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, Washington 98115

Refer to NMFS No:
2011/00333

October 20, 2011

Evan Lewis, Branch Chief
Corps of Engineers, Seattle District
Environmental and Cultural Resources
Post Office Box 3755
Seattle, Washington 98124-3755

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Skagit River – Diking Districts 1, 3, 12, 17, and 22 Levees Rehabilitation of Flood Control Works Project in Skagit County, Washington (6th Field HUC: 171100070202, South Fork Skagit River)

Dear Mr. Lewis:

The enclosed document contains a Biological Opinion prepared by the National Marine Fisheries Service pursuant to section 7(a)(2) of the Endangered Species Act on the effects of your proposed Skagit River – Diking Districts 1, 3, 12, 17, and 22 Levees Rehabilitation of Flood Control Works Project in Skagit County, Washington. In this Biological Opinion, the National Marine Fisheries Service concludes that the action, as proposed, is not likely to jeopardize the continued existence of Puget Sound Chinook salmon, and Puget Sound steelhead, or result in the destruction or adverse modification of designated critical habitat for Puget Sound Chinook salmon.

As required by section 7 of the ESA, the National Marine Fisheries Service provided an incidental take statement with the Biological Opinion. The incidental take statement describes reasonable and prudent measures the National Marine Fisheries Service considers necessary or appropriate to minimize incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements, that the Federal agency and any person who performs the action must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the Endangered Species Act take prohibition.

This document also includes the results of our analysis of the action's likely effects on Essential Fish Habitat pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes three conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. The conservation recommendations are an identical subset of the ESA Terms and Conditions and Conservation Recommendations. Section

305(b)(4)(B) of the MSA requires Federal agencies to provide a detailed written response to the National Marine Fisheries Service within 30 days after receiving these recommendations.

If the response is inconsistent with the Essential Fish Habitat conservation recommendations, the U.S. Army Corps of Engineers must explain why the recommendations will not be followed, including the justification for any disagreements over the effects of the action and the recommendations. In response to increased oversight of overall Essential Fish Habitat program effectiveness by the Office of Management and Budget, the National Marine Fisheries Service established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each Essential Fish Habitat consultation and how many are adopted by the action agency. Therefore, in your statutory reply to the Essential Fish Habitat portion of this consultation, we ask that you clearly identify the number of conservation recommendations accepted.

If you have questions regarding this consultation, please contact Joel Moribe at the Washington State Habitat Office at (206) 526-4359 or via email at joel.moribe@noaa.gov.

Sincerely,

for William W. Stelle Jr.
Regional Administrator

bc: F/NWR – PDF (Nickerson)
WSHO – File Copy
WSHO – PDF (Chron)
WHSO – PDF (Moribe)
WHSO – PDF (Sibley)

NMFS No.: 2011/00333

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Consultation

Skagit River – Diking Districts 1, 3, 12, 17, and 22 Levees Rehabilitation of Flood Control Works Project in Skagit County, Washington (6th Field HUC: 171100070202, South Fork Skagit River)

NMFS Consultation Number: *2011/00333*

Action Agency: Army Corps of Engineers

Affected Species and Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Puget Sound steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	No
Puget Sound Chinook salmon (*O. tshawytscha*)	Threatened	Yes	No	No

Fishery Management Plan That Describes EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service, Northwest Region

Issued By:

for William W. Stelle, Jr.
Regional Administrator

Date: October 24, 2011

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1. INTRODUCTION

This section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3 below.

1.1 Background

The biological opinion (opinion) and incidental take statement portions of this document were prepared by the National Marine Fisheries Service (NMFS) in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531, et seq.), and implementing regulations at 50 CFR 402.

The NMFS also completed an Essential Fish Habitat (EFH) consultation. It was prepared in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801, et seq.) and implementing regulations at 50 CFR 600.

The opinion and EFH conservation recommendations are both in compliance with section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-5444) ("Data Quality Act") and underwent pre-dissemination review.

1.2 Consultation History

Presently, the U.S. Army Corps of Engineers (COE) seeks ESA section 7 consultation on levee and revetment repair in the action area. The COE already completed the majority of the work described as part of the "proposed" action under ESA emergency procedures (50 CFR 402.5(b)). There remains a portion of the proposed work yet to be completed. All of the levee and revetment repair work conducted in the past and that is left to be completed comprise the proposed action under consultation.

In November 2006, the Skagit River crested and eroded banks throughout the Skagit River Basin, including numerous portions of the lower mainstem within the action area between River Mile (RM) 19.0 and both forks to the bay. The COE declared an emergency and began repairs in the fall of 2007 to 32 sites, totaling 17,348 noncontiguous linear feet of bank, when water levels were low and juvenile salmon abundance was low. Three other sites were deferred for future repair and several of the completed sites were proposed to be reworked. Subsequent floods occurring from 2008 to 2010 claimed more river bank and the COE identified more sites to be repaired. In the summer of 2011, the COE proposes to repair 20 sites that cover 10,255 noncontiguous linear feet.

The COE is itself conducting repair work or funding work by local levee and revetment sponsors (Diking Districts (DD) 1, 3, 12, 17, and 22, hereafter referred to collectively as "the applicant"). The COE replaced rock directly on the banks where the river had displaced preexisting rock during floods. The 2007 construction also included placement of willow stakes and some

"benches" that were constructed to mitigate for loss of complexity in fish habitat. Many of the eroded and repaired sites were near the same locations where riprap was placed in 2004 to repair a similar flood in 2003.

This biological opinion is based on information provided in the March 2010 Biological Assessment (BA) and the revised BA dated January 2011, and the BA addendum dated March 2011, and more than ten meetings from August 30, 2010 through March 25, 2011, e-mail exchanges from the COE and applicant, a site visit on October 25, 2010, and other sources of information. A complete record of this consultation is on file at the Washington State Habitat Office in Lacey, Washington.

1.3 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Although all actions conducted under the proposed action are generally related to flood repair in the Skagit River, they are described in this consultation as the proposed action and not as interrelated or interdependent actions. NMFS did not identify any interrelated or interdependent actions during this consultation.

The COE completed most of the repairs between August 20, 2007 and November 15, 2007 after identifying those actions as emergency ones so as to invoke the provision for emergency consultation in 50 CFR 402.5(b). Additional repair work is scheduled for June 15 through August 31, 2011. We consult on all of these activities as they are described below.

This consultation did not consider the short-term effects created by construction in 2007, which were temporary in nature. The COE conducted those activities in the summer when juvenile salmon are least likely to be present in the action area. Instead, this consultation evaluates the present effects of the 2007 repairs in the environmental baseline for the consultation and the long-term effects of the 2007 repairs as they persist into the future as effects of the action. NMFS considers these effects along with both the construction and long term-presence effects of the repairs and habitat enhancement forthcoming in 2011 in section 2.4, below.

The overall purpose of the project is to repair an existing levee which has been established for decades on the Lower Skagit River. The levee extends on both banks of the Skagit River mainstem from about River Mile 22.5 through the mouths of both forks. Several banks of sloughs in the lower delta (such as Freshwater Slough) are also included. The action shores up failing sites on banks where the Skagit River is actively eroding. These non-contiguous, individual repairs collectively maintain the levee system.

1.3.1 Construction Activities Conducted in 2007

In total, 10,143 linear feet (1.92 miles) of river bank were armored in varying widths, heights, and depths. The bank stabilization occurred non-contiguously throughout the action area ranging

from River Mile (RM) 19.3 in the mainstem to RM 2.5 on the South Fork and RM 4.3 on the North Fork. The COE placed large quantities of angular rocks (up to 24 inch maximum diameter, *i.e.* "riprap"), onto the banks of the Skagit River. All of the riprap was placed within the floodplain. Table 1 shows the details on each of the construction sites.

Table 1. List and description of riprap placements.

Approximate River Mile	**Description** (include descriptions of riparian vegetation impact and fish bench construction)	**Applicant**
19.3	109 linear feet (LF) of bank filled with riprap. Immature alders and willows removed. No willow lifts installed.	Diking District 12
17.9	261 LF. Four immature cottonwood trees removed and shrubbery including willows. Two rows willow lifts planted.	DD12
17.3	511.5 LF. Small willows and other small shrubbery removed. Two rows willow lifts installed.	DD12
15.6	236 LF. Blackberry and other shrubs removed. Willow lifts not installed	DD12
15.0	651 non-contiguous total LF. Immature alders and willows removed. Two rows willow lifts planted.	DD12
13.6	124 LF. Blackberry and other shrubs removed. Two willow lifts installed.	DD12
14.0	170 LF. Little vegetation removed. No willow lifts installed.	DD12
16.2	400 LF. 9 immature cottonwood trees removed. Two rows of willow lifts placed.	DD17
15.4	275 LF. Blackberry, immature alder and shrubs removed. Two rows of willow lifts placed.	DD17
15.3	159 LF. One mature alder and few immature alders and other shrubs removed. Two rows of willow lifts placed.	DD17
15.1	1,350 LF. One row of willows and alders at the river's edge were removed. One row of willow lifts were placed higher on the face of the revetment.	DD17
13.3	522 LF. Blackberry and grass, and one clump of willows removed. Two rows willow lifts were installed.	DD17
13.1	207.5 LF. Grass and shrubs removed. One willow lift placed very high on the bank.	DD1
12.9	200 LF. Shrub, immature alders and willows removed. One willow lift placed. Buried toe.	DD1
10.0	108 LF. Immature alders and willow removed. One willow lift installed.	DD1
9.0	257 LF. One small tree and brush removed. One will lift placed.	DD1
North Fork 7.1	585 LF. Seven large cottonwood trees, five mature	DD22

