UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Refer to:
2003/01460

May 12, 2004

Mr. Lawrence C. Evans
U.S. Army Corps of Engineers
Attn: Karla Ellis
Portland District, CENWP-CO-GP
P.O. Box 2946
Portland, OR 97208-2946

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Randy Rust Bank Stabilization Project, Columbia River Mile 98, Multnomah County, Oregon (Corps No. 200201001)

Dear Mr. Evans:

Enclosed is a biological opinion (Opinion) prepared by NOAA's National Marine Fisheries Service (NOAA Fisheries) pursuant to section 7 of the Endangered Species Act (ESA) for the issuance of a permit under section 10 of the Rivers and Harbors Act and section 404 of the Clean Water Act to Mr. Randy Rust for bank stabilization at Columbia River Mile 98, in Multnomah County, Oregon. The Corps of Engineers (COE) determined that the action is likely to adversely affect Snake River sockeye salmon (*Oncorhynchus nerka*), Snake River fall-run Chinook salmon (*O. tshawytscha*), Snake River spring/summer Chinook salmon, Upper Columbia River spring-run Chinook salmon, Lower Columbia River Chinook salmon, Upper Willamette River Chinook salmon, Columbia River chum salmon (*O. keta*), Snake River steelhead (*O. mykiss*), Upper Columbia River steelhead, Middle Columbia River steelhead, Upper Willamette River steelhead, and Lower Columbia River steelhead and requested formal consultation on this action. NOAA Fisheries concludes in this Opinion that the proposed action is not likely to jeopardize the continued existence of the above listed species or destroy or adversely modify designated critical habitat.

Pursuant to section 7 of the ESA, NOAA Fisheries has included reasonable and prudent measures with non-discretionary terms and conditions that NOAA Fisheries believes are necessary and appropriate to minimize the potential for incidental take associated with this project.

This document also serves as consultation on Essential Fish Habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and its implementing regulations (50 CFR Part 600). NOAA Fisheries concludes that the proposed

action may adversely affect designated EFH for coho salmon and Chinook salmon (*O. tshawytscha*) and starry flounder (*Platyichthys stellatus*). As required by section 305(b)(4)(A) of the MSA, included are conservation recommendations that NOAA Fisheries believes will avoid, minimize, mitigate, or otherwise offset adverse effects on EFH resulting from the proposed action. As described in the enclosed consultation, 305(b)(4)(B) of the MSA requires that a Federal action agency must provide a detailed response in writing within 30 days after receiving an EFH conservation recommendation.

Questions regarding this letter should be directed to Christy Fellas of my staff in the Willamette Basin Habitat Branch of the Oregon State Habitat Office at 503.231.2307.

Sincerely,

for Michael R Course

D. Robert Lohn
Regional Administrator

Endangered Species Act - Section 7 Consultation
Biological Opinion

&

Magnuson-Stevens Fishery Conservation and Management Act
Essential Fish Habitat Consultation

Randy Rust Bank Stabilization, Columbia River Mile 98,
Multnomah County, Oregon
(Corps No. 200201001)

Agency:	U.S. Army Corps of Engineers
Consultation Conducted By:	NOAA's National Marine Fisheries Service, Northwest Region
Date Issued:	May 12, 2004
Issued by:	for Michael R Crouse _____ D. Robert Lohn Regional Administrator
Refer to:	**2003/01460**

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1. INTRODUCTION

The biological opinion and incidental take statement portions of this consultation were prepared by NOAA Fisheries in accordance with section 7(a)(2) the Endangered Species Act (ESA) of 1973, as amended (16 USC 1531 et seq.), and implementing regulations at 50 CFR 402. The essential fish habitat (EFH) part of this consultation was prepared in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 USC 1801 et seq.) and implementing regulations at 50 CFR 600. The administrative record for this consultation is on file at the Oregon State Habitat Office.

1.1 Background

On December 1, 2003, NOAA's National Marine Fisheries Service (NOAA Fisheries) received a letter from the U.S. Army Corps of Engineers (COE) requesting formal consultation pursuant to the Endangered Species Act (ESA) for the issuance of a permit under section 10 of the Rivers and Harbors Act and section 404 of the Clean Water Act to Mr. Randy Rust for a bank stabilization project at Columbia River mile 98, in Multnomah County, Oregon. The COE determined the proposed action was likely to adversely affect the following ESA-listed species: Snake River (SR) sockeye salmon (*Oncorhynchus nerka*), SR fall-run Chinook salmon (*O. tshawytscha*), SR spring/summer Chinook salmon, Upper Columbia River (UCR) spring-run Chinook salmon, Lower Columbia River (LCR) Chinook salmon, Upper Willamette River (UWR) Chinook salmon, Columbia River (CR) chum salmon (*O. keta*), SR steelhead (*O. mykiss*), UCR steelhead, Middle Columbia River (MCR) steelhead, UWR steelhead, and LCR steelhead.

1.2 Proposed Action

The proposed action is issuance of a permit under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act to authorize construction of a riprap toe along 240 linear feet of sandy riverbank, with smaller rock and vegetation on the upper bank line. This project is the second phase of the total project that will ultimately stabilize 565 feet of riverfront property. In December 2002, Phase I was permitted, authorizing stabilization of 325 feet.

For the proposed project, a 2.5-foot deep toe trench will be excavated and the trench will be lined with filter fabric. Large riprap, 2.5 to 4 feet in diameter, will be placed in the trench, approximately 2 feet below the existing beach line. The entire slope will then be lined with filter fabric before installation of smaller riprap over the large riprap. The trench riprap will be covered with smaller rock, maintaining the existing 3:1 slope. All work will be conducted in the dry and from the top of bank. The entire project area will be planted with live stakes of willow and dogwood. A total of 133 cubic yards (yd^3) of material will be placed below the ordinary high water (OHW) mark. The work will be done in the recommended in-water work window of November 1 to February 28, or during low water when the project area is "in the dry."

The applicant proposes this project to repair and control erosion of a sandy bank that began eroding in the 1996 flood. An adjacent house and drainfield are at risk of damage if bank stabilization is not completed.

