quality or quantity of spawning areas by embedding fine sediment in spawning gravels. A detailed discussion of water quality impacts from increased sediment loading is in Section 3.6, Water. The following discusses fishery impacts due to changes in water quality and sediment regimes. Potential impacts are based on the proposal by OPL, including BMPs (see Appendix C).

The severity of impacts from construction-generated sediments at individual crossing sites would depend on several factors including crossing method; types of fish and habitat present at and downstream of the proposed crossing site; amount of bed, bank, and riparian area disturbance; stream and bank gradient and erodibility; number of crossings within basins; effectiveness of erosion control BMPs; and weather and streamflow conditions. Habitats at greatest risk are those containing spawning habitat for salmonids and other sensitive fish species where in-channel construction is proposed (Table 3.7-2).

OPL has identified 293 stream crossings that would be required for the proposal. OPL proposes to use non-invasive construction methods at 127 proposed crossings, including installation over or under culverts, attaching the pipeline to bridges, or boring or directionally drilling the crossings. Where non-invasive crossing methods are proposed, standard BMPs would include erosion control measures, appropriate storage and containment of trench spoils, and placement of secondary containment structures (e.g., filter fences, weed-free hay bales, sand bags) downslope of construction areas (see AAccidental Spill of Drilling Muds@ below for a separate discussion of potential impacts associated with drilling and boring). Although these methods are not 100 percent effective, implementing these BMPs at sites proposed for non-invasive crossing would reduce the potential for sediment transport impacts on fish or fish spawning/rearing habitat to a minor level.

OPL proposes to use invasive methods at 161 to 166 crossing sites (crossing methods to be used at 5 sites are currently undecided and are proposed as being either invasive or non-invasive). Invasive methods include trenching dry channels, flume and trench, divert and trench, and wet trench. Sixty-five streams for which invasive methods are proposed provide fish habitat at or just downstream of the proposed crossing location (see Appendix D). Additionally, 18 of the 65 crossings with fish habitat contain salmon or trout spawning habitat at or just downstream of the proposed crossing site (Table 3.7-2).

Table 3.7-2. Proposed Invasive Stream Crossing Sites with Salmonid Spawning Habitat Present at or just Downstream of Site

Stream Name	Crossing Number	Land Ownership	Type of Spawning Habitat Present
Cherry Creek	20	Private	salmon
Tolt River	26 & 27	Private	salmon
Griffin Creek	28	Private	salmon
Boxley Creek	44	Private	trout
Mine Creek	57	Private	trout
Roaring Creek	97	USFS	bull trout, kokanee, white fish
Meadow Creek	99	USFS	bull trout, kokanee, white fish
Mosquito Creek	103	USFS	trout
Cabin Creek	117	Private	salmon
Tucker Creek	124	Private	trout
Big Creek	127	Private	salmon
Little Creek	129	USFS	salmon
Granite Creek	131	Private	trout
Yakima River	147	Private	salmon
Swauk Creek	151	Private	steelhead, bull trout, cutthroat
Reecer Creek	166	Private	trout
Currier Creek	177	Private	trout

OPL evaluated the feasibility of using non-invasive crossing methods (boring, horizontally drilling, or bridging) to avoid in-channel impacts at stream crossing locations with spawning habitat, or that provide habitat for salmon or sensitive species. However, based on OPL's preliminary analysis, these methods were considered infeasible at these sites because of the presence of subsurface rocks, greater upland habitat impacts from staging and construction, access constraints, steep slopes, or vulnerability of an exposed pipeline to damage (OPL 1998).

OPL proposes to use standard in-channel construction techniques, which include BMPs to minimize sediment impacts to water quality and fish habitat (see the surface water impact analysis in Section 3.6 and the ASC for a detailed description of crossing methods). Construction techniques and other measures OPL has proposed to minimize impacts of the project on fish and water quality are detailed in Appendix C. Important features of the construction methods that would minimize fisheries impacts include:

Table 3.7-3. Construction Timing of Stream Crossings

County	Construction Window
King	June 15 - October 15
Snohomish	June 15 - September 30
Kittitas	June 15 - September 30
Grant	July 1 - September 30
Franklin	July 1 - September 30
Adams	July 1 - September 30
Special Timing Requirements	
Little Bear Creek	June 15 - September 30
Columbia River	October 16 - March 31
Keechelus Lake Tributaries	August 1 - August 15
Yakima River, Swauk Creek	Sept. 1 - Sept. 30 (Sept. 15 - Sept. 30 preferred)
Cabin, Big and Little Creeks	July 1 - August 31