(upstream end of Fir island)	alders, and other immature trees and brush removed. More work proposed for 2010 to create a toe. One willow lift is proposed.	
NF 4.9	554 LF. Up to 12 willow less than 25-feet tall were removed on river edge. Two willow lifts installed. Some rework proposed for 2010.	DD22
NF 4.3	338 LF. Immature alder and willows and brush cleared. Two willow lifts installed.	DD22
SF 7.0	359 LF. Up to 9 large cottonwood trees (30-50 feet tall), alders, and willows removed. Two rows willow lifts installed.	DD22
SF 5.3	70 LF. Four large cottonwoods and large alders up to 45 feet tall removed.	DD22
SF 5.0	246 LF. Brush and Japanese Knotweed removed. Two willow lifts installed.	DD22
SF 4.3	273 LF. 200 LF of mature riparian forest (cottonwood) removed. One willow lift placed.	DD22
Freshwater Slough 4.0	118 LF. Mature riparian forest (cottonwood, alder) with developed understory removed. Some blackberry and scrub removed. One willow lift planted.	DD22
Freshwater Slough 3.5	395 LF. Up to 30 cottonwood, alder, and willow up to 40 feet tall removed along river edge. One willow lift installed.	DD22
SF 6.5	382 LF. Brush removed. One willow lift installed.	DD3
SF 6.3	436 LF. Some alder and blackberry scrub removed. One willow lift at varying heights on the bank installed.	DD3
SF 6.0	139 LF. Immature alders and grass removed. One willow lift at varying heights on the bank planted.	DD3
SF 5.6	287 LF. Immature alders and brush removed. One willow lift planted.	DD3
SF 3.1	Seepage berm only.	DD3
SF 2.2	460 LF. Shrubs at rivers edge and grass removed. One willow lift installed, higher on the bank.	DD3
SF 2.5	375 LF. Shrubs were removed. Some root balls from the project (cottonwood) were placed high on the bank at this site. Additional work is proposed for 2010. Vegetation will be planted and rootballs will be replaced if moved for construction.	DD3

River miles are estimated from photos and descriptions provided by the COE (2011). River miles are based on maps provided in Williams et al. (1975) which seem to be different than what was provided by the COE. Estimates are provided for the most downstream end of each placement.

Rocks were placed on site individually with excavators, loaders, and other heavy equipment. All equipment was cleaned and inspected for leaks during construction to minimize pollutants from

entering the river. All construction was performed from the bank and heavy equipment did not enter the river. Construction occurred in the fall during low flow. Vegetation was removed as needed to access sites or place rock. Some trees were salvaged with roots attached and placed on the top of levees.

1.3.2 Construction Occurring in 2011

The COE proposes more repairs within the levee system between June 15 and August 31, 2011. In total, 17,460 linear feet (3.31 miles) of river bank will be armored in varying widths, heights, and depths. The COE will place large quantities of angular rocks (up to 24 inch maximum diameter), or riprap, onto the banks of the Skagit River non-contiguously throughout the action area ranging from River Mile (RM) 19.3 in the mainstem to RM 2.0 on the South Fork and RM 4.3 on the North Fork. All of the riprap will be placed within the floodplain and will be placed in the same manner as it was described in the 2007 construction. As with 2007, construction will be performed from the bank and heavy equipment will not enter the river. Table 2 shows the details on each of the construction sites.

Table 2. Locations and descriptions of proposed riprap placements

Approximate River Mile	**Description** (include descriptions of riparian vegetation impact and fish bench construction)	**Applicant**
19.3	250 LF. Layback (3 to 1, horizontal to vertical slope (3H:1V)) proposed. Double willow lift proposed.	DD12
17.7	180 LF. Alders and mature willows will be removed. Double willow lift proposed.	DD12
17.0	450 LF. Triple willow lift proposed.	DD12
15.8	670 LF. Triple willow lift proposed.	DD12
15.7	1,220 LF. Triple willow lift proposed.	DD12
15.4	1850 LF. Triple willow lift proposed.	DD12
15.0	220 LF.	DD12
15.0	160 LF. Alders and willows 8-15 feet tall covering 50-70% of the shoreline will be removed. Double willow lift proposed.	DD12
14.9	600 LF. Triple willow lift proposed.	DD12
14.2	50 LF.	DD12
13.1	350 LF. Nine-foot wide fish bench proposed ranging 2 feet above and below OHW. Double willow lift proposed.	DD12
15.9	800 LF. Triple willow lift proposed.	DD17
15.7	700 LF. Triple willow lift proposed.	DD17
15.5	200 LF. Triple willow lift proposed.	DD17
15.3	925 LF. Triple willow lift proposed.	DD17
15.2	125 LF. Triple willow lift proposed.	DD17
12.8	250 LF. A rock weir will be placed in front of the bank. Triple willow lift and native shrubs and a row of trees proposed.	DD17
12.0	75 LF. Anchored rootwads proposed. Double willow	DD1

	lift proposed.	
12.5	30 LF. Within a 2004 repair site.	DD1
12.9	50 LF. Just downstream of a 2007 repair site.	DD1
11.2	200 LF. Triple willow lift proposed.	DD3
SF 2.2	225 LF. Anchored rootwads proposed. Double willow lift proposed.	DD3
SF 2.0	150 LF. Anchored rootwads and logs proposed. Double willow lift proposed.	DD3
NF 7.1	350 LF. Large riparian trees will be removed. Layback, anchored rootwads, and double willow lift proposed. Overstory trees will also be planted on Riverward levee bench.	DD22
NF 4.2	360 LF. On levee repair only. Riparian forest riverward of levee will remain.	DD22
SF 4.3	110 LF. Will remove a mature riparian cottonwood forest. Double willow lift proposed.	DD22
FW Slough 3.0	Backslope seepage repair only.	DD22
FW Slough 2.8	300 LF. Double willow lift proposed	DD22

1.3.3 Habitat-Improving Features Incorporated into the Proposed Repairs

The COE and the applicants agreed to add habitat improvements throughout the action area to minimize the adverse effects of the long term levee maintenance on the habitat of listed species in the lower river. Floods in 2003, 2006, 2009, and 2011 scoured banks throughout the action area which were repaired by the COE. According to historical data, the Skagit River floods at "flood stage" (Mount Vernon gage = 28 feet) every 1.5 years. Banks appear to erode and need repair after Skagit River flows at flood stage. The COE opted to manage their levees and their effects on salmonid habitat more holistically than through individual consultations by batching levee repairs for consultations and for determining the location of habitat improvements. To determine the appropriate amount of habitat improvements to offset maintenance work, the COE, NMFS, U.S. Fish and Wildlife Service (USFWS), the Skagit River System Cooperative (SRSC), and diking districts (collectively referred to as the Technical Working Group) developed the Habitat Capacity Mitigation Tool.

The Habitat Capacity Mitigation Tool (HCMT) assumes density dependence among salmonid juveniles rearing in the lower river. The HCMT is designed to inform increases in quantity and quality of edge habitat in an environment limited by the presence of the levee system which prevents natural channel migration and the quantity and quality of rearing habitat in the action area. The Technical Working Group (TWG) reviewed the relevant scientific literature and developed a table using offset multipliers[1] which listed habitat improvements and their expected fish density increases. The primary documents used to determine multipliers were Hayman et al. 1996, Beamer and Henderson 1998, Peters et al. 1998, Beechie et al. 2005, and Oregon

[1] Offset multipliers are assigned numbers representing increases in salmon density of habitat features compared to a bare rock bank. For example, a multiplier of 1.4 would expect a site capacity increase of 1.4 times the existing estimate of fish at a rock bank. For the purpose of this consultation, the COE assigned an average density of 4.1 fish per linear foot for the entire levee system from Sedro Woolley to the mouth of the Skagit River.

Department of Fish and Wildlife 2003. The Technical Working Group also discussed and adjusted multiplier scores as most multipliers were relevant to their respective studies and not to the proposed action. All habitat improvement measures are intended improve habitat quality at the site. But the measures are experimental and will be evaluated through monitoring by the TWG. The offset multipliers in the HCMT are supported by literature and conceptually designed but the TWG will not know the actual value of the built products for salmonid habitat until these products have been built and evaluated.

Planting Willow Lifts

Willow lifts are the most common proposed habitat improvement feature of this project. Most banks are being planted with one to three rows of willows as low as water levels during construction allow and as high as ordinary high water. Willow lifts are cuttings that are placed within the rock bank and covered with soil. Willow lifts have varying levels of success with the best growing rapidly and providing brushy overhanging vegetation within seven years but some lifts being completely stripped away after the first flood event. Survival and growth of lifts has improved as placement methods continue to be altered with each placement. According to their National Levee Safety Program, the COE plans to cut willows when they grow to four inches diameter at breast height.

The Technical Working Group assigned a 0.7 times multiplier for a single row of willows placed on a rock bank, 1.4 multiplier for a double willow lift, and 1.8 multiplier for a triple willow lift. The value of the multiplier was adjusted to account for the lag time between planting, when the willow lifts are adding almost nothing to aquatic habitat until maturity when they are functional.

