5. ENVIRONMENTAL BASELINE

This section presents an analysis of the effects of past and ongoing human and natural factors leading to the current status of listed species and their habitat (including designated critical habitat) within the action area.

The action area is located within the Lower Columbia River subbasin. The Columbia River and its tributaries are the dominant aquatic system in the Pacific Northwest. The Columbia River originates on the west slope of the Rocky Mountains in Canada and flows approximately 1,200 miles to the Pacific Ocean, draining an area of approximately 219,000 square miles in Washington, Oregon, Idaho, Montana, Wyoming, Nevada, and Utah. Within the U.S., there are 11 major dams along the main reach of the river. In addition, there are 162 smaller dams that form reservoirs with capacities greater than 5,000 acre-feet in the Canadian and United States' portions of the basin (Fuhrer et al. 1996). Saltwater intrusion from the Pacific Ocean extends approximately 23 miles upstream from the river mouth at Astoria. Coastal tides influence the flow rate and river level up to Bonneville Dam at RM 146.1 (RKm 235) (USACE 1989).

5.1 HISTORICAL CONDITIONS

Within the Lower Columbia River subbasin, including the action area, flooding was historically a frequent occurrence, contributing to habitat diversity via flow to side channels and deposition of woody debris. The Lower Columbia River estuary is estimated to have once had 75 percent more tidal swamps than the current estuary because tidal waters could reach floodplain areas that are now diked. These areas provided feeding and resting habitat for juvenile salmonids in the form of low-velocity marshland and tidal channel habitats (Bottom et al. 2005).

Dams built on the river between the 1930s and 1970s significantly altered the timing and velocity of hydrologic flow and reduced peak season discharges. Availability of aquatic habitat for native fish, particularly those that rely heavily on low-velocity side channel habitat for holding, feeding, and rearing, has declined as a result of these changes to habitat-forming processes. Aquatic habitat components that have been affected by these changes include the amount and distribution of woody debris (e.g., controlled flows and navigation management discourage free transport of large wood), rates of sand and sediment transport, variations in temperature patterns, the complexity and species composition of the food web, the distribution and abundance of salmonid predators, the complexity and extent of tidal marsh vegetation, and seasonal patterns of salinity.

The Columbia River estuary historically received annual spring freshet flows that averaged 75–100 percent higher than current freshet flows. In addition, historical winter flows (October through March) were approximately 35–50 percent lower than current flows. The greater historical peak and variable flows encouraged greater sediment transport and more flooding of wetlands, contributing to a more complex ecosystem than exists today (ISAB 2000).

Historically, terrestrial habitat in the action area was characterized by closed upland forest/woodland, with patches of grassland savannah and prairie in lowland areas near water (Hulse et al. 2002). Forest types in the region included old-growth conifers such as Douglas-fir (*Pseudotsuga menziesii*), spruce (*Picea* sp.), and hemlock (*Tsuga* sp.); remnant hardwoods (e.g., Oregon oak [*Quercus garryana*] woodlands); and riparian, wetland, and aquatic systems (Omernik 1987). Most upland habitat in the action area has been converted to commercial and

residential developed uses. The action area is located within the Pacific Flyway, the major north-south route for migratory birds that extends from Patagonia to Alaska. Migratory birds use the area for resting, feeding, and breeding.

5.2 EXISTING BASELINE CONDITIONS

5.2.1 Terrestrial Habitats

Starting in the mid-1800s, European settlement and development of urban areas gradually displaced native plant and wildlife habitats. Current urbanized conditions preclude the persistence of most large mammals and many native amphibians, reptiles, birds, and other wildlife that were once common in the action area. Terrestrial vegetation and habitats currently are limited to urban landscapes and relatively small habitat patches protected by city and/or county regulations or programs (e.g., wetlands, forested park areas, open spaces, and riparian buffers), and currently support species with relatively small home ranges and restricted habitat requirements (e.g., turtles). Portions of the region adjacent to the action area (e.g., Forest Park and the western end of Hayden Island) retain forested and wetland habitats capable of supporting native wildlife.

Throughout the region and within the action area, most natural habitat for native plants has been lost or highly degraded through land use conversion from natural to urban use. Remaining habitat for botanical resources (insofar as it exists within the action area), particularly for rare plants, is restricted to open space, wetlands, riparian buffers, and park lands managed under protective mandate. These habitats tend to be relatively small and isolated from each other, limiting the distribution of native plants. Non-native and noxious weeds are ubiquitous in the action area and further limit the ability of native plants to persist in most of the remaining suitable habitat.

5.2.2 Aquatic Habitats

The action area contains portions of the following water bodies: the lower Columbia River, North Portland Harbor, Columbia Slough, and Burnt Bridge Creek. These are described individually in more detail below.

Because of potential impacts to the diet of the Southern Resident DPS of killer whales, the action area also includes that portion of the Pacific Ocean within 50 km of the coast from southern Oregon to the Queen Charlotte Islands. A description of the environmental baseline for this portion of the action area appears in Appendix H.

5.2.2.1 Columbia River and North Portland Harbor

The Columbia River and North Portland Harbor portions of the action areas are part of the Columbia River estuary. The Columbia River estuary is the portion of the Columbia River from the mouth upstream to all tidally influenced areas (that is, to Bonneville Dam). The I-5 bridges are located at RM 106 (RKm 171) of the Columbia River. The portion of the action area that occurs within the Columbia River extends from RM 101 to 118 (RKm 163 to 190). This area is highly altered by human disturbance, and urbanization extends up to the shoreline. There has been extensive removal of streamside forests and wetlands throughout this portion of the action area. Riparian areas have been further degraded by the construction of dikes and levees and the

placement of streambank armoring. For several decades, industrial, residential, and upstream agricultural sources have contributed to water quality degradation in the river. Additionally, existing levels of disturbance are high due to heavy barge traffic.

The North Portland Harbor is a large side channel of the Columbia River that flows between the south side of Hayden Island and the Oregon mainland. The channel branches off the Columbia River approximately 2 RMs upstream (east) of the existing bridge site, and flows approximately 5 RMs downstream (west) before rejoining the mainstem Columbia River.