2. ENDANGERED SPECIES ACT

2.1 Biological Opinion

2.1.1 Biological Information

The objective of this biological opinion (Opinion) is to determine whether the proposed action is likely to jeopardize the continued existence of the ESA-listed species or destroy or adversely modify designated critical habitat. This consultation is conducted pursuant to section 7(a)(2) of the ESA and its implementing regulations, 50 CFR 402.

The action area in the Columbia River serves as a rearing and migration area for juvenile ESA-listed salmonids, and as a migration area for adults (Table 1). Essential habitat features of juvenile rearing and migration areas include adequate water quality, water quantity, water velocity, cover/shelter, food, riparian vegetation, space, and safe passage conditions. The essential habitat features of critical habitat for adult migration corridors are similar to those of juvenile migration, except adequate food. The proposed action may affect the essential habitat features of water quality, cover/shelter, riparian vegetation and space.

2.1.2 Evaluating Proposed Action

The standards for determining jeopardy and adverse modification of critical habitat are set forth in section 7(a)(2) of the ESA as defined by 50 CFR 402.02 (the consultation regulations). In conducting analyses of habitat-altering actions under section 7 of the ESA, NMFS uses the following steps of the consultation regulations combined with the Habitat Approach (NMFS 1999): (1) Consider the status and biological requirements of the species; (2) evaluate the relevance of the environmental baseline in the action area to the species' status; (3) determine the effects of the proposed or continuing action on the species; (4) consider cumulative effects; and (5) determine whether the proposed action, in light of the above factors, is likely to appreciably reduce the likelihood of species survival in the wild or adversely modify its critical habitat. In completing this step of the analysis, NMFS determines whether the action under consultation, together with all cumulative effects when added to the environmental baseline, is likely to jeopardize the ESA-listed species or result in the destruction or adverse modification of critical habitat. If either or both are found, NMFS must identify reasonable and prudent alternatives for the action.

Table 1. References for Additional Background on Listing Status, Biological Information, Protective Regulations, and Critical Habitat Elements for the ESA-Listed Species Considered in this Consultation

Species ESU	Status	Critical Habitat	Protective Regulations	Biological Information, Historical Population Trends
Chinook salmon (*O. Tshawytscha*)				
Snake River fall-run	T 4/22/92; 57 FR 14653[1]	12/28/93; 58 FR 68543	7/10/00; 65 FR 42422	Waples *et al*. 1991b; Healey 1991
Snake River spring/summer-run	T 4/22/92; 57 FR 14653[2]	10/25/99; 64 FR 57399[2]	7/10/00; 65 FR 42422	Matthews and Waples 1991; Healey 1991
Lower Columbia River	T 3/24/99; 64 FR 14308		7/10/00; 65 FR 42422	Myers *et al.*1998; Healey 1991
Upper Willamette River	T 3/24/99; 64 FR 14308		7/10/00; 65 FR 42422	Myers *et al.*1998; Healey 1991
Upper Columbia River spring-run	E 3/27/99; 64 FR 14308		7/10/00; 65 FR 42422	Myers *et al.*1998; Healey 1991
Chum salmon (*O. keta*)				
Columbia River	T 3/25/99; 64 FR 14508		7/10/00; 65 FR 42422	Johnson *et al*. 1997; Salo 1991
Sockeye salmon (*O. nerka*)				
Snake River	E 11/20/91; 56 FR 58619	12/28/93; 58 FR 68543	11/20/91; 56 FR 58619	Waples *et al*. 1991a; Burgner 1991
Steelhead (*O. mykiss*)				
Lower Columbia River	T 3/19/98; 63 FR 13347		7/10/00; 65 FR 42422	Busby *et al*. 1995; 1996
Middle Columbia River	T 3/25/99; 64 FR 14517		7/10/00; 65 FR 42422	Busby *et al*. 1995; 1996
Upper Columbia River	E 8/18/97; 62 FR 43937		7/10/00; 65 FR 42422	Busby *et al*. 1995; 1996
Upper Willamette River	T 3/25/99; 64 FR 14517		7/10/00; 65 FR 42422	Busby *et al*. 1995; 1996
Snake River Basin	T 8/18/97; 62 FR 43937		7/10/00; 65 FR 42422	Busby *et al*. 1995; 1996

[1] Also see 6/3/92; 57 FR 23458, correcting the original listing decision by refining ESU ranges.

[2] This corrects the original designation of 12/28/93 (58 FR 68543) by excluding areas above Napias Creek Falls, a naturally-impassable barrier.

2.1.3 Biological Requirements

The first step in the methods NOAA Fisheries uses for applying the ESA section 7(a)(2) to listed salmonids is to define the species' biological requirements that are most relevant to each consultation. NOAA Fisheries also considers the current status of the listed species, taking into account population size, trends, distribution and genetic diversity. To assess the current status of the listed species, NOAA Fisheries starts with the determinations made in its decision to list the species for ESA protection and also considers new data available that is relevant to the determination.

The relevant biological requirements are those necessary for the listed species to survive and recover to a naturally-reproducing population level, at which time protection under the ESA would become unnecessary. Adequate population levels must safeguard the genetic diversity of the listed stock, enhance its capacity to adapt to various environmental conditions, and allow it to become self-sustaining in the natural environment. For this consultation, the biological requirements are improved habitat characteristics that function to support successful rearing and migration. The current status of the listed species, based on their risk of extinction, has not significantly improved since the species were listed.

2.1.4 Environmental Baseline

The action area is defined by NOAA Fisheries regulations (50 CFR 402) as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The action area is the Columbia River, including the streambed, streambank, water column, and adjacent riparian zone, at River Mile 98, on Sauvie Island in the City of Portland, Oregon, and 100 feet upstream and 100 feet downstream of the construction area.

Aquatic habitat in the project area consists primarily of fine and coarse-grained sands and silts. Some pockets of rubble, cobble, and gravels may also be present. Listed fish species use the action area primarily for juvenile migration and rearing, and for adult migration. Juvenile rearing in this area is likely limited by the lack of instream structure and riparian vegetation.