Levee Slope Layback

The COE is proposing to rebuild levees with gentler slopes than the standard 2H:1V design that dominates the system. This experimental design will theoretically support slower water velocity that can be used by aquatic organisms, and may more readily recruit woody debris, which would be beneficial for salmonids. The layback designs also theoretically add more storage capacity at the site and should reduce flood risk downstream.

The Technical Working Group assigned a multiplier ranging from 3.0 to 4.1 for laybacks depending on their width. Narrow laybacks will be less capable of slowing velocity or providing refuge as wider laybacks thus justifying the use of a range of multipliers for laybacks. The multiplier was initially scored higher as laybacks were compared to natural banks. However, the Technical Working Group recognized the designs would be constructed with rock and unnatural and would be less complex than natural banks sampled in the studies.

Fish Bench

The COE proposes one "fish bench" that is designed to provide a shallow shelf on the bank during moderately high flow. Theoretically, a low shelf on a bank would provide a refuge area up to a foot deep where juvenile salmonids can escape the rapid flow of the mainstem. If the bench is planted, it could provide feeding and rearing opportunities. A flat bench could also provide areas that are conducive to woody debris recruitment.

Since fish benches are designed to be functional aquatic habitat during high flow, it will not provide habitat for salmonids most of the time. Although overflow refuge is important habitat for salmonids, it is less important than habitat that would be available to salmonids all of the time. This is reflected in the low multiplier score of 1.3.

Anchored Rootwads

The COE proposes to place logs with rootwads in front of some sections of their levee. This has been a common minimization measure for effects of bank stabilization throughout the region. Federal, State, and local agencies, and non-governmental organizations fund or build large woody debris structures in rivers throughout the State to restore aquatic habitat. Large wood adds habitat diversity to bare banks by adding structures that obstruct and redirect river flow, creating pockets of refuge for salmonids and their prey. Natural interstices in the logs, especially within the roots, provide refuge and feeding areas for juvenile salmonids.

Anchored rootwads are logs attached to cables or chains that are attached to boulders that are partially buried into the river bed. Logs are attached with cables or chains long enough to be floating at most flows. Rootwads will be placed facing upriver, parallel to the bank, and will overlap logs to maximize root area and habitat on site.

Anchored rootwads are among the largest scored multipliers among the mitigation options in the HCMT at 8.7. The high multiplier score reflects the increase in amount and value or rearing habitat that will be added to the edge habitat at the site, and is confirmed in the literature review.

Habitat Weir

The COE is building one habitat weir in front of their bank stabilization sites near Mount Vernon. The design is defined in WDFW's Integrated Stream Protection Guidelines as a groin. Groins are constructed with rock in a trapezoidal formation pointed about 30 to 45 degrees in the direction of flow. The main functions of groins are to redirect flow away from a streambank and to reduce flow velocities near the bank which, in turn encourages sediment deposition. Groins tend to induce scour near their tips, and scour holes are likely to form in these locations (WDFW 2003). This pool formation may be beneficial to salmonids, especially larger individuals that use pool habitat for refuge and feeding.

The Technical Working Group assigned a multiplier of 4.0 for the habitat weir. While the placement of rock into an active channel is not generally accepted as restorative to aquatic

habitat, the placement of the structure angled upstream is likely to create pool habitat, which is rare in the lower Skagit River.

Invasive Plant Removal

The COE is also proposing to remove invasive plants along the banks of the Skagit River to help revegetate the riparian area with native trees and shrubs. The applicants will mechanically and manually remove blackberry, Reed canarygrass, Canada thistle, and Bittersweet nightshade and monitor and maintain the cleared site to prevent re-establishment. The applicants will also use some chemical treatment to kill and prevent re-establishment of Japanese knotweed. The applicant will limit their chemical use to 1% Imazapyr and 1% Agridex surfactant. Applicants will apply the solution using backpack sprayers and apply solution to bent stems. This method will prevent drift and runoff, which reduces exposure to the water column. Applicants will limit their use to 50-ounce handsprayers and 4-gallon backpack sprayers. The COE suggested that the solution would be sprayed at a rate of four pints of Imazapyr per acre, less than the label limit of six pints per acre.

1.3.4 Other Activities

Other actions included placing seepage berms on the land side of the levees to increase the stability of the levee by providing additional weight and counteracting upward seepage forces. Seepage berms are created by placing beds of crushed rock ranging from gravel size to 4-inch rock on the landward side of the levee. The applicants placed berms directly on the landward end of the existing levees, within the Skagit River floodplain. The applicants constructed the berms with dumptrucks, excavators, and other similar heavy equipment.

1.4 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

The action has both short term and long term effects. Considering the minimization measures implemented during construction, short term effects like turbidity and disturbance will be limited to a short distance from the construction sites. The long term effects of maintaining bank armoring are more extensive, and go beyond the immediate area of each repair. They extend upstream and downstream, including reaches one mile up and down river from each site. Furthermore, in some places, maintaining hardened banks extends the action area laterally into the floodplain to the extent that levee repairs and maintenance affect existing habitat function.

To describe the amount of affected floodplain in the action area, NMFS estimated the extent of the floodplain and migration zone behind the levees repaired by this project. The NMFS used aerial photos, 100-year flood maps, and the COE's Project Information Reports (PIR) to draw assumptions on the limits of sinuous meandering, braiding, and off channel formation. The lower Skagit River levee system prevents channel migration on both banks throughout the delta from Sedro Woolley to the mouth. The action area (Figure 1) includes all of the 100-year flood

event inundation limits estimated by the COE. The action area includes approximately 129.6 square miles (82,944 acres) of floodplain and migration area.

The 129.6 square miles cannot all be salmonid habitat all at once. As channels form, braid, and meander, it will abandon other areas and vacate channels. So there is no way of knowing where channels would appear if the action were not to occur and the affected portions of the levee were to disintegrate, over the duration of the repairs (over 50 years). Therefore, NMFS included the entire general zone where channels could occur where the levees prevent the development of or access to off- channel sloughs and connected wetlands from occurring in the action area.

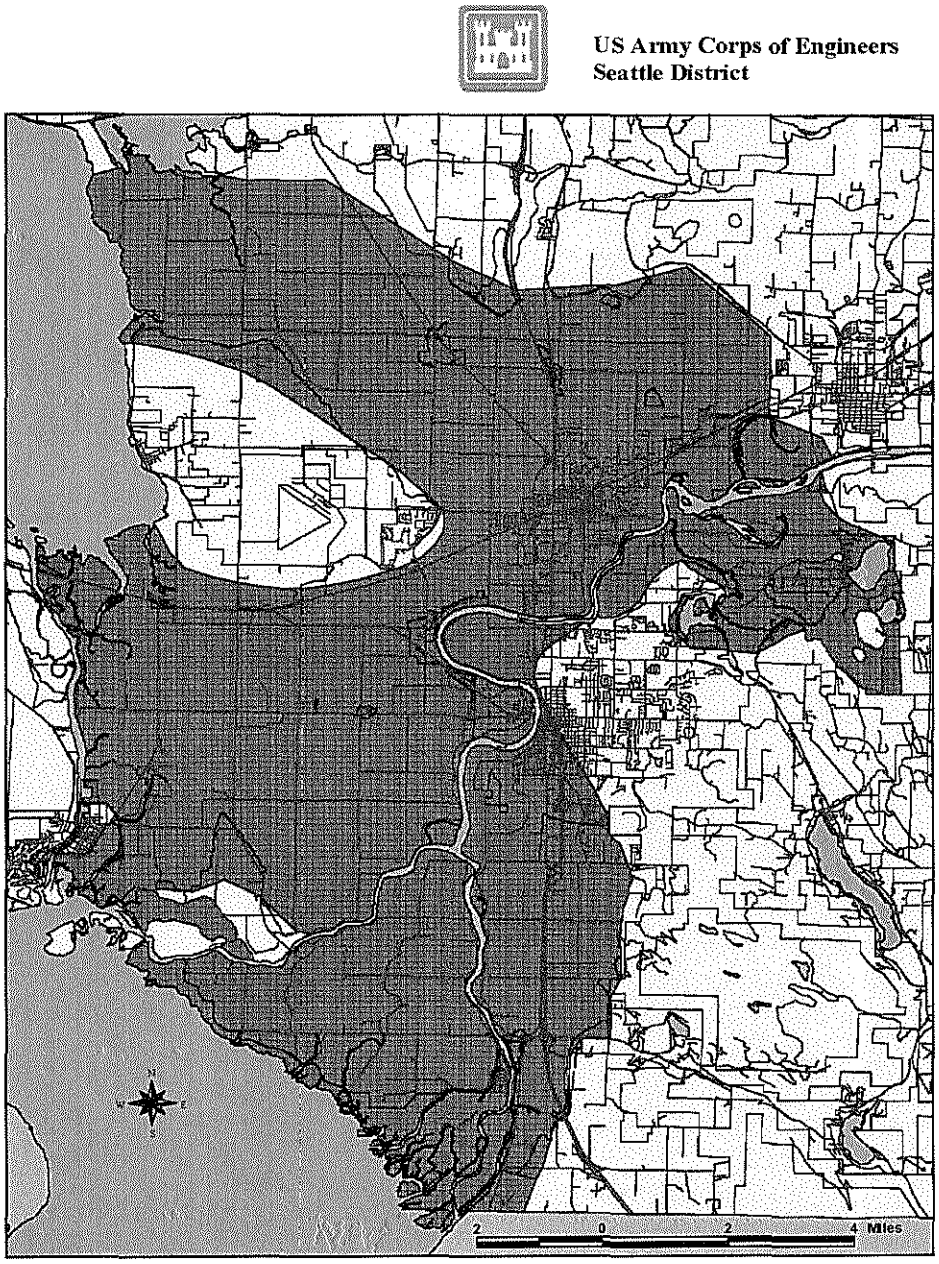


Figure 1. The action area, including the lateral effects of the action, including channel migration zones.