The existing I-5 crossing consists of two separate bridges. Each bridge is approximately 3,500 feet long by 45 feet wide with approximately 284,000 sq. ft. of total deck area located directly above the water surface. The bottom of each deck ranges from 25 to 60 feet above the water surface. Together, these bridges have 11 pairs of bridge piers, nine of which are located below the ordinary high water line (OHW) of the Columbia River. Two pairs (piers 10 and 11) are located in shallow-water (that is, less than 20 feet deep). Each pier measures approximately 32 feet wide by 50 feet long at the footing. In total, the in-water piers occupy approximately 27,800 sq. ft. of substrate and represent approximately 44,000 cubic yards of fill below OHW. At the existing structures, maximum water depth is about 40 to 45 feet. At present, all stormwater runoff drains directly from the bridge deck through scuppers into the Columbia River without undergoing water quality treatment. Together, these structures convey approximately 135,000 vehicles per day.

The existing North Portland Harbor bridge conveys I-5 from Hayden Island to the mainland. The structure is approximately 1,325 feet long by 150 feet wide with approximately 144,000 sq. ft. of total deck area located directly above the water surface. The bottom of the deck ranges from 25 to 30 feet above the water surface. This bridge has a total of 10 bents, six of which occur below OHW. Each bent consists of three piers, each measuring approximately 24 by 24 feet at the mudline. In total, the piers occupy 10,368 sq. ft. of substrate below OHW. Water depths at the crossing range from 0 to 20 feet, meaning that all of the piers occur in shallow water. At present, all stormwater runoff drains directly from the bridge deck through scuppers into North Portland Harbor without undergoing water quality treatment. This bridge conveys approximately 137,950 trips per day.

Hydrology

The 12 major dams located in the Columbia Basin are the primary factors affecting flow conditions in the action area. Consequently, the Columbia River, including the action area, is a highly managed waterbody that resembles a series of slack-water lakes rather than its original free-flowing state. Development of the hydropower system on the Columbia River has significantly influenced peak seasonal discharges and the velocity and timing of flows in the river. The Columbia River estuary historically received annual spring freshet flows that were on average 75 to 100 percent higher than current flows (ISAB 2000). Historical winter flows (October through March) also were approximately 35 to 50 percent lower than current flows (ISAB 2000). The second major contributor to stream flow conditions in the action area is tidal influence from the Pacific Ocean. Although the saltwater wedge does not extend into the action area, high-tide events affect flow and stage in the Columbia up to Bonneville Dam.

Hydrology in the action area has been profoundly altered from historical conditions. In the action area, natural landforms and constructed landforms (e.g., dikes and levees) are the dominant floodplain constrictions, while bridge footings are the subdominant floodplain constrictions.

Nine bridge pier pairs are located below OHW in the mainstem Columbia River, and one bridge pier is located below OHW in North Portland Harbor. A flood control levee runs along the south bank of North Portland Harbor, forming a boundary between the adjacent neighborhoods and the harbor. Numerous upstream dams, levees located along shorelines, and channel modifications (e.g., armoring, reshaping) have restricted habitat-forming processes such as sediment transport and deposition, erosion, and natural flooding. Therefore, habitat complexity is significantly reduced from historic conditions. Shoreline erosion rates are likely slower than they were historically due to flow regulation. The river channel is deeper and narrower than under historical conditions (Bottom et al. 2005).

Reduced flow poses particularly high risks for juvenile anadromous fish. Dramatic reductions in flow compared to the historical spring freshet have increased the travel time of juvenile outmigrants. This increases potential exposure to predation, elevated temperatures, disease, and other environmental stressors (NMFS 2008e, Bottom et al. 2005).

Water Quality

The Columbia River and North Portland Harbor are on the DEQ 303(d) list for the following parameters: temperature, polychlorinated biphenyls (PCBs), polyaromatic hydrocarbons (PAHs), dichlorodiphenyltrichloroethane (DDT) metabolites (e.g., dichlorodiphenyldichloroethylene [DDE]), and arsenic (DEQ 2007a). The Columbia River is on the Washington State 303(d) list for temperature, PCBs, and dissolved oxygen (Ecology 2009b). The U.S. Environmental Protection Agency (EPA) has approved TMDLs for dioxin and total dissolved gas in the Columbia River (DEQ 1991, 2002). In addition to the contaminants listed above, dissolved copper, a neurotoxicant that damages the olfactory abilities of fish, is also known to be present above naturally occurring levels in the Columbia River. Studies indicate that dissolved copper in the action area may occur at levels known to injure salmonids (WSDOT 2005; Ecology 2006; DEQ 2009).

Current studies indicate that there are high levels of chemical contaminants in the salmonid food chain in the Columbia River estuary (NMFS 2004). During several studies at Sand Island in the lower estuary, NMFS NWFSC Environmental Conservation Division consistently found elevated levels of DDT and PCBs in the stomach contents of juvenile salmonids (NWFSC Environmental Conservation Division 2001, cited in NMFS 2004). The PCB concentrations were of particular concern because levels exceeded threshold tissue concentrations believed to cause adverse effects to salmonids. The high levels of these contaminants in stomach contents indicated that exposure occurred while the juvenile salmonids were present in the estuary (NMFS 2004). Other data suggest that PAH concentrations are increasing in the lower estuary. In 1998, PAH concentrations found in the stomach contents of juvenile Chinook and PAH concentrations found in fish bile of collected near Sand Island were very low. However, by 2000, concentrations of PAH in both stomach contents and in fish file substantially higher (NMFS 2004).

Pesticides and heavy metal contaminants have been detected in Columbia River sediments (DEQ 2007b, as cited in NMFS 2008e), potentially resulting in immunosuppression, and reduced growth rates in juvenile fish during their residence in the estuary (Arkoosh et al. 1991, 1994, 1998; Varanasi et al. 1993; Casillas et al. 1995a, 1995b, and 1998a, all cited in NMFS 2008e).