The most recent evaluation of the environmental baseline for the Columbia River Basin, which includes the action area, is presented in NOAA Fisheries's Opinion for the Bonneville Power Administration's Habitat Improvement Program, issued in August 2003 (NOAA Fisheries No.: 2003/00750). A detailed evaluation of the environmental baseline of the Columbia River basin can be found in this Opinion (NOAA Fisheries 2003a).

The quality and quantity of fresh water habitat in much of the Columbia River basin have declined dramatically in the last 150 years. Forestry, farming, grazing, road construction, hydropower system development, mining, and development have radically changed the historical habitat conditions of the basin. More than 2,500 streams, river segments, and lakes in the Northwest do not meet Federally-approved, state, and/or Tribal water quality standards and are now listed as water-quality-limited under section 303(d) of the Clean Water Act. Tributary

water quality problems contribute to poor water quality when sediment and contaminants from the tributaries settle in mainstem reaches and the estuary. Most of the waterbodies in Oregon on the 303(d) list do not meet water quality standards for temperature. High water temperatures adversely affect salmonid metabolism, growth rate, and disease resistance, as well as the timing of adult migrations, fry emergence, and smoltification. Many factors can cause high stream temperatures, but they are primarily related to land-use practices rather than point-source discharges. Some common actions that cause high stream temperatures are the removal of trees or shrubs that directly shade streams, water withdrawals for irrigation or other purposes, and warm irrigation return flows. Loss of wetlands and increases in groundwater withdrawals contribute to lower base-stream flows that, in turn, contribute to temperature increases. Activities that create shallower streams also cause temperature increases.

Many waterways in the Columbia River basin fail to meet Clean Water Act (CWA) and Safe Drinking Water Act (SDWA) water quality standards due to the presence of pesticides, heavy metals, dioxins, and other pollutants. These pollutants originate from both point (*e.g.*, industrial and municipal waste) and nonpoint (*e.g.*, agriculture, forestry, urban activities) sources. The types and amounts of compounds found in runoff are often correlated with land use patterns; fertilizers and pesticides are frequently found in agricultural and urban settings, and nutrients are found in areas with human and animal waste. People contribute to chemical pollution in the basin, but natural and seasonal factors also influence pollution levels in various ways. Nutrient and pesticide concentrations vary considerably from season to season, as well as among regions with different geographic and hydrological conditions. Natural features, such as geology and soils, and land-management practices, such as stormwater drains, tile drainage, and irrigation, can influence the movement of chemicals over both land and water. Salmon and steelhead require clean water and gravel for successful spawning, egg incubation, and fry emergence. Fine sediments clog the spaces between gravel and restrict the flow of oxygen-rich water to the incubating eggs. Pollutants, excess nutrients, low levels of dissolved oxygen, heavy metals, and changes in pH also directly affect the water quality for salmon and steelhead.

Water quantity problems are also a significant cause of habitat degradation and reduced fish production. Millions of acres in the Columbia River basin are irrigated. Although some of the water withdrawn from streams eventually returns as agricultural runoff or groundwater recharge, crops consume a large proportion of it. Withdrawals affect seasonal flow patterns by removing water from streams in the summer (mostly May through September) and restoring it to surface streams and groundwater in ways that are difficult to measure. Withdrawing water for irrigation, urban consumption, and other uses increases temperatures, smolt travel time, and sedimentation. Return water from irrigated fields can introduce nutrients and pesticides into streams and rivers. Water withdrawals, primarily for irrigation, have lowered summer flows in nearly every stream in the basin and thereby profoundly decreased the amount and quality of rearing habitat. In 1993, fish and wildlife agency, tribal, and conservation group experts estimated that 80% of 153 Oregon tributaries had low-flow problems, two-thirds of which were caused, at least in part, by irrigation withdrawals (OWRD 1993). The Northwest Power Planning Council (NWPPC 1992) found similar problems in many Idaho, Oregon, and Washington tributaries.

Blockages that stop downstream and upstream fish movement exist at many dams and barriers, whether they are for agricultural, hydropower, municipal/industrial, or flood control purposes. Culverts that are not designed for fish passage also block upstream migration. Being diverted into unscreened or inadequately screened water conveyances or turbines sometimes kills migrating fish. While many fish-passage improvements have been made in recent years, artificial structures continue to block migrations or kill fish throughout the basin.

On the landscape scale, human activities have affected the timing and amount of peak water runoff from rain and snowmelt. Forest and range management practices have changed vegetation types and density that, in turn, affect runoff timing and duration. Many riparian areas, floodplains, and wetlands that once stored water during periods of high runoff have been destroyed by development that paves over or compacts soil, thus increasing runoff and altering natural hydrograph patterns.

Land ownership has also played its part in the region's habitat and land-use changes. Federal lands, which comprise 50% of the basin, are generally forested and situated in upstream portions of the watersheds. While there is substantial habitat degradation across all land ownerships, in general, habitat in many headwater stream sections is in better condition than in the largely non-Federal lower portions of tributaries (Doppelt *et al.* 1993, Frissell 1993, Henjum *et al.* 1994, Quigley and Arbelbide 1997). In the past, valley bottoms were among the most productive fish habitats in the basin (Stanford and Ward 1992, Spence *et al.* 1996, ISG 1996). Today, agricultural and urban land development and water withdrawals have significantly altered the habitat for fish and wildlife in these valley bottoms. Streams in these areas typically have high water temperatures, sedimentation problems, low flows, simplified stream channels, and reduced riparian vegetation.

While some habitats were being destroyed by water withdrawals in the Columbia basin, water impoundments in other areas dramatically reduced habitat by inundating large amounts of spawning and rearing habitat and reducing migration corridors to a single channel (for the most part). Floodplains have been reduced in size, off-channel habitat features have been lost or disconnected from the main channel, and the amount of large woody debris (large snags/log structures) in rivers has been reduced. Most of the remaining habitats are affected by flow fluctuations associated with reservoir management.

More than 50% of the original marshes and spruce swamps in the estuary have been converted to industrial, transportational, recreational, agricultural, or urban uses. More than 3,000 acres of intertidal marsh and spruce swamps have been converted by human use since 1948 (LCREP 1999). Many wetlands along the shore in the upper reaches of the estuary have been converted to industrial and agricultural lands after levees and dikes were constructed. Furthermore, water storage and release patterns from reservoirs upstream of the estuary have changed the seasonal pattern and volume of discharge. The peaks of spring/summer floods have been reduced and the amount of water discharged during winter has increased.

