Research Task	Justification	Duration	Data Analysis
Add two additional transects in different habitat types similar to those being done for the NMFS studies currently under way with annual fish evaluation process.	Provide additional habitat and salmonid distribution information for the estuary. Useful in establishing inventory information for future monitoring or restoration.	Begin before construction and for 3 years after completion of the Project construction phase.	Record value and use of different habitat types for juvenile salmonids and cutthroat trout.
Evaluate cutthroat trout use of the estuary and river areas.	Little is known about the species use of this habitat. Research to provide additional information regarding coastal cutthroat trout use of this habitat.	Conduct study for 2 years before construction and 2 years during construction.	Record value and use of different habitat types by cutthroat trout.
Conduct bank-to-bank hydrographic surveys of the estuary.	Has not been done in 20 years and is needed to assess available habitat and restoration actions.	Once, prior to construction.	Bathymetry will be available for shallow water areas in the estuary.
In conjunction with ongoing studies of juvenile salmonids habitat utilization in the Lower Columbia River, collect and analyze juvenile salmonids and their prey for concentrations of chemical contaminants.	Provide additional data on contaminants in listed salmonids and their prey. Useful in establishing inventory information for future monitoring or restoration.	Begin before Project construction and for 3 years after construction phase, depending on the results.	Record concentrations of persistent contaminants (e.g., DDTs, PCBs, PAHs, dioxin-like compounds) in juvenile salmonids and prey.
In conjunction with above contaminant study, assess sublethal effects of contaminants (e.g., growth, disease resistant) on salmonids.	Provide additional data for established contaminants thresholds effect levels to ensure that guidelines are Protective of salmonids; to better characterize performance of juvenile salmonids in the estuary.	Begin before construction and for 3 years after construction phase, depending on the results.	Record health status of juvenile salmonids collected above.
Estuarine Turbidity Maximum (ETM) workshop.	To further the knowledge of the ETM and the listed stocks.	Once.	Not required.

3.0 STATUS OF THE SPECIES

The terrestrial species opinion reviewed the rangewide status of bald eagle and Columbian white-tailed deer, and this information is incorporated herein by reference. No additional rangewide

status information for bald eagle or Columbia white-tailed deer is provided herein. However, updated site-specific information on bald eagle and Columbian white-tailed deer within the Project area is provided in the Environmental Baseline section, below. The following is a discussion of coastal cutthroat trout and bull trout status within their respective DPS areas.

3.1 Southwestern Washington/Columbia River Coastal Cutthroat Trout

3.1.1 Overview

A Status Review of coastal cutthroat trout from Washington, Oregon, and California was conducted by NMFS (Johnson et al. 1999). The status review determined there were six Evolutionary Significant Units (ESUs, the NMFS' equivalent to the Service's DPS) of coastal cutthroat trout along the coast of Washington, Oregon, and California. On April 5, 1999, the Services jointly proposed to list the anadromous form of coastal cutthroat trout as threatened in Southwestern Washington and the Columbia River, excluding the Willamette River above Willamette Falls (65 FR 16397). The proposal for listing was based upon perceived widespread decline in abundance and the small population sizes of anadromous coastal cutthroat trout throughout the lower Columbia River and southwestern Washington, and modifications to riverine and estuarine habitats. In April of 2000, the one-year listing deadline was extended by six months to obtain and review new information needed to resolve substantial scientific concerns about the status of the DPS, including information on above-barrier populations and influences of hatchery management (65 FR 20123). In 2000, the Service assumed sole jurisdiction over all extant subspecies of coastal cutthroat trout (65 FR 21376). Under a national settlement agreement, the Service has agreed to determine, by June 23, 2002, whether to list the Southwestern Washington/Columbia River Coastal Cutthroat Trout DPS.

The aquatic species BA, Appendix D, provides an excellent overview of anadromous coastal cutthroat trout biology and ecology; these descriptions are incorporated herein by reference. The following is a brief overview of coastal cutthroat trout biology and ecology.