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with the United States Fish and Wildlife Service, NMFS, or both, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitat. Section 7(b)(3) requires that at the conclusion of consultation, the Service provide an opinion stating how the agencies' actions will affect listed species or their critical habitat. If incidental take is expected, Section 7(b)(4) requires the provision of an incidental take statement (ITS) specifying the impact of any incidental taking, and including reasonable and prudent measures to minimize such impacts.

2.1 Introduction to the Biological Opinion

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. The jeopardy analysis considers both survival and recovery of the species. The adverse modification analysis considers the impacts to the conservation value of the designated critical habitat.

"To jeopardize the continued existence of a listed species" means to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02).

This biological opinion does not rely on the regulatory definition of 'destruction or adverse modification' of critical habitat at 50 C.F.R. 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.[2]

[2] Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS (Application of the "Destruction or Adverse Modification" Standard Under Section 7(a)(2) of the Endangered Species Act) (November 7, 2005).

We will use the following approach to determine whether the proposed action described in Section 1.3 is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- *Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed action. Describe the effects of the environmental baseline the action area. Analyze the effects of the proposed actions.*
- *Describe any anticipated cumulative effects in the action area..*
- *Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat*
- *Reach jeopardy and adverse modification conclusions.*
- *If necessary, define a reasonable and prudent alternative to the proposed action.*

2.2 Rangewide Status of the Species and Critical Habitat

Natural variations in freshwater and marine environments have substantial effects on the abundance of Pacific salmon and steelhead populations. Of the various natural phenomena that affect most populations of salmon and steelhead, changes in ocean productivity are generally considered the most important. Pacific salmon and steelhead are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation probably contributes to significant natural mortality, although the levels of predation are largely unknown. In general, Pacific salmon and steelhead are eaten by pelagic fishes, birds, and marine mammals.

Over the past few decades, the size and distribution of the salmon and steelhead populations considered in this Opinion, like the other salmon and steelhead that NMFS has listed, generally have declined because of natural phenomena and human activity, including the operation of hydropower systems, over-harvest, hatcheries, and habitat degradation. Enlarged populations of terns, seals, and sea lions in the Pacific Northwest have reduced the survival of some Pacific salmon and steelhead populations. As noted more fully in the status of the critical habitats section below, climate change is likely to play an increasingly important role in determining the abundance of salmon and steelhead by exacerbating long-term problems related to temperature, stream flow, habitat access, predation, and marine productivity (CIG 2004, Scheuerell and Williams 2005, Zabel et al. 2006, ISAB 2007).

2.2.1 Puget Sound Chinook Salmon

In 1999, NMFS listed Chinook salmon in the Puget Sound ESU as threatened (64 FR 14308). NMFS has compiled the following status summary based on information from the most recent status review (Good et al 2005), and recovery plan elements (Shared Strategy 2007), unless otherwise noted.

In 2005, the Biological Review Team (BRT) concluded that the naturally spawned component of the PS Chinook salmon ESU is likely to become endangered within the foreseeable future, and that hatchery programs do not substantially reduce the extinction risk. The Puget Sound Technical Recovery Team (TRT) recommended that "[a]n ESU-wide recovery scenario should include at least two to four viable Chinook salmon populations in each of 5 geographic regions

within Puget Sound, depending on the historical biological characteristics and acceptable risk levels for populations within each region" (PSTRT 2002). The loss of any additional genetic and life history characteristics from the Puget Sound ESU will affect the ability of the Chinook salmon to persist in the future (Shared Strategy 2007). The TRT stated that "[a]n ESU-wide recovery scenario should include within each geographic region one or more viable population from each major genetic and life history group historically present within that geographic region" (PSTRT 2002). Currently, no population within the ESU is meeting all four viability criteria and the ESU as a whole is not meeting any of the four viability criteria.

The Skagit River watershed is the largest within the Puget Sound. Its large size features relatively diverse sub-watersheds that support six independent populations of Chinook salmon: Lower Sauk, Upper Sauk, Suiattle, Upper Cascade River, Lower Skagit, and Upper Skagit populations (PSTRT 2006). No other river within Puget Sound supports more than two populations. Individually and collectively, the Skagit Chinook salmon populations are essential to the survival and recovery of the ESU because they provide vital contributions to its abundance, productivity, diversity and spatial structure.

Spatial Structure and Diversity. "Spatial structure" refers both to the spatial distributions of individuals in the population and the processes that generate that distribution. A population's spatial structure depends fundamentally on habitat quality and spatial configuration, and the dynamics and dispersal characteristics of individuals in the population (McElhany et al. 2000). Diversity indicates the differences within and among populations in genetic and behavioral traits, such as run timing, age structure, etc. Diversity allows a species to use a greater variety of habitats, and allows it to survive short and long term changes in the environment from naturally and human-caused factors. The PS Chinook salmon ESU includes all naturally spawned populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Straits of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington (March 24, 1999, 64 FR 14208). Ford et al. (2010) found that the spatial distribution of Chinook salmon populations with a strong component of natural-origin spawners in the Puget Sound ESU had not changed since the last status assessment by Myers et al. (1998). Populations containing significant numbers of natural-origin spawners whose status can be reliably estimated occur in the Skagit River basin, the south fork Stillaguamish, and Snohomish River basin. The remaining populations in mid- and south Puget Sound, Hood Canal, and the Strait of Juan de Fuca have significant but non-quantifiable fractions of hatchery origin spawners, so their contribution to spatial structure in the ESU in not possible to estimate.

Of 26 existing artificial propagation programs, eight are directed at conserving PS Chinook salmon. The remaining programs considered part of the ESU are operated primarily for fisheries harvest augmentation purposes (some of which also function as research programs) using transplanted within-ESU-origin Chinook salmon as broodstock. The NMFS determined that these artificially propagated stocks are no more divergent relative to the local natural population(s) than what would be expected between closely related natural populations within the ESU (NMFS 2005).

The PS Chinook salmon ESU had 31 historical quasi-independent populations, 22 of which are believed to be extant (Ruckelshaus et al. 2006). Ford et al. (2010) found that Puget Sound ESU diversity had not changed since the last status assessment. A majority of the PS Chinook salmon populations and spawning aggregations now believed extinct were early-run (spring) populations (Ruckelshaus et al. 2006). The loss of early run (spring) Chinook salmon stocks in Puget Sound represents an important loss of part of the diversity of the historical ESU (Ford et al. 2010). Three of the remaining seven Spring Chinook salmon populations in the ESU reside in the Skagit (Upper Sauk, Suiattle, and Cascade River populations).

In all, more than a fourth of the ESU's populations reside within the Skagit River system. The six Skagit River populations have been relatively uninfluenced by hatchery releases, as compared to most other ESU populations, and represent a significant portion of naturally produced fish within the ESU (Myers et al., 1998). Collectively, the Skagit Chinook salmon populations (in addition to the North Fork Stillaguamish population), make up one of six genetic groups within the ESU. Marshall et al. (1995) assigned all Skagit and North Fork Stillaguamish Chinook salmon stocks to the same Genetic Diversity Unit based on life history, genetic, and habitat similarities within the Skagit and North Fork Stillaguamish River basins. There is one hatchery in the Skagit River system. As such, these populations represent a valuable reserve of genetic diversity for the ESU.

Habitat throughout the Skagit system is hydrologically and geomorphically varied. For instance, the Upper and Lower Sauk River populations spawn and rear within habitat heavily influenced by glacial runoff, portions of some populations spawn within relatively small tributaries with rain-driven hydrographs, while the Upper and Lower Skagit populations spawn within the mainstem Skagit River, which has a discharge pattern that reflects the combined flow of the Skagit and most of its tributaries, the upper Skagit River, Baker River, and Sauk River. As these six Chinook salmon stocks have evolved within these differing habitat regimes, they have developed unique river entry timing, spawn timing and location, and juvenile rearing strategies. For example, the Upper Sauk and Suiattle populations have the largest percentage of adult returns, 44 percent and 51 percent (Beamer 2005a), respectively, that rear as stream-type (or yearling) fish in the ESU. These two populations also have the largest proportions of adults that return as five-year olds (36 and 45 percent) within the ESU. Glacial runoff conditions may limit juvenile growth, delay smolting and thus may influence this large return of five year-old fish in the Sauk/Suiattle Rivers. Within the Skagit River, several different life history, termed yearlings, tidal delta migrants, parr migrants, and fry migrants, subtypes have been identified to describe the variability in utilization patterns of riverine and estuarine habitats by young of the year juvenile Chinook salmon as shown in Table 3(Beamer and Larson 2004; Beamer et al. 2005a).

Table 3. Description of known juvenile life history strategies for wild Skagit Chinook salmon (Beamer et al. 2005a).