Terrestrial portions of the action area that drain to the Columbia River and North Portland Harbor are highly urbanized, containing a complex system of roadways, including I-5, state highways, local access roads, residential streets, parking lots, and other impervious surfaces. The

high area of impervious surface has implications for water quality in the Columbia River and North Portland Harbor. At present, the action area contains approximately 153 acres of pollution-generating impervious surface (PGIS) that drains to these water bodies. Of these, nearly 150 acres drain into the water without first undergoing water quality treatment. Typical pollutants found in stormwater runoff include total suspended solids, nutrients, oil and grease, other fluids associated with automobiles, PAHs, agricultural chemicals used in highway maintenance, total zinc, dissolved zinc, total copper, dissolved copper, and other metals (NMFS 2008j). These pollutants are known to be toxic to fish (Everhart et al. 1953; Hecht et al. 2007; Johnson et al. 2009; Sandahl et al. 2007; Sprague 1968) and have potential adverse effects on salmon and steelhead even at ambient levels (Loge et al. 2006; Hecht et al. 2007; Johnson et al. 2007; Sandahl et al. 2007; Spromberg and Meador 2006, all cited in NMFS 2008j). Stormwater outfalls have not been sampled for pollutant concentrations in the Columbia River and North Portland Harbor portions of project area. However, it is likely that the large amount of untreated runoff in the watershed contributes to the high levels of pollutant loading in the Columbia River and North Portland Harbor.

The Columbia River portion of the action area is on the 303(d) list due to excessively high water temperatures (DEQ 2007a). Columbia River water temperatures at Washougal, Washington, range from approximately 6 degrees (°) Celsius (C) (43° Fahrenheit [F]) in early spring to approximately 22°C (72°F) in late summer (USGS 2007). Temperatures in the action area are assumed to be comparable. For at least part of the year, water temperatures exceed maximum levels for spawning (60°F) and for migration and rearing (64°F). No Total Maximum Daily Load (TMDL) for temperature has been proposed at this time (DEQ 2009).

These high water temperatures represent a degradation of the environmental baseline in that they may increase the risk of risk of disease, delay adult migration, increase the foraging rate of predators, and decrease the survival rate of smolts (NMFS 2008e).

Turbidity in the action area is very low compared to historical conditions (Bottom et al. 2005). Although high turbidity levels are typically associated with negative impacts to fish and their habitat, there are also beneficial effects, especially when considering natural stream processes. Decreased spring flows and sediment discharges have reduced turbidity levels throughout the lower Columbia River (NMFS 2004). The hydropower system traps approximately 12 million cubic yards of debris and sediment that would otherwise flow uninhibited through the lower Columbia River (NMFS 2008j). Total sediment discharge in the lower Columbia River mainstem is about one third of levels measured in the 1800s (NMFS 2008e). From October 2002 to September 2007, Ecology conducted water quality sampling in the action area approximately 3 miles upstream of the I-5 bridges (Ecology 2009a). Of 36 samples, all were 12 nephelometric turbidity units (NTU) or under and 28 were 5 NTUs or under; this is extremely low turbidity. Accordingly, the reduction in sediments has reduced the extent, speed, and depth of the turbidity plume extending into the Pacific Ocean (Cudaback and Jay 1996; Hickey et al. 1997, both cited in NMFS 2008e) and has led to reduced sediment inputs into lower Columbia River shorelines and tidal marshes (NMFS 2008j: Bottom et al. 2005).

Throughout the estuary, lowered turbidity levels pose a risk to fish and fish habitat. The sediment supply is an important source of the organic material that was historically the basis the food web. Floodplain inundation continually replenished organic material and recharged primary production. With the loss of overland flow and this source organic detritus, the food web is currently driven by phytoplankton. This has decreased the food supply for salmonids, although

no study has quantified to what extent (Bottom et al. 2005). Within the action area, overland flow occurs only very occasionally, turbidity levels are extremely low, and sediment accumulating landforms (such as marshes, wetland forests, or beds of emergent vegetation) are rare. Thus, food sources for fish are expected to be much lower than historical levels.

Lowered turbidity levels may also pose a risk to individual fish. Decreased turbidity may lower visual cover for juvenile salmonids, making them more vulnerable to predation by birds and other fish. Low turbidity combined with reduced spring freshets pose particularly high risks to outmigrating juvenile salmonids (Bottom et al. 2005).

Substrate

In the Columbia River and North Portland Harbor, substrate consists mainly of sand with relatively small percentages of fine sediments and organic material (NMFS 2002; DEA 2006). Little to no gravel or cobble is present in the substrate within the action area. A bathymetric study completed in 2006 found significant scouring on the upstream side of each Columbia River bridge pier and scour channels on the downstream side (DEA 2006). The scouring ranged from approximately 10 to 15 feet deep. Bedload transport patterns were evident in the form of sand waves, a continuously shifting natural feature of the river bottom that indicates the influence of the currents. The sand waves observed in this study were especially distinct on the downstream side of the Columbia River bridges. The sand waves in the middle of the river were regular, while the sand waves on the northern downstream side were larger and more irregular. The northern upstream side of the bridge was relatively smooth and had few to no sand waves, while the southern upstream side had irregular sand waves. Average river depth was approximately 27 feet. Shallow-water habitat (defined as 20 feet deep or less) is present along both banks of the Columbia River, but is more abundant along the Oregon bank.

The substrate in North Portland Harbor within the project area is predominantly composed of sand with relatively small percentages of fine sediments and organic material. A bathymetric study completed in 2006 found deep scouring near the ends of the downstream piers of the existing North Portland Harbor bridge on the north bank, with scour holes approximately 8 to 10 feet deep (DEA 2006). Scouring around the upstream piers was approximately 3 to 7 feet deep. Scouring was more pronounced around the northern piers than the southern piers. A particularly deep area (approximately 21 feet deep) on the south side of the channel downstream of the existing bridge is indicative of a fast-moving current through the harbor. The average depth of the harbor was approximately 14 feet. Shallow-water habitat (defined as 20 feet deep or less) is present throughout the project area in North Portland Harbor.

Dredging and sand and gravel mining regulated by DSL occur in some areas of the Columbia River portion of the action area. For example, the Rose City Yacht Club (approximately 3 miles upstream of the existing I-5 bridges) holds a DSL permit for maintenance dredging of their marina, with subsequent sale of the dredged sand. This work is done in relatively shallow water (less than 20 feet in depth) and therefore may temporarily degrade on-site habitat for migrating salmonids. Columbia River Sand and Gravel and Northwest Aggregates each hold permits for dredging within the navigation channel within the action area between RM 102–106 (RKm 164–171) and RM 117–118 (RKm 188–190), respectively. Such in-channel activity is likely to temporarily and locally elevate turbidity and suspended sediment.