Coastal cutthroat trout occupy a wide range of habitat types and display a diverse range of life history strategies, perhaps making them one of the more locally adapted species of the salmonid family (64 FR 16397). Their life history is complex, with considerable variation within and among populations. Life history strategies include fish with limited spawning and foraging migrations (resident form), fish that undertake longer-distance spawning and foraging migrations strictly within freshwater (freshwater migratory form), and those that undertake spawning and foraging migrations between freshwater and saltwater (saltwater migratory or anadromous form). Various life history forms frequently occur in the same streams (Johnson et al. 1999). There is

also evidence that life history patterns can change within individual fish over time (Johnson et al. 1999). This diversity in life histories exhibited by coastal cutthroat trout may reflect an adaptive strategy, allowing coastal cutthroat trout to exploit habitats not fully utilized by other salmonid species (Johnson et al.1999). Within the Southwestern Washington/Columbia River DPS, all three forms of coastal cutthroat trout have been identified.

Resident coastal cutthroat trout typically inhabit small streams, often in headwater areas. These non-migratory fish typically live their entire life within a small reach of stream, but may undertake local movements and migrations. These fish normally do not grow to more than 150mm to 200mm and seldom live more than three years (Trotter 1989). Resident forms may occur throughout a river basin, but generally are more prevalent in upstream locations.

Freshwater-migratory coastal cutthroat trout perform movement and migrations within freshwater only. Several migration strategies have been observed: populations that migrate from large streams to smaller ones to spawn (fluvial); fish that reside in lakes the majority of the time but migrate upstream to spawn (adfluvial); and fish that live in lakes the majority of the time but migrate downstream to spawn in the lake outlet (lacustrine) (Johnson et al. 1999).

Anadromous coastal cutthroat trout undertake migrations from freshwater natal areas to estuary and marine waters and back to freshwater areas. Generally, the period of saltwater residence is of shorter duration for coastal cutthroat trout than other anadromous salmonids, and it is believed that coastal cutthroat trout do not overwinter in the ocean (Trotter 1997).

The majority of available information on coastal cutthroat trout pertains to the anadromous life history form. There is limited information about the distribution, abundance, or status of resident forms of coastal cutthroat trout in this DPS, and almost no information about relative abundances or status of freshwater migratory forms. Because the Project is proposed in locations where the anadromous form of coastal cutthroat trout is known to occur, the following information pertains to the anadromous form of coastal cutthroat trout.

3.1.2 Status and Distribution

Anadromous coastal cutthroat trout numbers have declined in some portions of their range in recent years. Coastal cutthroat trout are widely distributed throughout the fresh and near shore marine waters of the Pacific Northwest. The distribution of coastal cutthroat trout is broader than any other cutthroat trout subspecies (Johnson et al. 1999). Anadromous forms range from the Eel River in northern California to the Kenai Peninsula in Alaska, and generally less than 90 km inland. However, some populations may occur inland up to 160 km (Johnson et al. 1999). In

portions of Washington, Oregon, and California, the Cascade Mountains appear to limit the species' inland distribution.

3.1.3 Early Life History

Cutthroat eggs require approximately 300 Fahrenheit temperature units (generally 6-7 weeks) during incubation until hatching, and an additional 150 to 200 temperature units for emergence to occur (Stolz and Schnell 1991). Newly-emerged cutthroat trout are very small (<2.5 cm Total Length [TL]). Peak emergence is generally mid-April, but may range from March through June (Trotter 1997). At emergence, coastal cutthroat trout fry quickly migrate to channel margins and backwaters, where they remain throughout the summer. Upon leaving lateral habitats, juvenile coastal cutthroat trout use a variety of stream or riverine habitats. Juvenile coastal cutthroat trout may rear for two or more years in freshwater, seeking pools and other slow water habitats with root wads and large wood for cover (Trotter 1997). Often juvenile coho salmon are present in the same habitat, and the larger coho salmon will drive the cutthroat into riffles, where cutthroat will remain until fall and winter (Sabo 1995). Overwinter habitat includes pools near undercut banks or large woody debris (Bustard and Narver 1975). Juvenile coastal cutthroat trout are opportunistic feeders, taking advantage of whatever prey is available, with aquatic insects as the most available, and therefore most dominant, prey item consumed (Trotter 1997).