- constructing stream crossings during low-flow, WDFW work windows to minimize the presence of sensitive life history stages of fish (Table 3.7-3);

- narrowing the construction corridor width from 18 to 9 m (60 to 30 feet) within stream channels and riparian areas;

- minimizing sediment transport from active construction sites by constructing crossings when channels are dry, or using flumes or diversions to route water around active construction sites;

- minimizing crossing distance (cross channels perpendicular to flow);

- minimizing equipment disturbance to bed and banks by operating trenching equipment outside the stream channel or, where the stream is too wide, operating equipment from in-channel mats or portable bridges;

- storing trench spoils outside riparian areas and providing secondary containment;

- after bedding the pipeline, backfilling with native material and compacting, except for the top 0.6 m (2 feet) of backfill that would consist of angular material similar in size to existing bed composition;

- maintaining existing channel gradient and habitat characteristics;

- stabilizing streambanks and channel sideslopes;

- slowly releasing water from flume or diversion structures over the construction area to minimize sediment pulse; and
- revegetating the construction corridor.

Even with the above construction practices and BMPs, construction of trenched crossings through or above salmonid spawning habitat could result in a moderate impact.

Because construction of these crossings would not occur when sensitive life history stages are present (when fish are spawning, or when eggs or alevins are present in gravels), direct mortality from sedimentation is not expected. However, construction would result in a short-term (generally less than 3-year) reduction in the quality and/or quantity of spawning habitat at some of the proposed crossing locations.

As part of the permitting process, OPL would be required to mitigate any impacts to fish habitat. Mitigation would vary depending on the location and severity of impacts. Mitigation may include preparation of site-specific construction plans for streams containing sensitive fish habitats, construction and post-construction monitoring, replacement of impacted habitat, or enhancement of existing habitat. The design of site-specific crossing plans and mitigation would be coordinated through state and federal agencies.

Physical Disruption of Habitat. Depending on the location and construction methods used, physical impacts to fish habitat from construction of the pipeline could range from moderate to negligible. This impact category includes alteration of fish habitat such that it is physically modified or unusable for some period of time following construction.

Non-invasive crossing methods are less likely to physically disturb fish habitat. Impacts to fish habitat from non-invasive crossing methods would be limited to a potential temporary increase in sediment loading during the construction period (see ATurbidity and Sedimentation@ above), or with bored or drilled crossings, the potential risk of a bentonite seep (see AAccidental Spill of Drilling Muds@ below). Because of the BMPs included for construction (see Appendix C), sediment transport to streams from non-invasive crossing should be minimized and physical impacts would be minor to negligible.

At sites where invasive methods are proposed, physical channel and riparian disturbance would occur. These impacts would include:

- short-term alteration of stream structures, banks, and substrates within a 9 m (30-foot) wide construction corridor within the stream channel;

- short-term degradation of habitat from sedimentation (see above);

- short-term loss of riparian vegetation from a 6 m (20-foot) section of each bank; and

- long-term loss of riparian vegetation from a 3 m (10-foot) section of each bank that would remain cleared for maintenance of the pipeline.

The direct impact of trenched crossings would be disturbance of a 9 m (30-foot) wide corridor within stream channels. In flowing channels, a number of BMPs would be used to minimize disturbance area and sediment transport from the site (see previous discussion of sediment transport impacts). It is expected that substrates in the disturbed area would resemble natural conditions within 3 years as a result of natural hydrologic processes. This could result in locally reduced fish rearing and spawning habitat quality during that period.

Even with effective implementation of BMPs described here and in Section 3.6, Water, some physical impact of sedimentation downstream of the proposed crossing sites is inevitable. Physical impacts due to sedimentation could range from none to moderate. The extent and severity of sedimentation impacts would depend on a number of factors as discussed in the previous section.

Short- and long-term fish habitat impacts resulting from riparian vegetation removal are expected to be none to minor with implementation of BMPs. In most cases, the types of vegetation to be removed during construction range from none (road or trail beds) to shrubs. However, some trees would be cleared from the 9 m (30-foot) corridor at 22 proposed crossing sites. In the early planning process for the proposal, OPL adjusted the pipeline corridor at several crossings to avoid high-quality riparian areas (primarily trees) and to minimize impacts of riparian vegetation removal. The amount of riparian vegetation to be removed within the construction corridor would be minor in relation to that present in the drainage, and would not substantially alter stream temperatures or LWD recruitment.