2.1.5 Analysis of Effects

2.1.5.1 Direct Effects of the Proposed Action

The effects of the proposed action on ESA-listed salmonids are likely to include short-term construction effects, primarily increased turbidity and potential contamination, and less frequent natural channel adjustments. Site restoration with riparian vegetation is likely to have a long-term beneficial effect.

Turbidity from Construction
At moderate levels, turbidity can reduce primary and secondary productivity and, at high levels, turbidity can interfere with feeding and can injure and kill both adult and juvenile fish (Spence *et al.* 1996, Bjornn and Reiser 1991). Other behavioral effects on fish, such as gill flaring and feeding changes, have been observed in response to pulses of suspended sediment (Berg and Northcote 1985). Fine, redeposited sediments can also reduce primary and secondary productivity (Spence *et al.* 1996), and reduce incubation success and interstitial rearing space for juvenile salmonids (Bjornn and Reiser 1991). Salmonid fishes have been observed to move laterally and downstream to avoid turbid plumes (Sigler *et al.* 1984, Lloyd 1987, Servizi and Martens 1991). Juvenile salmonid fishes tend to avoid streams that are chronically turbid, such as glacial streams or those disturbed by human activities, except when the fish must traverse these streams along migration routes (Lloyd *et al.* 1987). In contrast, turbid water can provide cover and refuge from predation from piscivorous fish and birds (Gregory and Levings 1998). In habitats with intense predation pressure, this provides a beneficial trade-off of enhanced survival in exchange for physical effects such as reduced growth.

Exposure duration is a critical determinant of whether turbidity causes physical or behavioral effects and the extent of those effects (Newcombe and MacDonald 1991). Salmonids have evolved in waters that periodically experience short-term pulses (days to weeks) of high suspended sediment loads, often associated with floods, and are adapted to such high pulse exposures. Adult and larger juvenile salmonids appear to be little affected by the high concentrations of suspended sediments that occur during storm and snowmelt runoff episodes (Bjornn and Reiser 1991). However, chronic exposure can cause physiological stress that can increase maintenance energy and reduce feeding and growth (Redding *et al.* 1987, Lloyd 1987, Servizi and Martens 1991).

However, because the work will be done in the recommended in-water work window when the least numbers of fish are present or "in the dry" when no sediment is likely to reach the Columbia River, any increased turbidity from the proposed project is likely to be delayed until the return of high flows, and minor and local in its intensity.

Bank Stabilization
Rivers are dynamic systems that perpetually alter their courses in response to multiple physical criteria. Residences and other structures constructed along waterways are subject to flooding and undercutting as a result of these natural changes in stream course. Structural embankment

hardening has been a typical means of protection for structures along waterways. Impacts to waterways from revetment installation are: (1) Simplification of stream channels, (2) alteration of hydraulic processes, and (3) prevention of natural channel adjustments (Spence *et al*. 1996). Moreover, embankment hardening may shift the erosion point either upstream or downstream of the subject site and contribute to stream velocity acceleration. As erosive forces impact different locations, and bank hardening occurs in response, the river eventually attains a continuous fixed alignment lacking habitat complexity (COE 1977). The proposed project area, on the Columbia River, is constrained by bank hardening along most of the river.

Fish habitat is enhanced by the diversity of habitat at the land-water interface and adjacent bank (COE 1977). Streamside vegetation provides shade which reduces water temperature. Overhanging branches provide cover from predators. Organisms that fall from overhanging branches may be preyed on by fish. Immersed vegetation, logs, and root wads provide points of attachment for aquatic prey organisms, shelter from swift currents during high flow events, and retain bed load materials. The proposed vegetation on the newly-sloped bank will provide shelter during high flows and shade as the vegetation matures.

The most desirable method of bank protection is revegetation. However, revegetation alone can seldom stabilize banks steeper than 3:1 (vertical:horizontal) or areas of high velocity (COE 1977). Although biologically less desirable, fixed structures provide the most reliable means of bank stability. The use of structural measures should be a last resort. Combining structural measures (*i.e.* sloped riprap or mechanically stabilized earth walls) and vegetation is preferable to an unvegetated structural solution. The least preferable alternative is a vertical bulkhead (COE 1977). Due to the velocity and flows in the Columbia River, revegetation alone will not adequately protect the failing bank. The proposed riprap will protect the bank from further damage, and the vegetation will add to the habitat complexity and provide cover for salmonids during high flow events.

The proposed action will stabilize of 240 feet of the Columbia River bank with a combination of rock, filter fabric, and native vegetation. Construction is scheduled for the recommended in-water work window or when the project area is exposed and work can be completed in the dry. This will minimize the potential for stream turbidity and the likelihood that sediment will be transported to the river.

As with all construction activities, there is potential for accidental release of fuel, oil, and other contaminants to the waterway. To minimize this potential, equipment will work from above the bankline and be serviced away from any water body. A spill management plan and an inspection schedule for equipment will further minimize the potential for accidental release of hazardous materials.

2.1.5.2 Effects on Critical Habitat

NOAA Fisheries designates critical habitat based on physical and biological features that are essential to the listed species. Essential elements for designated critical habitat include:

Substrate, water quality, water quantity, water temperature, food, riparian vegetation, access, water velocity, space, and safe passage.

Critical habitat is currently in effect for Snake River stocks only. See Table 1 for more information about the critical habitat designations. Effects on critical habitat are included in the effects description above.

2.1.5.3 Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation."

NOAA Fisheries is not aware of any specific future non-Federal activities within the action area that would cause greater effects to listed species than presently occurs. Between 1990 and 2000, the population of Multnomah County increased by 13.1%.[3] Thus, NOAA Fisheries assumes that future private and state actions will continue within the action area, increasing as population density rises. Each subsequent action may have only a small incremental effect, but taken together they may have a significant effect that would further degrade the watershed's environmental baseline and undermine the improvements in habitat conditions necessary for listed species to survive and recover.