Life History Type	Life History Strategy Description
Ocean Type	**Fry Migrants** – These fry emerge from egg pockets and migrate quickly downstream to Skagit Bay. Fry migrants do not rear extensively in delta habitat, so no delta rearing structure is observed on their otolith. They enter Skagit Bay usually in February and March, at an average fork length (FL) of 39 mm (observed range from otoliths is 30–46 mm FL). Some fry migrants take up residence in pocket estuary habitat (Beamer et al. 2003). These areas are thought to provide fry migrants with a survival or growth advantage over other nearshore habitats.
	Delta Rearing Migrants – Delta rearing fry emerge from egg pockets and migrate downstream at the same time as fry migrants. Instead of directly entering Skagit Bay, they reside in tidal delta habitat for a period ranging from several weeks up to several months, reaching an average size of 74 mm FL (observed range from otoliths is 49–126 mm FL). The average delta residence period for delta rearing Chinook salmon in 1995 and 1996, combined, was 34.2 days (Beamer et al. 2000a). Following the delta rearing period, these fish migrate to Skagit Bay, usually starting in late May or June. We observe a delta rearing region on their otolith. Beamer and Larsen (2004) further defined several life history sub-strategies for delta rearing Chinook salmon based on movement patterns and overall residence period within the delta
	Parr Migrants – These fry emerge from egg pockets and rear for a couple of months in freshwater to achieve a similar size as their delta rearing cohorts over the same time period. Following freshwater residence, parr migrants move through the delta and into Skagit Bay, usually starting in late May or June, at the average size of 75 mm FL (observed range from mainstem trapping is 57–92 mm FL). Parr migrants do not reside in tidal delta habitats. We observe an extended freshwater rearing region and no delta rearing region on their otolith. Some of these fish may reside in off channel habitat within the large river floodplain areas of the Skagit River (Hayman et al. 1996)
Stream Type	**Yearlings** – These fry emerge from egg pockets and rear in freshwater for a period of over one year. Movement patterns and habitat preferences within freshwater are largely unknown. Yearlings migrate to the estuary generally from late March through May, at an average size of 120 mm FL (observed range is 92–154 mm FL). Yearlings do not reside in tidal delta habitats for an extended period of time like delta rearing migrants. Yearlings seem to pass through delta habitats, possibly lingering briefly, before they move on to nearshore areas. Yearlings are rarely found in shallow intertidal environments, and are most commonly detected in deeper subtidal or offshore habitats. Residence in nearshore areas of Skagit Bay by yearlings appears to be shorter than ocean type life histories

Chinook salmon populations in the Skagit collectively utilize the largest and most hydrologically diverse watershed in the ESU (PSTRT 2006). Aside from the Upper and Lower Skagit populations, spawning habitat among the six populations are geographically separated. For example, spawning habitat within the Upper and Lower Sauk populations is separated by eight to ten miles of habitat unsuitable for spawning. This large and varied spatial structure, over evolutionary timescales, has contributed to moderate within-population genetic diversity, and relatively high abundance and productivity. It also enhances each population's ability to tolerate natural disturbance events that could render portions of freshwater habitat unusable. From an ESU perspective, the Skagit Chinook salmon spawning areas are the most geographically removed from other Puget Sound tributaries (PSTRT 2006). Viability of the ESU is enhanced by this geographic distance because it provides some protection from large or localized disturbance events, and, as explained above, contributes to life-history and genetic diversity. Aside from its large size and location, some of the upper watershed is among the most intact

within the ESU. In most years this habitat enables good egg to fry/smolt emergence rates to seed rearing habitat throughout the basin.

Abundance and Productivity. Although some of the PS Chinook salmon populations have shown substantial progress in recent years, none of the 22 populations is currently close to meeting the minimum value of the viable planning range for abundance and productivity, all populations are considered to be at high risk, and the condition of all of the populations needs to improve (Shared Strategy 2007). The Puget Sound TRT identified five bio-geographical regions within Puget Sound based on similarities in physical and habitat features, and where groups of Chinook salmon have evolved in common.

Overall abundance of Chinook salmon in this ESU has declined substantially from historical levels of approximately 690,000 spawners in the early 1900s. The long- and short-term escapement trends for natural Chinook salmon runs in North Puget Sound were predominately negative through the mid-1990s when the North Fork Nooksack, Stillaguamish and Snohomish systems began to show improvements in escapements. In South Puget Sound and Hood Canal, both long- and short-term trends in escapements are predominantly positive. However, the contribution of hatchery fish to natural escapements in many of the populations may be substantial, masking the trends in natural production (NMFS 2008). Based on the geometric mean number of natural spawners from 1999 to 2007, the PS Chinook salmon ESU consisted of 42,424 fish (NMFS 2008). Nineteen of the 22 independent populations exhibited stable or increasing trends in abundance (NMFS 2008).

The median short-term population growth rate (lambda) between 1990 and 2002 was 1.0 when the reproductive success of naturally spawning hatchery fish is assumed to be equivalent to that of natural origin fish. The median estimate of lambda would be lower if the estimates of the fraction of naturally spawning hatchery fish were available for all populations in the ESU. Ten populations in the ESU for which no hatchery fraction information is available are all suspected to have a moderate to high fraction of hatchery-origin adults in natural escapements. Lambda values of 1.17 and 1.16 for the mid Hood Canal (Dosewallips, Duckabush, and Hamma Hamma rivers) and White River populations respectively are the highest among the independent populations (NMFS 2008), but these values are still only slightly above 1.0. Those with the lowest growth rate included the Green, Skykomish, North Fork Stillaguamish and North Fork Nooksack populations (Good et al. 2005).

Estimates of historic abundance in the Skagit watershed range from 71,530 (PSTRT 2002) to several hundred thousand (Hayman 2005) adults while contemporary abundance has been approximately 14,000 fish. Although harvest reduces adult returns and harvest practices vary, tracking adult recruitment (the number of adult salmon that return to spawn) provides a reasonable assessment of abundance trends. As recently as the mid-1980's, recruitment was estimated to be over 60,000 adults, while present day recruitment has been near 20,000 fish. This steep decline in recruitment has occurred despite a significant reduction in harvest. From an ESU perspective, this decline is particularly troubling considering that, as a whole, these six populations still represent a large portion (47.8 percent) of the natural production and abundance of the ESU. The Upper Skagit population is the most abundant population within the ESU. Based on recent run sizes, and assuming a stray rate of five percent for the six Chinook salmon

populations, an estimate of 700 Skagit Chinook salmon return to non-natal spawning grounds annually.

While current abundance is large compared to the other populations in the ESU, each Skagit population is a fraction of its historic abundance estimates (Table 4).

Table 4. Current and historic abundance of Skagit Chinook salmon

Population and return timing.	2005-2009 Natural Origin Recruits (% of historic)	Estimated Historical Spawner Capacity[3]	Productivity (Long-term trend, 1952-2009)	Productivity (Short-term trend, 1995-2009)
Lower Skagit (late)	2,067 (9.4)	22,000	0.987	1.064
Upper Skagit (moderately early)	9,724 (27.8)	35,000	1.004	1.033
Upper Cascade (moderately early)	329 (19.4)	1,700	0.955[4]	1.029
Lower Sauk (moderately early)	742 (9.5)	7,800	0.994	1.054
Upper Sauk (early)	486 (11.6)	4,200	1.035	0.977
Suiattle (very early)	250 (30.1)	830	0.985	0.981

The productivity of all six Skagit independent populations all have lambdas close to 1 (table 4), meaning that they are all near neutral. On average, spawners are merely replacing themselves with little increase or decrease in population abundance. Considering the Skagit River's size and abundance, it has importance as a potential source population, especially since both of its neighboring basins (Nooksack and Stillaguamish) presently support critically low Chinook salmon population abundances and productivities.

Habitat limitations can affect several different life history stages which affect abundance and productivity of salmonid populations. Climate, water temperature, and other natural factors influence ocean conditions, which influences smolt to adult survival and growth of salmonids. Other than human-induced climate change, few human activities influence ocean survival and productivity of salmonids. Seeding can be affected by human-caused problems like blockages, water quality, or low survival in other life history stages. Skagit River populations, namely the Lower Sauk, Upper Sauk, and Upper Cascade River populations, are underseeded, having fewer spawners than the habitat should support (Shared Strategy, 2007).

[3] Estimated potential spawning escapement abundance that the population could have supported under historical habitat conditions, derived from a HPVA model (PSTRT 2002).

[4] Cascade population long-term trend from 1981-2009.

2.2.2 Puget Sound Steelhead

Historically, there were 51 natural populations present within the Puget Sound DPS. Two populations, Baker-summer and Chambers-winter, became extinct after the construction of the Baker dams which blocked access to spawning areas in the Baker River. The remaining 49 populations are distributed between 10 watersheds, Nooksack, Skagit, Stillaguamish, Snohomish, Lake Washington, Duwamish/Green, Puyallup, South Sound, Hood Canal, and the Strait of Juan de Fuca basins. Only about 27 percent of these populations evaluated are considered "healthy." The status of 47 percent of the steelhead populations could not be rated because of the lack of a time series of escapement or other abundance data. Populations have been supported by the hatchery broodstock programs. Chambers-winter population and Skamania-summer population have served as broodstock support for hatchery runs found in Kendall Creek, Marblemount, Barnaby Slough, Whitehorse ponds, Reiter ponds, Tokul Creek, Palmer ponds, Soos, Puyallup, Hamma Hamma, Dungeness, and Lake Elwha. The inability to monitor the escapement of populations introduces significant uncertainty and risk into the management of steelhead in Washington.