All disturbed upland and riparian areas would be planted with approved seed mixtures to reduce post-construction erosion. Riparian areas would be replanted with native shrubs and/or trees, with the exception of a 3 m (10-foot) corridor required for pipeline maintenance. Bank stabilization and revegetation would be monitored and rectified (if necessary) to minimize the potential for long-term impacts (see Section 3.3, Botanical Resources, and Section 3.6, Water).

Hydrostatic Test Water Discharge. Hydrostatic testing of the pipeline at individual stream crossings, testing of the entire pipeline, or testing of storage tanks at the Kittitas Terminal would have negligible impacts on water quality and quantity (see Section 3.6, Water). Therefore, such testing would likely result in negligible impacts to fish or fish habitat.

Accidental Spill of Drilling Muds. OPL proposes to bore crossings at 40 to 44 sites and horizontally drill at one site, the Columbia River. If substantial seeps of drilling muds occurred at the proposed drilled crossing of the Columbia River, impacts to fish and their habitat would likely be moderate. Because of the low fish use within the canals, the probability of impacts to fish at those sites would be negligible to minor.

Occasionally, when crossings are bored or directionally drilled, drilling muds can seep to the surface, potentially resulting in impacts to fish or habitat if muds seep to or are conveyed to streams. Muds could also be conveyed to streams from staging areas. Bentonite, a clay-based mixture, is the most common lubricant used for boring and drilling, and is generally non-toxic. Polymers can also be used in some cases. The mud is pumped down the bore head to lubricate the boring mechanism. When pump pressures are sufficiently high (pressure generally increases with the diameter or distance of a bore), and the bore encounters fractures in the underlying rock, drilling muds may seep to the surface. If seeps occur in a flowing stream channel or if the muds are conveyed to a flowing stream, turbid conditions and sedimentation in the stream could result. This could affect fish by temporarily degrading water quality and potentially affecting fish habitats and prey by sedimentation.

As described in Appendix C, OPL would implement a number of BMPs to minimize the potential of drilling mud conveyance to stream channels, and consequent impacts to aquatic habitats, including:

- geologic survey of proposed bore or drill crossing sites to verify that the method is viable;
- preparation of site-specific construction plans for areas with sensitive resources;
- confined area of disturbance for staging areas;
- installation of primary and secondary sediment confinement between the staging areas and waterways; and
- preparation of a Spill Prevention, Control, and Countermeasure (SPCC) plan that would include close monitoring of drilling mud pressures and downstream waters to rapidly detect seeps and implement spill containment and contingency plans.

Accidental Spill of Hazardous Materials. Direct spills of toxic substances (fuel, oil, or other construction-related compounds) into streams could harm fish, depending on the quantity and concentration of the spilled material. Hazardous materials associated with the construction of the proposal would be limited to substances used for construction equipment, such as gasoline and diesel fuels, engine oil, and hydraulic fluids.

Potential water quality impacts of hazardous materials spills are discussed in detail in Section 3.6, Water. OPL would prepare an SPCC plan to minimize the potential for accidental spills of hazardous materials and, if they occur, to contain and clean up spills. The risk of direct spills and the potential for surface or groundwater contamination would be substantially reduced because fuel and other hazardous materials would be stored in staging areas at least 30 m (100 feet) away from any water body. Additionally, refueling, equipment servicing and maintenance, and storage of equipment would not occur within 30 m (100 feet) of any water body.

If a spill should occur, it would be contained and contaminated soils would be removed to an appropriate facility for treatment and/or disposal. The appropriate regulatory agencies would be notified immediately of any spill and cleanup procedure.

Acoustic Shock to Fishery Resources. Although not yet identified as being necessary, it is probable that construction within some areas in or near streams may require blasting bedrock. The detonation of explosives in or immediately adjacent to fish habitat could cause disturbance, injury, or death to fish and destruction or alteration of their habitats.

Blasting can affect fish by two different mechanisms depending on where charges are placed (Wright 1982). If the charge is detonated in water, it produces a post-detonation compressive shockwave which can rupture the swim bladder (a gas-filled organ which maintains fish buoyancy) or affect other organs. Fish eggs and larvae can also be affected by this pressure wave. When a charge is detonated next to fish-bearing waters, the charge sets up a vibration, which may damage incubating eggs.