3.1.4 Migration

Seaward migration of coastal cutthroat trout ranges from March to July, and peaks in mid-May (Trotter 1997). Average fish length at this time was found to be 150 mm TL (Johnston 1979). Within river systems that empty into sheltered ocean environments, coastal cutthroat trout generally smolt at age 2 (Trotter 1989). Non-hatchery Columbia River coastal cutthroat trout populations commonly smolt at age 2 or 3, even though the river enters a non-sheltered ocean environment (Loch and Miller 1988), whereas those of hatchery origin generally smolted at age 1. Populations that migrate into unsheltered coastal areas generally smolt at older ages and larger sizes. However, smolting in anadromous forms may occur any time between 1 and 5 years (Trotter 1989).

The amount of time spent in salt water varies between populations, ranging from 2 to 9 months (Thorpe 1994). In most populations, coastal cutthroat trout remain within a few kilometers of the coast, migrate no more than 70 km from their home stream, and do not cross large bodies of open water (Trotter 1997). However, in a few situations where riverine influence occurs well into offshore ocean areas, notably the Columbia River plume, coastal cutthroat trout may migrate more than 50 km from the coast. While in the ocean, coastal cutthroat trout are opportunistic

feeders on a variety of fish and invertebrate prey items (Trotter 1997). Growth while in saltwater is often rapid, with growth rates of 25 mm per month reported from fish occupying the Columbia River plume (Pearcy et al. 1990).

The timing of return migration to fresh water varies by population. Populations with appreciable estuaries generally have relatively early returning fish (July to October), whereas streams draining directly into the ocean have late returning populations (mid-winter)(Trotter 1997). Nearly all anadromous coastal cutthroat trout overwinter in freshwater, after feeding in marine or brackish water (Trotter 1997). Trotter (1997) speculated that important overwinter habitat is comprised of deep pools with associated cover. Not all coastal cutthroat trout spawn upon returning to fresh water.

3.1.5 Spawning

The spawning period for anadromous cutthroat trout ranges from December to June, with peak activity in February (Trotter 1989). Coastal cutthroat trout spawn in small coastal streams, and tributaries within small and large watersheds (Trotter 1997); spawning streams generally have summer low flows averaging 0.1 m^3/sec, and do not exceed 0.3 m^3/sec. Use of small streams for spawning appears to be an adaptation to isolate their nursery/rearing ground from other, more competitive, species such as steelhead trout (Stolz and Schnell 1991). However, overlap with steelhead trout and coho salmon spawning areas may occur (Johnson et al. 1999). The preferred spawning substrate is pea to walnut sized gravel, in water depth of 15-45 cm, with pools nearby for escape cover. Actual spawning may extend over a period of 2 to 3 days (Trotter 1997).

Anadromous coastal cutthroat trout may be repeat (iteroparous) spawners. Some fish have been documented to spawn each year for at least five years, although some do not spawn every year and some do not return to seawater after spawning but instead remain in fresh water for at least a year. Anadromous coastal cutthroat trout may live to an age of 7 or 8 years, spawning three, four, or even as many as five times during their life (Trotter 1997).

3.2 Columbia River Bull Trout

3.2.1 Overview

The aquatics species BA, Appendix D, provides an overview of bull trout biology and ecology; these descriptions are incorporated herein by reference. The following is a brief overview of bull trout in the Columbia River DPS.

Bull trout are char native to the Pacific Northwest and western Canada. Bull trout are relatively dispersed throughout tributaries of the Columbia River Basin, including its headwaters in Montana and Canada. The Columbia River DPS includes bull trout residing in portions of Oregon, Washington, Idaho, and Montana. Bull trout are estimated to have occupied about 60 percent of the Columbia River Basin and currently occur in 45 percent of the estimated historical range (Quigley and Arbelbide 1997). The Columbia River DPS comprises 141 bull trout subpopulations in four geographic areas of the Columbia River basin. The Project is located within the lower Columbia River geographic area, which includes all tributaries in Oregon and Washington downstream of the Snake River confluence near the town of Pasco, Washington.