Spatial Structure and Diversity. Puget Sound steelhead are found in all accessible large tributaries to Puget Sound and the eastern Strait of Juan de Fuca (WDFG 1932). The PS steelhead DPS is composed primarily of winter-run populations (37 of the 53 populations). No abundance estimates exist for most of the summer-run populations; all appear to be small, most averaging less than 200 spawners annually. Summer-run populations are concentrated in northern Puget Sound and Hood Canal; only the Elwha River and Canyon Creek support summer-run steelhead in the rest of the ESU. Steelhead are most abundant in northern Puget Sound, with winter-run steelhead in the Skagit and Snohomish rivers supporting the two largest populations (approximately 5,000 and 3,000 respectively).

There are seven populations that historically used the Skagit Basin for spawning, rearing, migrating, and holding, one of which, the Baker-summer population, became extinct following the construction of the Baker dams, which restricted access to the upper reaches used for spawning. The remaining six are: Mainstem Skagit/Tributaries-winter, Finney Creek-summer, Sauk-summer, Sauk-winter, Cascade-summer, and Cascade-winter. Only one of the six stocks, the Mainstem Skagit/Tributaries-winter steelhead, spawns in the Skagit River, but the remaining stocks use the river system for migration, rearing, and adult holding.
The PSSBRT concluded that the viability of PS steelhead is at moderate risk due to the reduced spatial complexity of, and connectivity among, populations.

The majority of the relatively abundant populations are in the northern regions of the DPS. The Lake Washington population, in the center of the DPS, is functionally extinct. This disconnects the abundant Snohomish River populations from the depressed south sound populations, making recovery difficult. The PSSBRT also suggested that the loss of a centrally located population within the last decade could contribute to the recent declines in abundance of the Snohomish and Skagit populations.

As discussed in the PS Chinook salmon status, the Skagit River is geographically and physically diverse and provides uniquely different freshwater spawning and rearing areas. Populations are

continuous and connected in many areas. Winter and summer steelhead spawning areas overlap in the Sauk River, only being separated by spawn timing. Other spawning aggregates are separated by physical limitations (e.g., gradient, temperature, flow speed) while some aggregates are virtually continuous (e.g., Mainstem Skagit and Sauk River winter run populations).

Limits to potential spawning grounds consist of natural and man-made obstacles, such as the falls on Finney Creek or the five dams on the Skagit River system. Access to the upriver areas stops at the Gorge Dam, located at RM 96.5, which is owned, along with the Ross and Diablo Dams, by Seattle City Light. Baker River has two dams, which have already lead to the extinction of one Skagit River stock. Access is further limited by habitat degradation, as evidenced by the spawning grounds used by the Sauk River stocks. The Sauk-summer stock spawns in the north and South Fork Sauk River, as well as slightly below the forks, but the distribution separates one stock from other summer steelhead stocks in the Skagit basin by more than 50 miles. The Cascade summer population is similarly affected, where spawning most likely occurs in the upper reaches of the Cascade River and its forks, but distribution is separated from other Skagit basin summer stocks by a distance of 40 miles.

Of the Pacific salmonids, *O. mykiss* exhibits the most diverse and complex life-history traits; they can be anadromous (steelhead) or freshwater residents (rainbow trout), and under some circumstances, yield offspring of the opposite life-history form. Non-anadromous *O. mykiss*, referred to as resident rainbow trout or rainbow trout, spend their entire life-cycle in freshwater, overlapping areas occupied by steelhead as well as areas inaccessible to steelhead due to geomorphology or human intervention. Genetically, the resident and anadromous life forms in the same geographic area are more similar to each other than either is to the same form from a different geographic area.

Steelhead generally leave freshwater to rear in the ocean as smolts around age-2, bypassing the extended estuary transition stage which many other salmonids need, and spend between 2 to 7 years in the ocean before re-entering freshwater to spawn. Anadromous steelhead can be divided into two basic reproductive ecotypes, based on the state of sexual maturity at the time of river entry and duration of spawning migration. The summer-run or "stream-maturing" type, enter freshwater in a sexually immature condition between May and October, and requires several months to mature and spawn. The winter-run or "ocean-maturing" type, enter freshwater between November and April with well-developed gonads and spawns soon after. In basins with both summer and winter steelhead runs, the summer run generally occurs where habitat is not fully utilized by the winter run, or where an ephemeral hydrologic barrier separates them, such as a seasonal velocity barrier at a waterfall. Summer steelhead usually spawn farther upstream.

Steelhead can reproduce more than one time throughout their life (iteroparous). Steelhead and cutthroat (*O. clarkii*) are the only species of *Oncorhynchus* in Washington that display this iteroparity. Adults that return to reproduce a second time are generally females that have been in marine waters for as little as 2-6 months but more typically one year. These repeat spawners can comprise a significant proportion of the run; up to 23 percent of the total spawners have been repeat spawners in the Quillayute River. More typically in Washington, 5-10 percent of the winter run is comprised of repeat spawners.

Other examples of diversity among salmonids include morphology, fecundity, run timing, spawn timing, juvenile behavior, age at smolting, age at maturity, egg size, and development rate, among others (McElhaney et al. 2000). Of these traits, some are genetically based, while others are likely a result of a combination of genetic and environmental factors. Diversity is important to population viability because: (1) it allows a species to use a wider array of environments; (2) it protects against short term spatial and temporal changes in the environment, increasing the likelihood that some individuals would survive and reproduce when faced with environmental variation; and (3) genetic diversity provides the raw material for surviving long-term environmental changes. Salmonids have adapted to environments that feature regular and cyclic changes due to natural dynamics, such as ocean conditions. Genetic diversity can enable fish to adapt to these changes.

The PSSBRT concluded that the viability of PS steelhead is at moderate risk due to the reduced life history diversity of populations and the potential threats posed by artificial propagation and harvest in the Puget Sound. All summer-run populations are depressed and concentrated in northern Puget Sound. Another major diversity concern is the homogenization of genetic diversity throughout the DPS by hatchery produced steelhead. Large production of "out-of-DPS" hatchery runs (Chambers Creek winter-run and Skamania River summer-run) and "out-of-basin origin" hatchery runs largely outnumber naturally-produced steelhead in many basins throughout Puget Sound.

Since 1990, 535,000 winter-run steelhead smolts are released yearly at several locations throughout the Skagit River mainstem (PSSBRT 2005). The origin of the steelhead hatchery stock at the Marblemount hatchery is from Chambers Creek. Some native run stock was mixed in with the Chambers Creek stock until 1995, when production returned to using Chambers Creek exclusively. There are no estimates of how much straying occurs within hatchery returning adults.

Abundance and Productivity. Total steelhead run size (catch and escapement) for Puget Sound in the early 1980s can be calculated from estimates in Light (1987) to be approximately 100,000 winter-run and 20,000 summer-run fish. Light provided no estimate of hatchery proportions specific to Puget Sound streams, but for Puget Sound and coastal Washington combined; he estimated that 70 percent of steelhead in ocean runs were of hatchery origin. The percentage of hatchery-origin fish in escapement to spawning grounds would be substantially lower due to differential harvest and hatchery rack returns. In the 1990s the total run size for major stocks in this ESU was greater than 45,000, with total natural escapement of about 22,000. Busby et al. (1996) estimated 5-year average natural escapements for streams with adequate data range from less than 100 to 7,200, with corresponding total run sizes of 550-19,800. Nehlsen et al. (1991) identified nine PS steelhead stocks at some degree of risk or concern. WDF and WWTIT (1993) considered 53 stocks within the ESU, of which 31 were considered to be of native origin and predominantly natural production. Their assessment of the status of these 31 stocks was 11 healthy, 3 depressed, 1 critical, and 16 of unknown status. Their assessment of the status of the remaining (not native/natural) stocks was 3 healthy, 11 depressed, and 8 of unknown status.

Nehlsen et al. (1991) identified nine PS steelhead stocks at some degree of risk or concern. WDF and WWTIT (1993) identified 53 stocks within the DPS, of which 31 were considered to

be of native origin and predominantly natural production. They assessed 11 of the 31 stocks to be healthy, 3 to be depressed, 1 critical, and 16 of unknown status. Their assessment of the remaining (not native/natural) stocks was 3 healthy, 11 depressed, and 8 of unknown status. Of the 21 populations in the Puget Sound ESU reviewed by Busby et al. (1996), 17 had declining and 4 increasing trends, with a range from 18 percent annual decline (Lake Washington winter-run steelhead) to 7 percent annual increase (Skykomish River winter-run steelhead).

Of the 21 populations in the Puget Sound DPS reviewed by Busby et al. (1996), 17 had declining and 4 increasing trends, with a range from 18 percent annual decline (Lake Washington winter-run steelhead) to 7 percent annual increase (Skykomish River winter-run steelhead). Eleven of these trends (9 negative, 2 positive) were significantly different from zero. These trends were for the late-run naturally produced component of winter-run steelhead populations; no adult trend data were available for summer-run steelhead. Most of these trends were based on relatively short data series. The two basins producing the largest numbers of steelhead (Skagit and Snohomish rivers) both had modest overall upward trends at the time of the Busby et al. (1996) report.