Potential impacts of blasting (if it is required) could range from major to none depending on the location and timing of the explosion (Wright 1982, 1994). The impact would be major if it resulted in the mortality of federally listed or proposed species, or if it occurred in an area that affected concentrations of salmon or their eggs or fry. The impact would be low to none if it occurred in or near non-fish-bearing waters or waters with poor fish habitat. In general, mechanical excavation is preferable to blasting if fish are in the immediate area.

Based on studies conducted by the Canadian government (Munday et al. 1986), measures to reduce the impact of blasting may include:

- # a thorough evaluation of the objective of blasting to ensure that blasting is the only method available;
- # careful planning of the blast program to minimize the size and damaging effects of charges;
- # removing and excluding fish from areas potentially affected by the blast through electroshock capture or other methods; and
- # timing the blasting program to avoid periods of high fish presence.

If blasting is required in or near fish-bearing streams, OPL would contact appropriate permitting agencies to meet requirements. If blasting is required in or adjacent to streams supporting federally listed or proposed species, OPL would also be required to contact USFWS and/or NMFS. Construction, including blasting in or near streams, would only be performed during authorized in-water work windows based on WDFW procedures for the protection of salmon and their eggs (see Table 3.7-3). OPL has indicated that resident fish would be removed from stream crossing areas when blasting is necessary. Procedures to follow if blasting is required would be clearly defined in the Section 404/10 permit, USFS and BLM plans of development, or other approvals.

Guidelines developed by the Canadian government (Wright 1994) may be useful in preparation of blasting plans and other additional measures to minimize or avoid potential fish impacts. (See the AAdditional Proposed Mitigation Measures@ at the end of this section.)

Blockage of Fish Movement and Migration. The proposal is expected to result in negligible impacts in regard to the blockage of fish movement or migration. Fish movement would be restricted at invasive crossing sites during construction; however, most crossings would be completed within a few days, and construction would be timed to avoid important migrational periods of fish. Larger river crossings such as the Tolt and Yakima Rivers and Getty=s Cove would take longer to construct (1 to 2 weeks). Diversions which would only block a portion of the channel would be used for larger invasive crossings. Diversions could impede fish movement, but movement would not be completely blocked during construction. Again, construction of these crossings would occur outside important migration periods.

The proposal does not include the placement of new permanent culverts, but temporary culverts may be installed to facilitate equipment movement during construction and some culverts may be replaced. Temporary culverts would be removed after construction, and stream channels at culvert and crossing locations would be restored to pre-construction conditions. Thus no residual blockage of fish movement corridors is anticipated. If existing culverts are replaced at agency request due to poor condition, inadequate sizing, or as additional mitigation (see below), culverts would be designed to maintain fish passage.

Federally Listed or Proposed Threatened or Endangered Fish Species. Federally listed fish species or fish species proposed for listing could be affected by the proposal (see Table 3.7-2). Impacts to these species are expected to be none to moderate with the implementation of BMPs.

Puget Sound Chinook Salmon. The Snoqualmie River mainstem, the Tolt River, and Cherry and Harris Creeks support Puget Sound chinook salmon, which has recently been proposed for listing as threatened. With the exception of the Snoqualmie River crossing (which would be bridge attached), invasive crossing methods would be used at these crossing locations (fluming or diverting water around the crossing site during construction). Spawning habitat for Puget Sound chinook salmon is present at the Tolt River and Cherry Creek crossing sites. Invasive crossing methods used at these sites would have a moderate impact on physical spawning habitat.

As discussed earlier in this section, OPL proposes to use standard construction BMPs to minimize potential water quality and physical habitat impacts to fish, including those federally listed and species proposed for federal listing. Construction timing would avoid sensitive periods when fish are spawning or migrating, or when eggs or aleviens are present in gravels. However, there would be a short-term (generally less than 3 years) impact on the available quantity and quality of spawning areas at each site. If construction occurs after the species is officially listed, the construction at these sites could constitute a Atake@ of the species. Issues of Atake@ would be evaluated as part of Section 7 consultation for the project. As part of the permitting process, OPL would be required to design crossings to avoid impacting federally listed species. Mitigation for any short-term loss of habitat would be negotiated with NMFS and WDFW.