Physical Habitat Features

Since the 1800s, USACE has performed dredging throughout the Columbia River estuary in order to maintain the navigation channel (NMFS 2004). Once maintained at a depth of 20 feet, the channel is now dredged to an average depth of 43 feet (NMFS 2008j). USACE has also realigned the navigation channel and installed hydraulic control structures, such as in-water fills, channel constrictions, and pile dikes (NMFS 2004). As a result, benthic habitat is highly degraded throughout the lower Columbia River system (NMFS 2008j). Navigation channel maintenance over the past century has closed river side channels, realigned river banks, inhibited natural channel migration, and removed many habitat features that promote the survival of listed fish within the estuary.

Within the action area, the Columbia River and North Portland Harbor contain few to no backwaters, ponds, oxbows, and other low-energy off-channel areas. Historic off-channel areas have been filled, rechanneled, diverted, and otherwise developed over the past 150 years. As a result, there is a severe reduction in connectivity between the Columbia River and North Portland Harbor and their historic floodplains. Overbank flows occur only very occasionally. Wetland extent is drastically reduced, and the succession of riparian vegetation has been significantly altered. As a result, the action area provides few refugia for salmonids. North Portland Harbor may provide some of the only off-channel habitat functions (lower energy flows relative to the Columbia River).

The remaining tidal marsh and wetland habitats in the estuary are restricted to a narrow band along the Columbia River and its lower tributaries (NMFS 2004). Some high-quality backwater and side channel habitats have persisted along the lower Columbia River banks and near undeveloped islands (USACE 2001) downstream of the action area, and to some extent, within the action area at Government Island. These habitats contain high-quality wetlands and riparian vegetation, such as emergent plants and low herbaceous shrubs.

The riparian area within the action area is relatively degraded. Tree canopy is generally absent or sparse. As a result, shallow-water habitat has only sparse vegetative cover (see site photos in Appendix B for examples of existing riparian conditions). Because riparian areas are limited in size and are unlikely to expand in this urban setting, there is little potential for future large wood recruitment. Fish cover elements are generally sparse to absent in the action area, although some boulders and artificial structures (for example, docks and pilings) are present.

Shallow-water and nearshore habitat is present in the action area on both the Oregon and Washington sides of the river and is influenced by flow and sediment input from tributaries and the mainstem river that eventually settles to form shoals and shallow flats. This shallow-water habitat is used extensively by juvenile and adult salmonids for migrating, feeding, and holding. Phytoplankton, microdetritus, and macroinvertebrates are present in shallow areas and serve as the prey base for salmonids (USACE 2001). Overall, shallow-water habitat has been greatly reduced from historical levels throughout the estuary and in the project area. As river stage has declined with the operation of the hydropower system, shallow-water habitat has decreased concurrently (Bottom et al. 2005). Dredging, diking, armoring, and other shoreline alterations have exacerbated the problem, such that shallow-water habitat is rare in the project area. What little shallow-water and nearshore habitat that remains is of low quality. Shoreline armoring has reduced the quality of shallow-water habitat areas by providing habitat for predaceous fish, increasing water temperatures, removing resting and holding areas for juvenile fish, and reducing

primary productivity. Numerous overwater structures in shallow-water habitat areas likely provide habitat for predaceous fish and birds and may cause interference with juvenile migration. North Portland Harbor, in particular, contains a high density of permanently moored floating homes and docks.

5.2.2.2 Columbia Slough

The Columbia Slough (also known as the Slough) is a slow-moving, low-gradient drainage canal running nearly 19 miles from Fairview Lake in the east to the Willamette River in the west (see site photos in Appendix B). Running roughly parallel to the Columbia River, the Slough is a remnant of the historic system of lakes, wetlands, and channels that dominated the south floodplain of the mainstem Columbia.

The Columbia Slough has undergone profound hydrologic alteration from its original condition. Originally, the Slough was a side channel of the Columbia River. Today, the original inlet is blocked at the upstream end, and it no longer receives flows from the Columbia. The Slough is now intensively managed to provide drainage and flood control with dikes, pumps, weirs, and levees (CH2M Hill 2005). The Columbia Slough Watershed drains approximately 37,741 acres of land in portions of Portland, Troutdale, Fairview, Gresham, Maywood Park, Wood Village, and unincorporated Multnomah County. The Slough and surrounding area were historically used by Native Americans for fishing, hunting, and gathering food (BES 2006).

The Slough is divided into upper, middle, and lower reaches. The Upper and Middle Sloughs receive water inputs from Fairview Lake, as well as groundwater and stormwater from PDX and other industrial, commercial, and residential sites in the surrounding area. Water levels in the Upper and Middle Sloughs are managed to provide adequate flows for pollution reduction (PDX de-icing) and surface water withdrawals, flood control, and recreation (COP 2009b).

The project area crosses the Lower Slough at Slough RM 6.5 (RKm 10.5) (CH2M Hill 2005). The Lower Slough extends from the Peninsula Drainage Canal to the Willamette River, less than 1 mile south of its confluence with the Columbia River. It experiences from 1 to 3 feet of tidal fluctuation in its water surface daily. Water levels are generally unmanaged, but are affected by the management of the dams on the Columbia and Willamette Rivers. The Lower Slough ranges from 2.0 to 4.5 feet NGVD and is generally between 100 and 200 feet wide. The Lower Slough receives water inputs from combined sewer overflows, stormwater, Smith and Bybee Lakes, leachate from the St John's Landfill, and the Upper Columbia Slough (COP 2009a).

I-5 crosses the Slough at RM 6.5 (RKm 10.5) in a highly urbanized area. The predominant land use around the Slough in the project vicinity is light industrial, with some residential. The Slough connects to the Willamette River approximately 6.5 miles west of the project area, within 1 mile of the confluence of the Columbia and Willamette Rivers (COP 2009b).

Anadromous fish can access the Lower Columbia Slough up to an impassable levee located near NE 18th Avenue (RM 8.3 [RKm 13.3]). At Smith and Bybee Lakes, a water control structure allows fish passage.

The water column in the Slough is characterized by algal and aquatic macrophyte growth, especially in summer months when flow is low and temperatures are high. The Slough is a lentic (still water) system with low dissolved oxygen levels. However, it provides habitat for many fish and wildlife species. As of 2004, 26 species, including juvenile salmonids, other fish species, freshwater shrimp, and crawfish, have been identified in the Lower Slough, which provides some

of the only remaining off-channel and refugia habitat in the lower Willamette River area (COP 2009b).