Overall, the PSSBRT determined that the risk to the viability of PS steelhead due to declining abundance throughout the DPS is high. While populations in several basins throughout the DPS are critically low, the Skagit River populations are relatively healthy. Historical commercial data from 1889 to 1920 estimated peak run size for Puget Sound would range from 327,592 and 545,987 fish (PSSBRT 2005). Within four decades, the population crashed to fewer than 10,000 fish before commercial harvest was banned by the Washington State Game Commission in 1932. In the 1990s the total run size for major stocks in the PS steelhead DPS was greater than 45,000, with total natural escapement of about 22,000. Busby et al. (1996) estimated 5-year average natural escapements for streams with adequate data range from less than 100 to 7,200, with corresponding total run sizes of 550-19,800.

The Skagit and Snohomish River winter-run populations have been approximately three to five times larger than the other populations in the DPS, with average annual spawning of approximately 5,000 and 3,000 total adult spawners respectively (March 29, 2006, 71 FR 15671).

The PSSBRT concluded that the risk to the viability of PS steelhead due to declining productivity is high. Nearly all steelhead populations in the DPS exhibited diminished productivity as indicated by below-replacement population growth rates, and declining short and long-term trends in natural escapement and total run size.

Access to historical spawning grounds is limited by anthropogenic habitat changes and degradation of riparian habitat further threatens the continued existence of this species. An estimated 9 to 27 percent of historical winter steelhead habitat and 17 to 30 percent of historical summer steelhead habitat is no longer accessible or utilized by steelhead. There are substantial habitat blockages by dams in the Skagit and Elwha River basins, and minor blockages, including impassable culverts, throughout the region. Degradation of riverine, estuarine, and nearshore habitat has resulted in the loss of an average of 83 percent of the potential production of the 42 steelhead populations assessed in Washington.

In the 1990s, the total run size for major stocks in this DPS was greater than 45,000, with total natural escapement of about 22,000. Busby et al. (1996) estimated 5-year average natural escapements for streams ranged from fewer than 100 to 7,200 fish, with corresponding total run sizes of between 550 and 19,800 fish.

Considered one of the strongholds of the DPS as recently as 1996 (Busby et al. 1996), the Skagit River populations now are showing downward trends in escapement, total run size, recruitment, and population growth rate. The petition for listing underscored the fact that this decline in productivity has occurred at a time when fishery impacts on naturally produced steelhead presumably declined substantially with the advent of hatchery-only retention in the sports fishery and curtailment of most tribal fisheries. Since 1992 there has been a general downtrend in steelhead populations in this DPS. Over this period, the number of populations considered to be "healthy" declined from 14 (26 percent of all populations in the DPS) to 5 (9 percent), and the number of populations of "depressed" status increased from 14 (26 percent) to 19 (35 percent). One population (1 percent) remained "critical," but the number of populations of unknown status increased from 24 (45 percent) to 27 (50 percent).

2.2.3 Puget Sound Chinook Salmon Critical Habitat

The NMFS reviews the status of designated CH affected by the proposed action by examining the condition and trends of PCEs throughout the designated area. The PCEs are physical and biological features essential to the conservation of the listed species because they support one or more life stages of the ESU (e.g., sites with conditions that support spawning, rearing, and migration). Watersheds within designated critical habitat, called Fifth-field Hydrologic Unit Codes (HUCs) have been ranked as to the conservation value they provide to each listed species they support[5]; conservation rankings are high, medium, or low. To determine the conservation value of each watershed to ESU viability, the CHART evaluated the quantity and quality of habitat features (for example, spawning gravels, wood and water condition, side channels), the relationship of the area compared to other areas within the ESU, and the significance to the ESU of the population occupying that area. Thus, even a location that has poor quality of habitat could be ranked at high conservation value if that location was essential due to factors such as limited availability (e.g., one of a very few spawning areas), the unique contribution of the population it served (e.g., a population at the extreme end of geographic distribution), or other important role (e.g., obligate area for migration to upstream spawning areas).

On September 2, 2005 (70 FR 52630), NMFS designated critical habitat for Puget Sound Chinook salmon. The critical habitat designated for PS Chinook salmon includes the major Puget Sound Basin tributaries, and the nearshore areas of Puget Sound (the zone from extreme high water out to a depth of 30 meters) adjacent to watersheds occupied by the ESU (NMFS 2005). The Puget Sound Chinook salmon ESU has 61 freshwater and 19 marine water areas within its range. Of the freshwater watersheds, 41 are rated high conservation value, 12 as low

[5] The conservation value of a site depends upon "(1) the importance of the populations associated with a site to the ESU [or DPS] conservation, and (2) the contribution of that site to the conservation of the population through demonstrated or potential productivity of the area" (NMFS 2005).

conservation value, and eight received a medium rating. Of the marine water areas, all 19 are ranked with high conservation value.

The PCEs of PS Chinook salmon critical habitat are:

> PCE 1--Freshwater spawning sites with water quantity and quality conditions and substrate that support spawning, incubation, and larval development;
>
> PCE 2--Freshwater rearing sites with (1) water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility, (2) water quality and forage that support juvenile development, and (3) natural cover such as shade, submerged and overhanging large wood, logjams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks;
>
> PCE 3--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 that support juvenile and adult mobility and survival;
>
> PCE 4--Estuarine areas free of obstruction and excessive predation with (1) water quality, water quantity, and salinity conditions that support juvenile and adult physiological transitions between fresh water and salt water, (2) natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels, and (3) juvenile and adult foraging opportunities, including aquatic invertebrates and prey fish, supporting growth and maturation;
>
> PCE 5--Nearshore marine areas free of obstruction and excessive predation with (1) water quality and quantity conditions and foraging opportunities, including aquatic invertebrates and fishes, supporting growth and maturation, and (2) natural cover including submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels;
>
> PCE 6--Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Throughout the freshwater portion of critical habitat designated for PS Chinook salmon, the water quality, water quantity, floodplain connectivity, and riparian cover PCE attributes have been diminished by loss of riparian and floodplain habitat, elevated water temperatures, increased nitrogen and phosphorus levels, higher levels of turbidity, and agriculture and livestock impacts in many Puget Sound tributaries. Peak stream flows have increased over time due to paving (roads and parking areas), reduced percolation through surface soils on residential and agricultural lands, simplified and extended drainage networks, loss of wetlands, and rain-on-snow events in higher elevation timber clearcuts. Freshwater migration PCEs have been negatively affected by dams, water diversions, and shifts in flow regime due to hydroelectric development and flood control projects.

The nearshore and offshore marine area PCEs have also been negatively impacted by human activities. These impacts include loss and/or simplification of deltas and delta wetlands; modification of shorelines by armoring, overwater structures and loss of riparian vegetation; contamination of nearshore and marine resources, including degradation of water quality; alteration of biological populations and communities.

The degradation of multiple PCEs throughout CH of PS Chinook salmon indicates that there are limiting factors throughout the CH, even in areas where the conservation value of habitat is ranked high.

Climate change is likely to have negative implications for the conservation value of designated critical habitats in the Pacific Northwest (CIG 2004, Scheuerell and Williams 2005, Zabel et al. 2006, ISAB 2007). Average annual Northwest air temperatures have increased by approximately 1°C since 1900, or about 50 percent more than the global average warming over the same period (ISAB 2007). The latest climate models project a warming of 0.1 to 0.6°C per decade over the next century. According to the ISAB, these effects may have the following physical impacts within the next 40 or so years:

- Warmer air temperatures will result in a shift to more winter/spring rain and runoff, rather than snow that is stored until the spring/summer melt season.

- With a shift to more rain and less snow, the snowpack will diminish in those areas that typically accumulate and store water until the spring freshet.

- With a smaller snowpack, these watersheds will see their runoff diminished and exhausted earlier in the season, resulting in lower stream flows in the June through September period.

- River flows in general and peak river flows are likely to increase during the winter due to more precipitation falling as rain rather than snow.

- Water temperatures will continue to rise, especially during the summer months when lower stream flows and warmer air temperatures will contribute to the warming regional waters.

These changes will not be spatially homogeneous across the entire Pacific Northwest. Sites with elevations high enough to maintain temperatures well below freezing for most of the winter and early spring would be less affected. Low-lying areas that historically have received scant precipitation are likely to be more affected. The ISAB (2007) also identified the likely effects of projected climate changes on Columbia River salmon and their habitat. These effects may include, but are not limited to, depletion of cold water habitat, variation in quality and quantity of tributary rearing habitat, alterations to migration patterns, accelerated embryo development, premature emergence of fry, and increased competition among species. Similar effects are likely to occur to some extent throughout the Pacific Northwest.

The specific critical habitat that will be affected by the proposed action, and the human activities that affected PCE trends within those units are PCE 1 – freshwater spawning sites, PCE 2 – freshwater rearing sites, PCE 3 – migration corridors, and PCE 4 – Estuarine areas.

At the time of designation, each habitat area contained one or more PCE within the acceptable range of values required to support the biological processes for which the species uses that habitat.

NMFS rated the fifth field HUC within which the action area lies as having a "high" conservation value. All of the Lower Skagit River mainstem within the action area is within the designated critical habitat and some sloughs such as Britt Slough, Freshwater Slough, and Browns Slough are within critical habitat while others are not. Activities identified as degrading PCEs within this area included agriculture, channel and bank modifications such as riprap and diking, wetland loss and removal, and urbanization (NMFS 2005). The condition of PCE's and other habitat elements of the action area are described in more detail in the Environmental Baseline Section, below.