Columbia River Bull Trout. The Columbia River bull trout population segment has been federally listed as threatened. Bull trout populations are present in areas potentially affected by the proposal including Keechelus Lake, the Yakima River, the Columbia River, and several of their tributaries (see Appendix D). It is also possible that bull trout populations may utilize other streams in the Yakima Basin that would be crossed by the pipeline corridor. WDFW is presently surveying the Yakima River Basin for bull trout and would likely find additional populations.

The proposed pipeline corridor along Keechelus Lake lies within the John Wayne Trail, and crosses 4 named and 11 unnamed tributaries to the lake. OPL proposes over- or under-culvert crossings for all unnamed streams and Mill and Cold Creeks (86), and diversion and trenching of Roaring (97) and Meadow (99) Creeks. Construction of stream crossings using non-invasive methods is expected to have negligible to minor impacts on bull trout with effective implementation of BMPs. Construction of crossings would occur during the USFS preferred construction window of August 1 to August 15 between the emergence of spring spawning salmonid fry and bull trout spawning activity, which would minimize the potential for a take of this species. Because this window can shift due to weather conditions each year, OPL will verify construction timing with USFS during the year of construction.

Diverting and trenching crossings of Roaring and Meadow Creeks could have a minor to moderate but localized impact on bull trout spawning habitat below the proposed crossing sites. Even with implementation of BMPs, some sediment from construction is likely to be deposited in these spawning areas. Substrate data from the channels of Roaring and Meadow Creeks below the crossings have not been gathered at this time. Alternative non-invasive crossing methods are being evaluated for these crossings. Based on preliminary reports, boring or directional drilling below the streambed at these crossings would not be feasible due to subsurface rock, and the existing bridges are inadequate for supporting the pipeline (Dames & Moore 1997).

Alternative crossing methods are being considered for Cabin Creek (117), Yakima River (147), and Swauk Creek (151) because they are known to support bull trout. Preliminary reports indicate that boring or drilling would not be feasible at Cabin Creek due to subsurface rock, and the existing bridge is inadequate for supporting the pipeline. Boring would not be feasible at the Yakima River crossing because the water table is shallow, the site would be too constricted for drilling, and no access would be available on the west side. Boring would not be feasible at the Swauk Creek crossing due to the required depth of the launch and receive pits, impracticality of drilling in subsurface rock and on steep slopes, and technical infeasibility of bridge construction.

Species Present at Columbia River Crossing. Upper Columbia River steelhead (endangered), Upper Columbia River chinook salmon (proposed endangered), and middle Columbia River steelhead (proposed threatened) could be present at the crossing of the Columbia River and at Getty's Cove. Horizontal drilling of the Columbia River crossing would result in minimal impacts to listed and proposed salmonids. However, as discussed earlier, there is some potential for seepage of drilling muds to water bodies crossed using drilling or boring methods. If conditions appear feasible and agency approval is granted, OPL would also implement drilling BMPs to identify seeps should they occur. These BMPs include close monitoring of drilling fluid pressures, and monitoring water conditions downstream of the crossing site.

All fish species found in this reach of the Columbia River could be present in Getty=s Cove, including federally listed or proposed species. OPL would cross this cove using the divert and trench method. Construction of the crossing would resuspend sediments, temporarily increasing turbidity and possibly pollutant concentrations, and could lower dissolved oxygen due to the relatively confined nature of the cove. Impacts to fish could range from minor to moderate.

Species Present at Snake River. Threatened spring/summer and fall-run chinook salmon and endangered sockeye salmon are present in the Snake River near the terminus of the pipeline corridor. The proposal is not expected to result in negative impacts to these species because construction would not affect water quality or habitat within the Snake River.

Construction Impacts - Columbia River Approach Options. There are no significant fisheries resources within the segment of the pipeline corridor affected by the proposed YTC route (crossings 1-A to 1-M) or the alternative YTC segment options (crossings 207 to 215).

Construction Impacts - Columbia River Crossing Options. In addition to the proposed Columbia River crossing method (horizontally drill a crossing below Wanapum Dam), OPL has identified four alternative Columbia River crossing routes: dredging a crossing north of I-90, attaching the pipeline to the I-90 Bridge, crossing the Wanapum Dam, or attaching the pipeline to the Burlington Northern Beverly Railroad Bridge. There are also various approach routes to the alternative crossing sites.