The Columbia Slough does not exceed 303(d) list standards for turbidity. However, according to the National Pollutant Discharge Elimination System (NPDES) 1200-COLS permit regulating industrial discharges to the Columbia Slough, the in-stream target for total suspended solids (TSS) is 25 mg/L in the Columbia Slough (COP 2009a). Downstream of the project area, near Portland International Raceway, less than 50 percent of City of Portland samples met the target. Generally, though, water clarity improves in the Columbia Slough with distance upstream from the confluence with the Willamette River. Upstream of the project area, near the Vancouver Avenue crossing of the Columbia Slough, greater than 90 percent of the samples met the target.

Columbia Slough is on the 303(d) list for exceedance of temperature standards (DEQ 2007a). The 303(d) list notes temperatures greater than 17.8°C (64°F) from RM 0 to 8.5 (RKm 0.0 to 13.8), including the action area. These temperatures exceed levels considered suitable for salmonid spawning (60°F) and salmonid rearing (64°F). A draft TMDL is being prepared.

The Columbia Slough is on the 1994/1996 DEQ 303(d) list of water quality-impaired streams for the following parameters: lead, PCBs, DDE/DDT, dieldrin, and 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), pH, dissolved oxygen, phosphorous, chlorophyll a, bacteria, and temperature (COP 2009a). TMDLs have been established for all of these parameters except temperature (DEQ 1998).

Benthic habitat in the Lower Slough is dominated by sand, is extremely low in dissolved oxygen, and contains toxic pollutants. Generally, the benthic community, including 36 taxa, increases in abundance from the Lower to the Upper Slough. This increase in species abundance is correlated to an increase in silt dominance, which increases with the distance upstream in the Slough. Most of the species are adapted to low dissolved oxygen levels and still water conditions. The benthic community in the Slough appears to be similar in species richness and density to similar aquatic habitats in the region (COP 2009b).

Riparian habitat along the Slough has been largely replaced by buildings and pavement. Remaining areas of vegetation generally occur in a narrow band along Slough banks and are dominated by black cottonwood (*Populus trichocarpa*), Oregon ash (*Fraxinus latifolia*), willows (*Salix* spp.), red osier dogwood (*Cornus stolonifera*), Himalayan blackberry (*Rubus discolor*), common snowberry (*Symphoricarpos albus*), and reed canarygrass (*Phalaris arundinacea*). Both Himalayan blackberry and reed canarygrass are aggressive non-native species. The Slough's riparian area functions are highly impaired; these functions include microclimate and shade, bank stabilization and sediment control, pollution control, stream flow moderation, organic matter input, large woody debris, and contiguous wildlife travel corridors.

Habitat elements that typically support the life stages of listed fish are generally lacking in Columbia Slough. Large woody debris is scarce and because the riparian area is largely devoid of trees, the potential for future large woody debris recruitment is limited. Because the Slough has been intensely managed through dredging and channelization, habitat complexity is limited and habitat structures such as boulders and undercut banks are largely absent. Overbank flow occurs very infrequently and the stream is severed from its original floodplain. Likewise, low-energy off-channel areas (such as backwaters, ponds, and oxbows) are also scarce. However, remnant wetlands and restored wetlands do exist in the Slough watershed and provide habitat for wildlife, thermoregulation, nutrient removal, and other important ecosystem functions. Smith and

Bybee Lakes, a 2,000-acre complex of wetlands, are the dominant wetland features of the Lower Slough. This wetland complex borders the Lower Slough and connects to the Lower Slough via the North Slough, a mile-long channel running between the St John's Landfill and the south side of Bybee Lake (COP 2009b).

Several restoration efforts are ongoing in the Columbia Slough area. The City of Portland's Watershed Revegetation Program and its community partners are conducting non-native species removal and native plantings in many areas along the Slough. MCDD now uses in-channel equipment to perform repairs and maintenance of channel and bank areas. Formerly, MCDD cleared vegetation to access these areas from the shore. Both vegetation enhancement and MCDD's alteration of maintenance practices have resulted in an increase in native plant diversity and cover in the Slough watershed. The City of Portland Bureau of Environmental Services has been involved in revegetation efforts in the Slough watershed since 1996 and has successfully re-established native vegetation along many parts of the Slough (COP 2009b).

DEQ has listed irrigation, domestic and industrial water supply, livestock watering, anadromous fish passage, salmonid fish rearing, salmonid fish spawning, resident fish and aquatic life, wildlife and hunting, fishing, boating, water contact recreation, aesthetic quality, and hydropower as beneficial uses of the Columbia Slough (COP 2009b).

5.2.2.3 Burnt Bridge Creek

Burnt Bridge Creek is a small perennial tributary to the lower Columbia River. It originates near the Mill Plain suburb located east of Vancouver, Washington, and flows west (roughly paralleling SR 500 for approximately 5 miles) to its outlet at Vancouver Lake. The lake then drains into the lower Columbia River via Lake River. Burnt Bridge Creek crosses I-5 at approximately RM 2 (RKm 3.2). For the majority of its course, the stream passes through a valley constrained by surrounding land uses (primarily residential development). Stream slope is between 0 and 2 percent, but approximately 80 percent of the stream has a gradient of less than 0.1 percent (PBS 2003). Habitat in the majority of the upper reaches of the creek is degraded by urban development, non-native vegetation, channelization, and bank armoring, and provides little habitat for salmonids.

Hydrology in Burnt Bridge Creek has been highly altered compared to its original state. The overall watershed is heavily urbanized, and numerous stormwater outfalls discharge to the creek. Additionally, the creek was lengthened several miles through the draining and channelization in the early 1900s of a large marsh located at its original headwaters near Falk Road. Its current headwaters are located in east Vancouver near NE 162nd Avenue. All of these factors have increased peak flows, reduced base flows, and altered flow timing in comparison to historical conditions (PBS 2003).

Upstream of the action area, between Fourth Plain Boulevard and I-5, there are mature trees providing high canopy cover, with abundant beaver activity and pond habitat. Good rearing and spawning habitat is present in portions where the stream flows through a greenbelt with protected riparian areas (e.g., Leverich and Arnold Parks) (WDFW 2007a).