2.1.6 Conclusion

NOAA Fisheries has determined that, based on the available information, the proposed action is not likely to jeopardize the continued existence of listed species nor result in the destruction or adverse modification of critical habitat. NOAA Fisheries used the best available scientific and commercial data to analyze the effects of the proposed action on the biological requirements of the species relative to the environmental baseline, together with cumulative effects. These conclusions are based on the following considerations: (1) In-water work will take place between November 1 and February 28 when the fewest ESA-listed species are likely to be present or when the project area is "in the dry;" (2) any increases in sedimentation and turbidity in the project area will be short-term and minor in scale; (3) vegetative plantings included as part of the site restoration process will improve rearing and migration conditions for juvenile salmonids, particularly during high flow events; and (4) the proposed action is not likely to impair properly functioning habitat, or retard the long-term progress of impaired habitat toward proper functioning condition essential to the long-term survival and recovery at the population or ESU scale.

[3] U.S. Census Bureau, State and County Quickfacts, Multnomah County, Oregon. Available at http://quickfacts.census.gov/qfd/states/41/41051.html

2.1.7 Reinitiation of Consultation

Consultation must be reinitiated if: (1) The amount or extent of taking specified in the incidental take statement is exceeded, or is expected to be exceeded; (2) new information reveals effects of the action may affect listed species in a way not previously considered; (3) the action is modified in a way that causes an effect on listed species that was not previously considered; or (4) a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

2.2 Incidental Take Statement

The ESA at section 9 [16 USC 1538] prohibits take of endangered species. The prohibition of take is extended to threatened anadromous salmonids by section 4(d) rule [50 CFR 223.203]. Take is defined by the statute as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." [16 USC 1532(19)] Harm is defined by regulation as "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavior patterns, including, breeding, spawning, rearing, migrating, feeding or sheltering." [50 CFR 222.102] Harass is defined as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering." [50 CFR 17.3] Incidental take is defined as "takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant." [50 CFR 402.02] The ESA at section 7(o)(2) removes the prohibition from any incidental taking that is in compliance with the terms and conditions specified in a section 7(b)(4) incidental take statement [16 USC 1536].

2.2.1 Amount or Extent of the Take

NOAA Fisheries anticipates that the actions covered by this Opinion are reasonably certain to result in incidental take of listed species because of increased turbidity and alteration of hydraulic and channel forming processes along the shoreline during high flows. Even though NOAA Fisheries expects some low level of incidental take to occur due to the actions covered by this Opinion, the best scientific and commercial data available are not sufficient to enable NOAA Fisheries to estimate a specific amount of incidental take to the species itself. In instances such as these, NOAA Fisheries designates the expected amount of take as "unquantifiable". Based on the information provided by the COE and other available information, NOAA Fisheries anticipates that an unquantifiable amount of incidental take could occur as a result of the action covered by this Opinion.

The extent of the take is limited to habitat harm resulting from construction activities within the action area, and the transitory response of juveniles and adults who respond by bypassing or temporarily leaving the proposed action area. The action area is the Columbia River, including

the streambed, streambank, water column and adjacent riparian zone, at River Mile 98, and 100 feet upstream and 100 feet downstream of the work area.

2.2.2 Reasonable and Prudent Measures

The measures described below are non-discretionary. They must be implemented so that they become binding conditions in order for the exemption in section 7(a)(2) to apply. The COE has the continuing duty to regulate the activities covered in this incidental take statement. If the COE fails to adhere to the terms and conditions of the incidental take statement through enforceable terms added to the document authorizing this action, or fails to retain the oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(a)(2) may lapse.

NOAA Fisheries believes that the following reasonable and prudent measures are necessary and appropriate to avoid or minimize take of listed salmonid species resulting from the action covered by this Opinion.

The COE shall include measures in the subject permit that will:

1. Ensure completion of a comprehensive monitoring and reporting program to confirm this Opinion is meeting its objective of minimizing take from permitted activities.

2. Avoid or minimize incidental take from construction-related activities by applying permit conditions that require completion of construction, operation and maintenance actions with minimum harm to aquatic and riparian systems.

2.2.3 Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the COE must comply with the following terms and conditions, which implement the reasonable and prudent measures described above for each category of activity.

1. To implement reasonable and prudent measure #1 (monitoring), the COE shall ensure that:

    a. Salvage notice. The following notice is included as a permit condition:

> NOTICE. If a sick, injured or dead specimen of a threatened or endangered species is found, the finder must notify the Vancouver Field Office of NOAA Fisheries Law Enforcement at 360.418.4246. The finder must take care in handling of sick or injured specimens to ensure effective treatment, and in handling dead specimens to preserve biological material in the best possible condition for later

analysis of cause of death. The finder also has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not disturbed unnecessarily.

b. Written planning requirements. Before beginning any work below bankfull elevation,[4] the permittee will provide a copy of the written plans for site restoration and pollution and erosion control to the Oregon State Habitat Office of NOAA Fisheries at the following address. Plan requirements are described below.

Director, Oregon State Habitat Office
Habitat Conservation Division
National Marine Fisheries Service
Attn: 2003/01460
525 NE Oregon Street
Portland, OR 97232

c. Implementation monitoring report required. The permittee submits an implementation monitoring report to the COE and to NOAA Fisheries, at the address below, within 120 days of completing all in-water work. The monitoring report will describe the permittee's success meeting his or her permit conditions.
   i. If the in-water work will not be completed by January 31 following the year during which consultation was completed, the permittee shall submit a report to the COE and to NOAA Fisheries by January 31 saying why the in-water work was not complete.
   ii. If the monitoring report or explanation of why work was not completed is not received by the COE and NOAA Fisheries by January 31, NOAA Fisheries may consider that a modification of the action that causes an effect on listed species not previously considered and causes the incidental take statement of the Opinion to expire.
   iii. Submit a copy of the monitoring report or explanation of why work was not completed to the Oregon State Habitat Office of NOAA Fisheries, at the address above.

d. Implementation monitoring report contents. Each monitoring report will include the following information.
   i. Project identification
      (1) Permittee name, permit number, and project name.
      (2) Project location, including any compensatory mitigation site(s), by 5th field HUC and by latitude and longitude as determined from the appropriate USGS 7-minute quadrangle map.