The alternate routes for the dredged and I-90 crossings of the Columbia River continue east on the north side of I-90, cross the river, and continue south along the east side of the Columbia River, rejoining the proposed alignment approximately 25 km (4 miles) east of Wanapum Dam. With the exception of the Columbia River, streams crossed by these two alternative routes (crossings 24a to 24c) do not appear to provide fish habitat. Fish, including federally listed and proposed species, do occur in this reach of the Columbia River. There would be negligible impacts to fish if the pipeline crossed the Columbia River via the I-90 Bridge, the Burlington Northern Bridge, or Wanapum Dam. Impacts to fish from crossing the Columbia River via a dredged crossing would be greater than the proposed drilled crossing, and could be moderate to major. Dredging the Columbia River would result in resuspension of sediments, temporarily increasing turbidity and possibly pollutants which could affect fish.

There are also several alternative approach routes which originate north of I-90 and extend to the proposed crossing location (crossing 223) and the Burlington Northern Railroad Bridge crossing. None of the streams crossed by these alternative alignments provide fish habitat with the exception of the alternative route segment which crosses Johnson Creek (crossing 222). Johnson Creek is known to provide salmon spawning habitat.

Operational Impacts. Operational impacts on fisheries are those impacts resulting from maintenance or operation of the proposal. Routine maintenance activities would normally be minimal, including inspection of the pipeline corridor and occasional vegetation management within a 3 m (10-foot) wide corridor. Under normal conditions, operation of the proposal should have no to minor effects on fisheries. However, an accidental spill from the pipeline, depending on the location and severity, has the potential to have a major impact on fisheries.

Biological impacts of a spill include direct impacts of the spilled product on the organism (e.g., acute or chronic toxic effects and smothering). Other important impacts include modification of habitat by destroying or damaging vegetation, or modification of in-channel habitats important for fish spawning or rearing either by the spill or through the cleanup efforts (e.g., removing contaminated soil or building access roads or fire breaks). A spill or cleanup could also affect organisms that serve as food for fish.

Spill scenarios for spill events at waterway crossings are presented in the ASC product spill analysis (OPL 1998). The assessment of impact was made using the following five factors:

- the types of products spilled,
- the size of the spill,
- the local conditions at the time and place of the spill,
- the receptors of the impact and their characteristics, and
- the specific emergency response and cleanup activities used.

Scenarios are presented for Little Bear Creeks, Harris Creek, Olallie Creek, Keechelus Lake, Yakima River, Columbia River, and Crab Creek. The ASC product spill analysis concluded that there would be a measurable but small probability of spills from the proposed pipeline at waterway crossings. If spills occur at waterways, fish would experience a major but relatively short-term (days to months) impact. Impacts would be more significant if they occurred to a discrete salmonid run or to a listed species, either of which could measurably affect a population. In streams and rivers, impacts can extend to a broad area, but the dynamic nature of the environment also tends to dilute and reduce impacts with time. Long-term chronic impacts are potentially less significant due to naturally occurring mechanisms in the environment that buffer, disperse, absorb, or degrade material introduced to the environment by an accidental release.

OPL would prepare an SPCC plan, including maintenance, monitoring, and emergency management, to minimize the potential and impact of spills (and consequent containment and cleanup activities). In the event of a spill, OPL would be required to mitigate for damages to fish or fish habitats.

Operational Impacts - Columbia River Approach and Crossing Options. No operational impacts to fish would occur for any of the options approaching the Columbia River because no fish are present in this area of the pipeline corridor. There would be no impacts to fish from normal operation of the pipeline for any of the Columbia River crossing options. If product were to spill into the Columbia River, minor to major impacts to fish could occur, depending on the timing and the volume of the spill. Impacts would be similar to those described in the Columbia River spill scenario in the spill analysis section of the ASC and summarized discussions earlier in this section.

Cumulative Impacts. Cumulative impacts to fish are considered minor. Several salmon, trout, and steelhead stocks within the project area are federally listed or proposed for listing as threatened or endangered and/or considered depressed stocks by the WDFW. In areas where trenched crossings are proposed to cross spawning areas, the project could result in localized, short-term impacts to the quality and quantity of spawning habitat for these species. Many stream crossings during construction in the same watershed can reduce sediment from multiple sources. Due to planned low flow or no flow construction limited size of crossings and construction period, such release should be minor. Short-term loss of spawning habitat could locally reduce spawning success, but is not likely to significantly affect populations.