Burnt Bridge Creek enters the action area in Leverich Park, northeast of the SR-500/I-5 interchange. In the park area, the creek has substantial overhead cover from large-diameter trees and shrubs in some areas, and sparse cover by widely spaced large-diameter trees in areas maintained by park staff. In the more open areas within the park, the banks are highly eroded by

regular visitor usage and mowing of herbaceous vegetation in the vicinity of the channel. Substrate within the park consists of fine sediments and gravels. Both riffles and pools are present within the park channel (WDFW/MHCC 1999).

From Leverich Park, the Burnt Bridge Creek channel passes under Leverich Park Way through a cement culvert and onto City property adjacent to I-5. The channel is armored for approximately 100 feet, after which it continues north, parallel to I-5 and Leverich Park Way, through a silt-dominated channel. The vegetation surrounding this portion of the channel is dominated by reed canarygrass with some overhanging blackberry and dogwood (*Cornus* sp.). Site observations indicate that the channel banks are undercut due to the growth habit of reed canarygrass and eroded due to the presence of nutria (*Myocastor coypus*).

Approximately 500 feet north of the cement culvert, Leverich Park Way bends to the west and the Burnt Bridge Creek channel passes under the roadway through a large corrugated metal pipe culvert. Upstream of the second culvert under Leverich Park Way, the channel is dominated by fine sediments (PBS 2003), and has moderate to dense overhanging vegetation consisting of deciduous and coniferous tree and shrub species. The channel continues north through a densely vegetated, privately owned area for about 200 feet. No permission to enter this area was granted during field visits to assess habitat and site characteristics. The channel then crosses under I-5, continuing north alongside a WSDOT wetland mitigation site to the west and Bonneville Power Administration (BPA) property and private land to the east.

Within the action area, habitat in the creek between I-5 and Vancouver Lake is characterized by low-gradient pool and marsh habitat with moderate canopy cover, and was described in a 2007 WDFW survey as good salmonid rearing habitat (WDFW 2007a).

There are no complete passage barriers in Burnt Bridge Creek, although seasonal velocity and flow barriers exist. A 2007 WDFW fish passage inventory of the creek documented several culverts within the action area that function as partial barriers, including the I-5 culvert at MP 3.07 (RM 1.9). This structure is an undersized box culvert with less than 1 percent slope, which results in high velocities through the culvert at certain flows (WDFW 2007a). Yearly stream flows vary, and the frequency with which the culvert is impassable is unknown; however, the presence of coho redds above the culvert in November and December 2002 indicates that access to spawning habitat is possible (WDFW unpublished data).

Within the action area, a temperature gauge at Leverich Park (gauge BBC 2.6) indicated that from mid-May through late September 2008, the highest annual running 7-day average of maximum temperatures exceeded 17.5°C (63.5°F) 92 times (Ecology 2008). These measurements indicate that temperatures in Burnt Bridge Creek exceed standards for salmonid spawning (60°F) and salmonid migration and rearing for at least part of the year (NMFS 1996). The 303(d) list includes Burnt Bridge Creek as a stream that exceeds standards for temperature (Ecology 2008).

In general, turbidity is not considered to be a parameter of concern in Burnt Bridge Creek (Ecology 2009a). Burnt Bridge Creek does not appear on the 303(d) list for streams impaired by turbidity (Ecology 2008).

The 303(d) list shows 16 segments of Burnt Bridge Creek that exceed standards for fecal coliform bacteria, dissolved oxygen, and temperature (Ecology 2009b). The 2008 303(d) list also shows 12 segments of Burnt Bridge Creek with pH impairments (Ecology 2009a). Naturally

occurring concentrations of phosphorus in the groundwater, coupled with nutrient inputs from urban and agricultural runoff, has supported nuisance growths of algae and has further degraded aquatic habitat (COV 2007). Of nine samples taken between July and August 2008 at a gauge near Leverich Park, bacteria were above water quality standards in six of the samples, and pH was above standards in one sample (Ecology 2009a). Upper reaches of the stream pass through farmland, where the use of chemical fertilizers and pesticides likely contribute chemical contamination and nutrients to the stream.

Burnt Bridge Creek does not appear on the 303(d) list as having water quality issues related to chemical contaminants. Most stormwater runoff from the project area is discharged into the ground through buried infiltration facilities. However, there are three stormwater outfalls from I-5 that discharge runoff into Burnt Bridge Creek. These outlets likely discharge chemical contaminants to the creek.

5.3 CRITICAL HABITAT: FUNCTIONAL CONDITION OF PRIMARY CONSTITUENT ELEMENTS

Critical habitat is present in the action area in the Columbia River and North Portland Harbor for all ESUs and DPSs of salmonids shown in Table 1-3. Critical habitat is defined under the ESA as: (1) specific areas within the geographical area occupied by the species at the time of listing, on which are found those physical or biological features that are essential to the conservation of the listed species and that may require special management considerations or protection, and (2) specific areas outside the geographical area occupied by the species at the time of listing that are essential for the conservation of a listed species (70 FR 52630).

Critical habitat for Chinook, sockeye, and chum salmon and steelhead within the action area falls under two separate designations. The first designation occurred in 1993 (58 FR 68543) and covers critical habitat for SR sockeye, SR spring/summer-run Chinook, and SR fall-run Chinook. The second designation occurred in 2005 (70 FR 52630) and covers 12 ESUs/DPSs, nine of which occur in the action area. Critical habitat was designated for the Columbia River DPS of bull trout in 2005 (70 FR 56211), but does not include any portion of the action area within the Columbia River; a revised designation was proposed on January 14, 2010, and includes the Columbia River portion of the action area (75 FR 2269).

No designated or proposed critical habitat is present in Burnt Bridge Creek or portions of the Columbia Slough that occur within the action area.

Critical habitat units are described by their primary constituent elements (PCEs). PCEs are the physical and biological features of critical habitat essential to the conservation of listed species, including, but not limited to (1) space for individual and population growth and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and (5) habitats that are protected from disturbance or are representative of the historic geographic and ecological distributions of a species (USFWS and NMFS 1998). The sections below identify the PCEs for each critical habitat designation and describe the current functional condition of the each PCE occurring in the action area.