[4] 'Bankfull elevation' means the bank height inundated by a 1.5 to 2-year average recurrence interval and may be estimated by morphological features such average bank height, scour lines and vegetation limits.

(3) COE contact person.
(4) Starting and ending dates for work completed.

ii. Habitat conditions. Photos of habitat conditions at the project and any compensation site or sites, before, during, and after project completion.[5]
(1) Include general views and close-ups showing details of the project and project area, including pre and post construction.
(2) Label each photo with date, time, project name, photographer's name, and a comment about the subject.

iii. Project data.
(1) Work cessation. Dates work ceased due to high flows, if any.
(2) Pollution control. A summary of pollution and erosion control inspections, including any erosion control failure, contaminant release, and correction effort.
(3) Site preparation.
(a) Total cleared area – riparian and upland.
(b) Total new impervious area.
(4) Site restoration. Photo or other documentation that site restoration performance standards were met.

e. Reinitiation contact. To reinitiate consultation, contact the Oregon State Habitat Office of NOAA Fisheries, at the address above.

2. To implement reasonable and prudent measure #2 (construction-related activities), the COE shall:

a. Minimum area. Construction impacts must be confined to the minimum area necessary to complete the project.
b. Timing of in-water work. Work below ordinary high water must be completed during the work window of November 1 to February 28, or when the project area is in the dry, unless otherwise approved in writing by NOAA Fisheries.
c. Cessation of work. Project operations must cease under high flow conditions that may result in inundation of the project area, except for efforts to avoid or minimize resource damage.
d. Pollution and erosion control plan. A pollution and erosion control plan must be prepared and carried out to prevent pollution caused by surveying or construction operations. Submit an electronic copy of this plan with the project notification.
i. Contents. The pollution and erosion control plan must contain the pertinent elements listed below, and meet requirements of all applicable laws and regulations.

[5] Relevant habitat conditions may include characteristics of channels, eroding and stable streambanks in the project area, riparian vegetation, water quality, flows at base, bankfull and over-bankfull stages, and other visually discernable environmental conditions at the project area, and upstream and downstream of the project.

(1) The name and address of the person responsible for accomplishment of the pollution and erosion control plan.
(2) Practices to prevent erosion and sedimentation associated with access roads, construction sites, equipment and material storage sites, and fueling operations.
(3) A description of any regulated or hazardous products or materials that will be used for the project, including procedures for inventory, storage, handling, and monitoring.
(4) A spill containment and control plan with notification procedures, specific cleanup and disposal instructions for different products, quick response containment and cleanup measures that will be available on the site, proposed methods for disposal of spilled materials, and employee training for spill containment.

ii. Inspection of erosion controls. Monitor instream turbidity and inspect all erosion controls daily during the rainy season, weekly during the dry season, or more often as necessary, to ensure the erosion controls are working adequately.[6]
(1) If monitoring or inspection shows that the erosion controls are ineffective, immediately mobilize work crews to repair, replace, or reinforce controls as necessary.
(2) Remove sediment from erosion controls before it reaches 1/3 of the exposed height of the control.

iii. Preconstruction activity. The following actions must be completed before significant[7] alteration of the project area.

iv. Marking. Flag the boundaries of clearing limits associated with site access and construction to prevent ground disturbance of critical riparian vegetation, wetlands and other sensitive sites beyond the flagged boundary.

v. Emergency erosion controls. Ensure that a supply of materials for emergency erosion control are available onsite (*e.g.*, silt fence, straw bales).[8]

vi. Temporary erosion controls. All temporary erosion controls must be in-place and appropriately installed downslope of project activity within the riparian area until site restoration is complete.

e. Heavy Equipment. Use of heavy equipment is restricted as follows:

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[6] 'Working adequately' means that project activities do not increase ambient stream turbidity by more than 10% above background 100 feet below the discharge, when measured relative to a control point immediately upstream of the turbidity causing activity.

[7] 'Significant' means an effect can be meaningfully measured, detected or evaluated.

[8] When available, certified weed-free straw or hay bales must be used to prevent introduction of noxious weeds.

i. Choice of equipment. When heavy equipment will be used, the equipment selected must have the least adverse effects on the environment (*e.g.*, minimally sized, low ground pressure equipment).

ii. Vehicle and material staging. Store construction materials, and fuel, operate, maintain and store vehicles as follows.

(1) To reduce the staging area and potential for contamination, ensure that only enough supplies and equipment to complete a specific job will be stored on-site.

(2) Complete vehicle staging, cleaning, maintenance, refueling, and fuel storage in a vehicle staging area placed 150 feet or more from any stream, waterbody or wetland, unless otherwise approved in writing by NOAA Fisheries. Requests for approval should be submitted with the project notification.

(3) Inspect all vehicles operated within 150 feet of any stream, waterbody or wetland daily for fluid leaks before leaving the vehicle staging area. Repair any leaks detected in the vehicle staging area before the vehicle resumes operation. Document inspections in a record that is available for review on request by COE or NOAA Fisheries.

(4) Before operations begin and as often as necessary during operation, steam clean all equipment that will be used below ordinary high water until all visible external oil, grease, mud, and other visible contaminates are removed.

f. Site preparation. Native materials must be conserved on site for site restoration.

i. If possible, leave native materials where they are found.

ii. If materials are moved, damaged or destroyed, replace them with a functional equivalent during site restoration.

iii. Stockpile all large wood[9] taken from below ordinary high water and from within 150 feet of a stream, waterbody or wetland, native vegetation, weed-free topsoil, and native channel material displaced by construction for use during site restoration.

iv. All large wood taken from the riparian zone must be placed back in the riparian zone or stream as part of site restoration.

g. Earthwork. Earthwork, including excavation, filling and compacting, must be completed as quickly as possible. Stabilize all disturbed areas, including obliteration of temporary roads, following any break in work unless construction will resume within four days.