3.7.2.2 No Action

Under the No Action Alternative, the pipeline would not be constructed, and thus no construction or operational impacts of the proposed pipeline would result. Transport of product via tanker trucks and river and ocean barges would increase to meet demand. This could increase the potential for impacts to fisheries if spills increased using those two transportation methods. Fishery resources from Seattle to the Kittitas area would be at risk from tanker trucks instead of a pipeline. Tanker truck spills are predicted to occur at a greater frequency but lower volume than a pipeline. A tanker truck or barge spill could have a similar impact to an isolated fish run or listed species as the proposal.

The frequency potential for spills related to transport under No Action is slightly greater than under the proposal, primarily due to the greater number of tanker truck trips and product being transported to and up the Columbia River and in Puget Sound and the coast. The significance of fisheries impacts could range from minor to major depending on the timing, volume, and location of an accidental spill.

3.7.3 Additional Proposed Mitigation Measures

3.7.3.1 Construction Mitigation and Subsequent Impacts

OPL has included BMPs to minimize impacts to fish and fish habitat associated with construction of stream crossings (Appendix C). Although it is not possible to completely eliminate all impacts, especially at invasive crossings, the following additional mitigation would further minimize impacts to fish:

- Complete a detailed analysis of alternative non-invasive crossing construction methods for sensitive stream crossings.

- Prepare site-specific construction plans for stream crossings with sensitive fish resources (including water quality).

- Complete the analysis of maximum scour potential for all stream reaches crossed by the pipeline.

- As mitigation for short-term degradation of bull trout spawning habitat, OPL could replace culverts at the Mill and Cold Creek crossings to increase the availability of spawning and rearing areas to the reintroduction of adfluvial bull trout to those streams. The existing culverts block fish passage from the lake into the stream above the John Wayne Trail, where most of the potentially available bull trout spawning habitat in these stream basins occurs. Replacement of these culverts would result in additional temporary turbidity and short-term sediment impacts to bull trout habitat downstream of the culverts. However, restoration of passage to habitat in the upper reaches of these streams, if reintroduction is successful, would result in a net beneficial impact to this species in the Keechelus Lake Basin.

- OPL has indicated they would replace culverts that are undersized, and that they may modify culverts that block migration of fish. To ensure that culverts are adequately addressed, OPL should evaluate existing culverts and consult with agencies regarding requirements for culvert replacement during construction. Replacement of culverts would involve in-channel work that would increase the potential for sediment transport to streams, and could result in a short-term impact on fish habitat downstream of the culvert replacement. However, if the culvert replacement is successful in providing fish access to currently unutilized habitat, or prevents the failure of a culvert because it was in poor condition or undersized, the long-term impact of the replacement would be beneficial. BMPs and mitigation for culvert replacement are discussed in detail in Section 3.6, Water.

- Provide construction and post-construction monitoring to ensure BMP effectiveness.

- Provide downstream monitoring at all drill and bore crossings to minimize potential for drilling mud spill impacts.

- Even though no in-water work would occur at the Columbia River, perform the drilled crossing of the Columbia River during WDFW work windows to minimize the potential for impacts to salmonids from accidental spill of drilling muds.

- Provide downstream monitoring of turbidity at all invasive stream crossing sites.

- If blasting is required in or near streams that provide fish habitat, consult appropriate resource agencies and prepare a blasting plan that minimizes blasting needs and protects fisheries.

- Implement additional mitigation to protect water quality (see Section 3.6, Water).

3.7.3.2 Operational Mitigation and Subsequent Impacts

OPL has included numerous safeguards to minimize the potential for a product spill from the proposed pipeline. There is concern that channel scouring could expose the pipeline and subject it to damage, which could result in a product spill. OPL intends to place the pipe 0.6 m (2 feet) below maximum scour depth throughout the 100-year floodplain of each crossing to minimize the potential for the pipe to be exposed. However, determination of scour depth for many streams is difficult due to lack of suitable models. Regulatory agencies and OPL will determine suitable analytical and field methods to determine appropriate burial depths. Additional safeguards, such as monitoring scour at specific crossings, would be appropriate where high scour rates are possible (see Section 3.6, Water, for discussion of monitoring methods). If it is determined that the crossing is at risk (based on agency determined threshold values), corrective actions, up to and including cessation of pipeline operation, would be required.

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