5.3.1 2005 Salmonid Critical Habitat Designation

Of the critical habitat units that occur in the action area, the 2005 designation addresses LCR Chinook, UWR Chinook, UCR Chinook, CR chum, UCR steelhead, SR steelhead, MCR steelhead, LCR steelhead, and UWR steelhead. This designation consists of six PCEs, three of which occur in the action area.

PCE: Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.

Spawning habitat is extremely limited in the action area, and is present for only three species. CR chum spawn in shallow habitat on the Washington shore of the Columbia River near Government Island, approximately RM 7 (RKm 11) upstream of the I-5 bridges. LCR steelhead spawn in Burnt Bridge Creek and LCR Chinook may spawn in the lowest reaches of Burnt Bridge Creek near Vancouver Lake. Otherwise, the rest of the action area appears to lack suitable spawning habitat (e.g., gravel substrate influenced by groundwater seeps). Although there is suitable chum spawning habitat in the action area, redds may be at risk if river levels drop and expose eggs. Due to residential development in upland areas adjacent to spawning habitat, groundwater seeps that support hyporheic flow may be at risk.

PCE: Freshwater rearing sites with: (i) water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; (ii) water quality and forage supporting juvenile development; and (iii) natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

This PCE is functioning in the action area but is highly degraded. Based on site visits and the interpretation of aerial photographs, floodplain connectivity with associated off-channel refugia is limited or absent. Dikes, levees, and streambank armoring are abundant alongside critical habitat within the action area. Urban development extends up to the streambank in numerous locations. Water quality in the action area is 303(d)-listed for temperature, PCBs, PAHs, DDT metabolites (DDE), and arsenic; EPA has approved TMDLs for dioxin and total dissolved gas (DEQ 2007a). Dissolved copper and dissolved zinc are commonly detected in highway stormwater runoff, and are likely to be present in the action area. Natural cover elements are limited or absent due to the highly altered and managed nature of the river channel. Given the volumes of water conveyed in the mainstem Columbia River, water quantity is not necessarily limited. However, flow control at Bonneville Dam affects river levels, and juvenile strandings and entrapments are possible (FPC 2008). Forage for juvenile salmonids is not documented as limited in the action area. However, lack of complex habitat structure and cover likely reduces the abundance and diversity of forage species.

PCE: Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

The action area functions as a migration corridor for salmonids, but this PCE is highly degraded. There are no known physical barriers to fish passage between the action area and the Pacific Ocean. However, water quality is impaired, and natural cover is limited or absent within the action area. Water quantity is not a limiting factor, with the exception of the risk of strandings and entrapments as discussed above.

PCE: Estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh-and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Although the Columbia River estuary is generally defined as the portion of the Columbia River extending from the mouth to all tidally influenced areas (that is, to Bonneville Dam), this PCE is more applicable to those portions of the estuary with salinity conditions conducive to physiological changes required for juveniles to transition between freshwater and the saltwater marine environment. The intrusion of saltwater into the lower Columbia River is generally limited to Harrington Point at RM 23 (RKm 37); however, at lower daily flows saltwater intrusion can extend past Pillar Rock at RM 28(RKm 45) (LCREP 2007). This reach is approximately 78 miles downstream of the I-5 bridge. Therefore, this PCE is not present in the action area.

PCE: Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

This PCE refers to marine areas in the Pacific Ocean. As discussed in section 3, the action area portion of the Pacific Ocean (i.e., the marine environment within 50 km of the Pacific coast from southern Oregon north to the Queen Charlotte Islands) is related to the overlap of the distribution of Southern Resident killer whales and Chinook salmon. This portion of the action area is specifically addressed only for killer whales. Effects to this PCE for salmon will not occur and are not addressed in this document.

PCE: Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

This PCE refers to marine areas in the Pacific Ocean and does not occur in the action area.

5.3.2 1993 Salmonid Critical Habitat Designation

Of the critical habitat units that occur in the action area, the 1993 designation addresses SR spring/summer-run Chinook, SR fall-run Chinook, and SR sockeye. Critical habitat for these species includes the bottom and water of the designated waterways and the adjacent riparian zone (areas within 300 feet of the OHW of the designated water body) (58 FR 68543). This designation consists of four "Habitat Components" two of which occur in the action area.

Habitat Component: Spawning and Juvenile Rearing

This PCE is not present in the action area. According to the critical habitat designation, spawning and rearing for these ESUs occurs several hundred miles upstream of the project area, in the Snake River and its tributaries (58 FR 68544).

Habitat Component: Juvenile Migration Corridors

Juvenile migration corridors for these ESUs include the Columbia River to the Pacific Ocean, including the action area (in the Columbia River and North Portland Harbor). This habitat component consists of ten "essential habitat features:" (1) substrate, (2) water quality, (3) water

quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) safe passage conditions.

This habitat component is degraded but functioning, as evidenced by successful migration of individuals from these ESUs through the action area. Substrate in the action area is predominantly sand. Although dredging and flow management associated with upstream dams have altered substrate transport and deposition patterns to some extent, substrate composition is fairly consistent with historical conditions and is functioning for juvenile migration. Water quantity and velocity are not compromised in the mainstem Columbia River within the action area, and provide sufficient flow to allow juveniles to migrate. Cover and shelter in the action area are limited, but are present in low-velocity shoreline habitat at Government Island, Hayden Island, and in North Portland Harbor. Food (e.g., aquatic macroinvertebrates) is not known to be a limiting factor for migrating juveniles within the action area. Space is not limited in the action area, as migrating juveniles have full access to the width and depth of the water column in the Columbia River and North Portland Harbor. Passage conditions for migrating juveniles are generally safe, although predators (e.g., piscivorous fish such as pikeminnow; piscivorous birds) are likely to be seasonally present within the action area. There are no passage barriers for these ESUs within the action area.

Water quality, water temperature, and riparian vegetation are the most degraded of the essential habitat features. The Washington State 303(d) list includes records in the action area for water temperatures of greater than 68°F, well above standards for salmonid survival (Ecology 2009b). High levels of chemical contaminants (PCBs, PAHs, DDT, arsenic) and low levels of dissolved oxygen occur on the 303(d) list for reaches of the Columbia River that occur within the action area. Riparian areas have experienced particularly high levels of disturbance due to urbanization and streambank armoring. Riparian vegetation therefore offers less function in terms of cooling water temperatures and providing shoreline habitat complexity, relative to historical conditions.