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[9] Large wood' means a tree, log, or rootwad big enough to dissipate stream energy associated with high flows, capture bedload, stabilize streambanks, influence channel characteristics, and otherwise support aquatic habitat function, given the slope and bankfull channel width of the stream in which the wood occurs. See, Oregon Department of Forestry and Oregon Department of Fish and Wildlife, A Guide to Placing Large Wood in Streams, May 1995 (www.odf.state.or.us/FP/RefLibrary/LargeWoodPlacemntGuide5-95.doc).

h. Site restoration plan. A site restoration plan must be prepared and carried out to ensure that all streambanks, soils and vegetation disturbed by the project are cleaned up and restored as follows.

i. General considerations.

(1) Restoration goal. The goal of site restoration is renewal of habitat access, water quality, production of habitat elements (*e.g.*, large wood), channel conditions, flows, watershed conditions and other ecosystem processes that form and maintain productive fish habitats.

(2) Streambank shaping. Restore damaged streambanks to a natural slope, pattern and profile suitable for establishment of permanent woody vegetation, unless precluded by pre-project conditions (*e.g.*, a natural rock wall).

(3) Revegetation. Replant each area requiring revegetation before the first April 15 following construction. Use a diverse assemblage of species native to the project area or region, including grasses, forbs, shrubs and trees. Noxious or invasive species may not be used.

(4) Stockpiled materials. Use as much as possible of the large wood, native trees, native vegetation, topsoil, and native channel material that was stockpiled during site preparation.

(5) Pesticides. Take of ESA-listed species caused by any aspect of pesticide use is not included in the exemption to the ESA take prohibitions provided by this incidental take statement. Pesticide use must be evaluated in an individual consultation, although mechanical or other methods may be used to control weeds and unwanted vegetation.

(6) Fertilizer. Do not apply surface fertilizer within 50 feet of any stream channel.

(7) Fencing. Install fencing as necessary to prevent access to revegetated sites by livestock or unauthorized persons.

ii. Plan contents. Include each of the following elements.

(1) Responsible person. The name and address of the person responsible for meeting each component of the site restoration requirements, including providing and managing any financial assurances and monitoring necessary to ensure restoration success.

(2) Baseline information. This information may be obtained from existing sources (*e.g.*, land use plans, watershed analyses, subbasin plans), where available.

(a) A functional assessment of adverse effects, *i.e.*, the location, extent and function of the riparian and aquatic resources that will be adversely affected by construction and operation of the project.

(b) The location and extent of resources surrounding the restoration site, including historic and existing conditions.

(3) Goals and objectives. Restoration goals and objectives that describe the extent of site restoration necessary to offset adverse effects of the project, by aquatic resource type.

(4) Performance standards. Use these standards to help design the plan and to assess whether the restoration goal is met. While no single criterion is sufficient to measure success, the intent is that these features should be present within reasonable limits of natural and management variation.

(a) Human and livestock disturbance, if any, is confined to small areas necessary for access or other special management situations.

(b) Areas with signs of significant past erosion are completely stabilized and healed; bare soil spaces are small and well dispersed

(c) Soil movement, such as active rills and soil deposition around plants or in small basins, is absent or slight and local.

(d) Native woody and herbaceous vegetation, and germination microsites, are present and well distributed across the site.

(e) Plants have normal, vigorous growth form, and a high probability of remaining vigorous, healthy and dominant over undesired competing vegetation.

(f) Vegetation structure is resulting in rooting throughout the available soil profile.

(g) Plant litter is well distributed and effective in protecting the soil with few or no litter dams present.

(h) Streambanks are stable, well vegetated, and protected at margins by roots that extend below baseflow elevation, or by coarse-grained alluvial debris.

(5) Work plan. Develop a work plan with sufficient detail to include a description of the following elements, as applicable.

(a) Water supply source, if necessary.

(b) Boundaries for the restoration area.

(c) Restoration methods, timing, and sequence.

(d) Geomorphology and habitat features of stream or other open water.

(e) Site management and maintenance requirements, including a plan to control exotic invasive vegetation.

(f) Elevation and slope of the restoration area to ensure they conform with required elevation and hydrologic requirements of target plant species.

(g) Woody native vegetation appropriate to the restoration site.[10] This must be a diverse assemblage of species that are native to the project area or region, including grasses, forbs, shrubs and trees. This may include allowances for natural regeneration from an existing seed bank or planting.

(6) Five-year monitoring and maintenance plan.

(a) A schedule to visit the restoration site annually for 5 years or longer as necessary to confirm that the performance standards are achieved. Despite the initial 5-year planning period, site visits and monitoring must continue from year-to-year until the COE certifies that site restoration performance standards have been met.

(b) During each visit, inspect for and correct any factors that may prevent attainment of performance standards (*e.g.*, low plant survival, invasive species, wildlife damage, drought).

(c) Keep a written record to document the date of each visit, site conditions and any corrective actions taken.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

3.1 Background

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance essential fish habitat (EFH) for those species regulated under a Federal fisheries management plan. Pursuant to the MSA:

- Federal agencies must consult with NOAA Fisheries on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect EFH (§305(b)(2)).

- NOAA Fisheries must provide conservation recommendations for any Federal or state action that would adversely affect EFH (§305(b)(4)(A)).

- Federal agencies must provide a detailed response in writing to NOAA Fisheries within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with

[10] Use references sites to select vegetation for the mitigation site whenever feasible. Historic reconstruction, vegetation models, or other ecologically-based methods may also be used as appropriate.

NOAA Fisheries EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations (§305(b)(4)(B)).

EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (MSA §3). For the purpose of interpreting this definition of EFH: "Waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle (50 CFR 600.10), and "adverse effect" means any impact which reduces quality and/or quantity of EFH, and may include direct (*e.g.*, contamination or physical disruption), indirect (*e.g.*, loss of prey or reduction in species fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810).

EFH consultation with NOAA Fisheries is required regarding any Federal agency action that may adversely affect EFH, including actions that occur outside EFH, such as certain upstream and upslope activities.

The objectives of this EFH consultation are to determine whether the proposed action may adversely affect designated EFH and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to EFH.