The current distribution of bull trout in the lower Columbia River Basin is less than the historical range (Buchanan et al. 1997). Bull trout are thought to have been extirpated from several tributaries in five river systems in Oregon: the Middle Fork Willamette River, the North and South Forks of the Santiam River, the Clackamas River, the upper Deschutes River (upstream of Bend, Oregon), and the Crooked River (tributary to the Deschutes River) (Buchanan et al. 1997). Hydroelectric facilities and large expanses of unsuitable, fragmented habitat have isolated these subpopulations. Large dams, such as McNary, John Day, The Dalles, and Bonneville, separate four reaches of the lower Columbia River. Although bull trout may pass each facility in both upstream and downstream directions, the extent to which bull trout use the Columbia River is unknown. In addition, the nine major tributaries have numerous water storage facilities, many of which do not provide upstream passage.

4.0 ENVIRONMENTAL BASELINE

The aquatic species BA provides an extensive description of historic and current habitat conditions in the Columbia River and estuary (Chapter 2), a description of the complex processes and functions that occur in these riverine and estuarine habitats (Chapter 4), and discussions of coastal cutthroat trout and bull trout within these riverine and estuarine habitats (BA pages 4-10

to 4-12, and Appendix pages D1-7 to D1-10, D2-1 to D2-26, and D3-1 to D3-62); these descriptions are incorporated herein by reference.

The Environmental Baseline section, below, is presented in four sub-sections. The first sub-section (4.1 Lower Columbia River and Estuary Conditions) provides an overview of the current environmental conditions in the Colombia River and estuary. The second sub-section (4.2 Coastal Cutthroat Trout and Bull Trout in the Lower Columbia River and Estuary) reviews current information on coastal cutthroat trout and bull trout in the lower Columbia River and estuary, and discusses the importance of the Columbia River and its estuary's physical processes and resultant habitats to coastal cutthroat trout and bull trout. The third sub-section (4.3 Description of Lower Columbia River and Estuary Baseline Conditions Using a Conceptual Ecosystem Model) presents a framework for describing the complex river and estuary ecosystem processes and functions; how the Project may influence these important ecosystem processes and functions is the foundation for analysis of potential Project effects (presented in 5.0 Effects of Action section, below). The fourth sub-section (4.4 Updated Environmental Baseline Information for Columbian White-tailed Deer and Bald Eagle) updates the Service's terrestrial species opinion with new information on bald eagle and Columbian white-tailed deer in the Project area. Unless otherwise cited, the following information is extracted from the aquatic species BA.

4.1 Lower Columbia River and Estuary Conditions

The Columbia River is naturally a very dynamic system. It has been affected and shaped over eons by a variety of natural forces, including volcanic activity, storms, floods, natural events, and climatological changes. These forces had and continue to have a significant influence on biological factors (e.g., flow), habitat, inhabitants, and the whole riverine and estuarine environment of the Columbia River.

Over the past century, human activities have dampened the range of physical forces in the action area and resulted in extensive changes in the lower Columbia River and estuary. Effects that have been particularly large have occurred through changes to flow hydrographs, isolation of the floodplain, and diking and filling of wetland areas. The Columbia River estuary has lost approximately 43% of its historic tidal marsh (from 16,180 to 9,200 acres) and 77% of historic tidal swamp habitats (from 32,020 to 6,950 acres) between 1870 and 1970 (Thomas 1983). Within the lower Columbia River, diking, river training devices (pile dikes and rip rap), railroads, and highways have narrowed and confined the river to its present location. Between the Willamette River and the mouth of the Columbia River, diking, flow regulation, and other human activities have resulted in a confinement of 84,000 acres of flood plain that likely contained large amounts of tidal marsh and swamp. The lower Columbia River's remaining tidal marsh and