Habitat Component: Areas for Growth and Development to Adulthood

This habitat component refers to marine areas in the Pacific Ocean and does not occur in the action area.

Habitat Component: Adult Migration Corridors

This habitat component consists of the same ten essential habitat features as juvenile migration corridors. This habitat component is present in the action area but is highly degraded as described for juvenile migration corridors above.

5.3.3 2010 Bull Trout Proposed Critical Habitat

This proposed designation consists of nine PCEs, six of which occur in Columbia River portion of the action area.

PCE: Springs, seeps, groundwater sources, and subsurface water connectivity (hyporehic flows) to contribute to water quality and quantity and provide thermal refugia.

These habitat characteristics are applicable to spawning and rearing habitat, and are not present within the action area.

PCE: Migratory habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.

The action area functions as a migration corridor for bull trout, but this PCE is degraded, particularly with respect to water quality (see Section 5.3.1). The Washington State 303(d) list includes records in the action area for water temperatures of greater than 68°F, well above standards for salmonid survival (Ecology 2009b). Water temperatures within the action area are likely to seasonally limit bull trout presence. Water temperatures above 15ºC (59ºF) may limit bull trout distribution (Fraley and Shepard 1989; Rieman and McIntyre 1995). Columbia River water temperatures at Washougal, Washington, range from approximately 6ºC (43ºF) in early spring (mid-March) to approximately 22ºC (72ºF) in late summer (late July/early August) (USGS 2009); temperatures in the action area are assumed to be comparable. Depending on the year, water temperatures in the action area may exceed the bull trout tolerance threshold of 15ºC (59ºF) between May and October.

There are no known physical barriers to fish passage in the action area.

PCE: An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

This PCE is present within the action area. Because the riparian areas within the action area are highly degraded and little intact riparian vegetation is present, terrestrial organisms of riparian origin are very limited. However, aquatic macroinvertebrates (e.g., sand shrimp, mysids) are present (NMFS 2005c). Forage fish species for bull trout include sculpins (*Cottus* spp.), minnows (*Cyprinidae*), whitefish (*Prosopium* spp.), and juvenile salmonids (Rieman and McIntyre 1993), all of which are present in the Columbia River and North Portland Harbor within the action area.

PCE: Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes with features such as large wood, side channels, pools, undercut banks and substrates, to provide a variety of depths, gradients, velocities, and structure.

As discussed in Section 5.2.2.1, the complexity of riverine habitat in the action area has been reduced relative to historical conditions. Numerous upstream dams, levees located along shorelines, and channel modification (e.g., armoring, reshaping) have restricted habitat-forming processes such as sediment transport and deposition, erosion, and natural flooding. Shoreline erosion rates are likely slower than they were historically due to flow regulation. Connection to historical floodplains and side channels has been altered or lost. The river channel is deeper and narrower than historical conditions. Therefore, this PCE is present, but degraded, in the action area. Lake, reservoir, and marine shoreline habitats are not present in the action area.

PCE: Water temperatures ranging from 2 to 15°C (36 to 59°F), with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will vary depending on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shade, such as that provided by riparian habitat; and local groundwater influence.

This PCE is degraded in the action area, as water temperatures exceed the tolerance threshold for bull trout for significant portions of the year. Compared to other salmonids, bull trout have a more narrow tolerance for habitat quality parameters, and require particularly cold, clean water. As discussed above, water temperatures above 15ºC (59ºF) likely limit bull trout distribution

(Fraley and Shepard 1989; Rieman and McIntyre 1995). Depending on the year, water temperatures in the action area may exceed the bull trout tolerance threshold of 15ºC (59ºF) between May and October. During these months, adequate thermal refugia are likely to be scarce in the action area. Water temperatures between November and April, however, are suitable for bull trout.

Within the action area, the Columbia River does not meet DEQ standards for temperature and is 303(d) listed (DEQ 2007a). No TMDL for temperature has been proposed at this time (DEQ 2009).

PCE: Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount (e.g., less than 12 percent) of fine substrate less than 0.85 mm (0.03 in) in diameter and minimal embeddedness of these fines in larger substrates are characteristic of these conditions.

This PCE is specific to bull trout spawning and rearing habitat, and is not present in the action area.

PCE: A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, they minimize departures from a natural hydrograph.

This PCE is present but is degraded from historical conditions. Development of the hydropower system on the Columbia River has significantly influenced peak seasonal discharges and the velocity and timing of flows in the river. The Columbia River estuary historically received annual spring freshet flows that were 75–100 percent higher on average than current freshet flows. Historical winter flows (October through March) also were approximately 35–50 percent lower than current flows (ISAB 2000). Although current conditions represent a departure from the natural hydrograph, base flows in the action area have not been disrupted to the extent that foraging, migration, and overwintering behavior are significantly impaired for bull trout.

PCE: Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

As discussed above, water quality is impaired within the action area, and flows are altered from historical conditions. However, water quality and quantity are suitable to the extent that foraging, migration, and overwintering behavior of bull trout is possible. Spawning and rearing habitat is not present, although growth and survival of bull trout are not precluded by current conditions (as evidenced by a limited number of documented sightings in the lower Columbia River; see Appendix J).

PCE: Few or no non-native predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); inbreeding (e.g., brook trout); or competitive (e.g., brown trout) species present.

Non-native fish species are present in the action area. Given the paucity of data on bull trout distribution and habitat use in the lower Columbia River, the extent to which non-native fish affect bull trout in the action area is unknown. Because any bull trout occurring in the action area are expected to be subadults or adults (see discussion in Section 4.15.1), they are likely to be less susceptible to predation than juveniles. Therefore, non-native predatory fish are unlikely to have a significant impact on bull trout in the action area. Bull trout do not breed in the action area, and would not be affected by the potential for inbreeding with non-native species.

Non-native competitive species may be present in the action area. Brown trout, for example, are more likely to be present in tributaries to the Columbia River (including associated lakes and reservoirs) because they are stocked for recreational harvest; however, it is possible that brown trout could stray to the mainstem river and survive there. The extent to which this actually occurs is unknown; however, the potential for such non-native species to be present in the mainstem cannot be ruled out.

Therefore, this PCE is not expected to be present in the action area because the potential exists for non-native competitive fish species to be present.