3.2 Identification of EFH

Pursuant to the MSA, the Pacific Fisheries Management Council (PFMC) has designated EFH for Federally-managed fisheries within the waters of Washington, Oregon, and California. Designated EFH for groundfish and coastal pelagic species encompasses all waters from the mean high water line and upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon and California, seaward to the boundary of the U.S. exclusive economic zone (370.4 km) (PFMC 1998a, 1998b). Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other waterbodies currently or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the PFMC 1999), and longstanding, naturally-impassable barriers (*i.e.*, natural waterfalls in existence for several hundred years) (PFMC 1999). In estuarine and marine areas, designated salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (370.4 km) offshore of Washington, Oregon, and California north of Point Conception to the Canadian border (PFMC 1999).

Detailed descriptions and identifications of EFH are contained in the fishery management plans for groundfish (PFMC 1998a), coastal pelagic species (PFMC 1998b), and Pacific salmon (PFMC 1999). Casillas *et al.* (1998) provides additional detail on the groundfish EFH habitat

complexes. Assessment of the potential adverse effects to these species' EFH from the proposed action is based, in part, on these descriptions and on information provided by the COE.

3.3 Proposed Actions

The proposed action and action area are detailed above in sections 1.2 and 1.3 of this Opinion. The action area includes habitats that have been designated as EFH for various life-history stages of Chinook and coho salmon and starry flounder (*Platyichthys stellatus*).

3.4 Effects of Proposed Action

As described in detail in section 2.1.5 of this document, the proposed action will result in short-term adverse effects to a variety of habitat parameters. NOAA Fisheries believes that the proposed action will cause a minor, short-term degradation of anadromous salmonid habitat due to increases in turbidity. Minimization measures will be incorporated into the construction methods to reduce adverse impacts to EFH.

3.5 Conclusion

NOAA Fisheries concludes that the proposed action will adversely affect the EFH for Chinook and coho salmon and starry flounder (*Platyichthys stellatus*).

3.6 EFH Conservation Recommendations

Pursuant to section 305(b)(4)(A) of the MSA, NOAA Fisheries is required to provide EFH conservation recommendations to Federal agencies regarding actions which may adversely affect EFH. While NOAA Fisheries understands that the conservation measures described in the BA will be implemented by the COE it does not believe that these measures are sufficient to address the adverse impacts to EFH described above. However, the terms and conditions outlined in section 2.2.3 are generally applicable to designated EFH for the species designated in section 3.3, and address these adverse effects. Consequently, NOAA Fisheries incorporates them here as EFH conservation recommendations.

3.7 Statutory Response Requirement

Pursuant to the MSA (§305(b)(4)(B)) and 50 CFR 600.920(j), Federal agencies are required to provide a detailed written response to NOAA Fisheries' EFH conservation recommendations within 30 days of receipt of these recommendations. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity on EFH. In the case of a response that is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

3.8 Supplemental Consultation

The COE must reinitiate EFH consultation with NOAA Fisheries if the proposed action is substantially revised in a manner that may adversely affect EFH, or if new information becomes available that affects the basis for NOAA Fisheries' EFH conservation recommendations (50 CFR 600.920(k)).

4. LITERATURE CITED

Bjornn, T.C. and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. *In:* W.R. Meehan (editor). Influences of forest and rangeland management on salmonid fishes and their habitats. Amer. Fish. Soc., Spec. Pub. 19, Bethesda, MD.

Casillas, E., L. Crockett, Y. deReynier, J. Glock, M. Helvey, B. Meyer, C. Schmitt, M.Yoklavich, A. Bailey, B. Chao, B. Johnson and T. Pepperell. 1988. Essential Fish Habitat West Coast Groundfish Appendix. National Marine Fisheries Service, Montlake, Washington.

COE (United States Army Corps of Engineers). 1977. Nehalem Wetlands Review: A Comprehensive Assessment of the Nehalem Bay and River (Oregon). U.S. Army Engineer District, Portland, Oregon. [Page count unknown].

Gregory, R.S., and C.D. Levings. 1998. Turbidity Reduces Predation on Migrating Juvenile Pacific Salmon. Transactions of the American Fisheries Society 127: 275-285.

Lloyd, D.S. 1987. Turbidity as a water quality standard for habitats in Alaska. North American Journal of Fisheries Management 7:34-35.

Newcombe, C. P. and D. D. MacDonald. 1991. Effects of Suspended Sediments on Aquatic Ecosystems. North American Journal of Fisheries Management 11: 72-82.

NOAA Fisheries (National Marine Fisheries Service). 2003a. Biological Opinion for the Bonneville Power Administration Habitat Improvement Program. See website at: http://www.nwr.noaa.gov/1publcat/allbiops.htm

PFMC (Pacific Fishery Management Council), 1998a. Final Environmental Assessment/Regulatory Review for Amendment 11 to the Pacific Coast Groundfish Fishery Management Plan. October 1998.

PFMC (Pacific Fishery Management Council), 1998b. The Coastal Pelagic Species Fishery Management Plan: Amendment 8. Portland, Oregon.

PFMC (Pacific Fishery Management Council). 1999. Amendment 14 to the Pacific Coast Salmon Plan. Appendix A: Description and Identification of Essential Fish Habitat, Adverse Impacts and Recommended Conservation Measures for Salmon. Portland, Oregon.

Redding, J. M., C. B. Schreck and F. H. Everest. 1987. "Physiological Effects on Coho Salmon and Steelhead of Exposure to Suspended Solids." Transactions of the American Fisheries Society 116: 737-744.

Servizi, J. A. and Martens, D. W. 1991. Effects of temperature, season, and fish size on acute lethality of suspended sediments to coho salmon. Canadian Journal of Fisheries and Aquatic Sciences 49:1389-1395.

Sigler , J. W., T.C. Bjornn and F.H. Everest. 1984. Effects of chronic turbidity on density and growth of steelhead and coho salmon. Trans. Am. Fish. Soc. 111:63-69.

Spence, B.C., G.A. Lomnicky, R.M. Hughes and R.P. Novitzki. 1996. An ecosystem approach to salmonid conservation. ManTech Environmental Research Services, Inc., Corvallis, Oregon, to NMFS, Habitat Conservation Division, Portland, Oregon (Project TR-4501-96-6057).