2.3 Environmental Baseline

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

At 1,433,205 acres, the Skagit River Watershed is largest within the ESU, and contributes roughly one-third of freshwater inflow to the Puget Sound. In general, its headwaters, small tributaries, and major tributaries (such as the upper Sauk River) feature intact and functioning habitat. River habitat conditions become more degraded as these major tributaries flow to form the mainstem Skagit. Studies conducted by the SRSC and the NWFSC, WDFW, the USGS and others indicate that habitat loss and degradation, most prominently within the mainstem and estuary, are significant factors in the declines in Skagit Chinook salmon abundance within the last century. Steelhead populations have also trended downward in the past decade. Impaired upland sediment budgets in some subbasins, the loss of floodplain, off channel and wetland areas, impaired riparian areas, simplified mainstem edge habitat, inaccessible and altered estuarine habitat, and isolation, degradation and loss of nearshore habitat continue to be fundamental habitat limitations that cumulatively impede the viability of each population. Despite these impacts, portions of the watershed are among the best remaining habitat within Puget Sound.

The general landscape of the Lower Skagit River, where the action area is located, is dominated by agricultural land use with some urbanized centers such as the Cities of Mount Vernon and Burlington. The lower Skagit sub-basin contains the most highly degraded freshwater salmonid habitat in the Skagit Basin with considerable impacts in every habitat category (Smith 2005). Management of agricultural and urban lands has degraded salmonid habitat in many areas of the watershed. Floodplain disturbances and hydrologic effects are associated with bridges, roads,

towns and private property developments. Practices such as farming to the edge of streams, removing riparian vegetation, filling off-channel areas, diking and channelization, conversion of native perennial vegetation to annual crops, irrigation, increasing stormwater flow into the river, pollutant and fine sediment loading, increased surface water temperature, and exacerbated flooding have all contributed to habitat degradation in the action area.

Sections of the Skagit River within the action area are impaired and designated under Section 303(d) of the Clean Water Act. A section from RM 12 to RM 16 was listed for polychlorobiphenyls (PCB) and fecal coliform. Some sections of both North and South Forks of the Skagit River are listed for fecal coliform. Water quality is generally worse in the lowland tributaries than in the mainstem, below the Sauk River.

Reduced riparian cover, water withdrawals, and runoff are likely to be contributors to decreased habitat quality, including degraded water quality in the action area. Agricultural practices, armored banks, and urban development have reduced vegetated riparian habitat. Vegetated areas are narrow and vegetation is mostly immature. Bank armoring has hindered LWD recruitment in the action area, and debris generally does not persist along armored banks. Large debris jams often form on the numerous bridge piles and other man-made structures in the action area. However, these jams are often removed for safety. Roads, urban and rural development, and agricultural land uses have altered channel dynamics and hydrology in the basin. Beamer et al. (2000) identified the action area as having an impaired peak flow.

The COE described the Skagit mainstem within the action area as predominantly a run or glide throughout the area (COE 2011). The Skagit mainstem within the action area was considerably different prior to human activity in the early 20th century when log jams were removed and the mainstem was channelized. The loss and simplification of floodplain, off channel, and edge habitat in the mainstem (above the estuary delta) contributes to a reduction of freshwater rearing capacity for each population (Beamer et al. 2005c).

The earliest recorded history of westerners and the Skagit River mainstem documents a distaste of large wood and large wood structures in the Skagit. Among the earliest documented events in the Skagit River is the removal of a massive pile of woody debris in the mainstem near Mount Vernon in 1879 by private citizens. Wood removal continued with the commencement of "snag boat" operation in 1882, which lasted for decades. Woody debris removal continues today as diking districts, cities, and counties routinely dismember log piles on bridge piers and other manmade structures to keep debris piles from catastrophically destroying bridges, and keep log piles from slowing conveyance. Riprapped banks virtually eliminate soft banks where large wood can lodge into the sediments and build wood piles that create pools and sort gravel. Riprapped banks can also indirectly affect wood recruitment in the middle of mainstems, where it can form gravel bars and "islands", by speeding the flow through the reach and making it difficult for wood to settle into the river bed.

Decades of logging, farming and other land uses in the Skagit watershed have contributed to degraded water quality in the Lower Skagit River. Poor agricultural and logging practices have contributed to unnaturally large sediment loads into the river. Fine sediments dominate the

Lower Skagit where gravel sorting is non-existent because of the homogenous banks that do not regulate flow and lack of woody debris along the lower 20 miles of river.

One of the most significant habitat alterations on the lower Skagit River is the existence of levees on or near the banks along the entire mainstem river from RM 22.5 to the mouths of both forks of the river. Currently, riprap forms the levees that exist on or near the banks of the lower Skagit River throughout the action area. Kunzler (1996a, 1996b, 1997) documented several actions that straightened and channelized the Lower Skagit River in the early 20th century and eliminated miles of side channels and sloughs. The straightening of the mainstem that cut off Hart Slough and DeBay Slough also increased the slope of the river which hinders gravel recruitment (Beamer, pers com.) Figure 2 shows the reduction of channels from various channelization actions since 1915. Bolton and Shellberg (2001) describe channelization as the deliberate, or indeliberate, alteration of one or more of the interdependent hydraulic variables of slope, width, depth, roughness or size of sediment load. Thus, the effects of the habitat alteration on the Skagit River related to the riprap are evaluated here as channelization.

Channelization typically causes changes in physical parameters of the channel including changes in depth, shade, sediment, temperature, altered hydrology, and isolation of floodplain habitats. These physical changes lead to longer term biotic responses that are transmitted throughout the biological system including changes in nutrient cycling and populations of different trophic levels (Bolton and Shellberg 2001). The NMFS recognizes two major pathways in which channelization effects fish habitat: 1) edge habitat at the site level, and 2) channel migration at the reach level.

Bank hardening in the form of riprap prevents bank erosion. Bank erosion is critical for creating habitat at the watershed scale. Preventing bank erosion has several deleterious effects to the river system, both at the site of hardening and downstream. Florsheim et al. (2008) noted that bank erosion provides a sediment source that creates riparian habitat, creates and maintains a diverse structure and habitat functions, and modulates changes in channel morphology and pattern.
The effects of streambank alteration are not limited to the wetted stream channel. Connectivity longitudinally (up and downstream), laterally (floodplain and uplands) and vertically (groundwater, hyporheic, and phreatic) is a major feature of stream corridors (Stanford and Ward 1992). The temporal nature of the system adds a fourth dimension. These linkages mean that the effects of channelization can be transmitted over areas far beyond the actual work zone. Impacts include changes in hydrology, biology, morphology and water quality (Bolton and Shellberg 2001).

Spawning in the Lower Skagit River is limited. Spawning rarely occurs in the action area primarily because the action area lacks gravel bars and interstitial flow needed to supports redds. Mainstem spawning in the Skagit River is limited to one gravel bar downstream of the Hwy-9 bridge near Sedro Woolley, where riprap and levees cover 85 percent of the banks.

Three major factors contribute to the lack of spawning in the action area: 1) Historical channelization of the mainstem (Kunzler 1996a, 1996b, 1997), 2) lack of woody debris, and 3) sedimentation due to poor land use practices in the watershed. Gravel recruitment below the

gravel bar is hindered by lack of woody debris and the increased slope of the river due to channelization. The initial channelization of the river removed an S-bend consisting of the present-day Hart Slough and DeBay Slough (Figure 2) that historically supported mainstem spawning (Collins 2000; Beamer pers. comm.). The few spawners returning to the gravel bar near Hwy 9) are believed to be remnants of the historical spawning population. The COE (2010) reported that historical spawning may have occurred as far downstream as RM 19. This is considered unusual and an uncommon occurrence today. Above Sedro Woolley, where mainstem spawning essentially begins, only 15 percent of the banks were hydromodified.

There are no historical records of Chinook salmon or steelhead spawning in the action area near Mount Vernon. There are no historical records showing any attempts to survey or document spawning. According to fishery biologists with decades of experience in the Skagit River system (E. Beamer, pers. comm.), spawning may have occurred in the Mount Vernon area prior to channelization in the 1920's if gradients were more natural (i.e., gradual) and wood piles which were common on banks could recruit and retain gravel. While historical spawning may have occurred in the action area, mainstem and floodplain conditions would have to drastically improve to support spawning again.

Adding riprap to a natural bank physically changes the hydrology of the reach in ways that can adversely affect habitat near the edges of the hydromodified banks through three primary pathways: 1) channel depth, 2) channel velocity, and 3) lack of gravel recruitment (from bank erosion and from gravel recruitment upstream). Riprap also changes vertical flow through groundwater, hyporheic, and phreatic flow which also affects spawning by limiting aeration or oxygenation of gravels in the reach. Riprap bank stabilization was identified as a primary cause for the decline of salmon in the Sacramento River, California when the riprapping eliminated re-entrainment of gravels necessary for creating spawning habitat (Schmetterling et al. 2001). As more riprap is added to the Lower Skagit mainstem, the sediment structure and flow intensity will become more unstable and destructive. This will threaten the stability of the gravel bar as a spawning location for PS Chinook salmon. Spawning locations depend on several factors including gravel size, flow, and temperature. Spawning areas are dynamic and may change as channels migrate, flows and/or substrate are altered. It is assumed that all locations throughout an unrestricted and connected channel migration zone could provide adequate spawning sites presently or in the future if gravel can be sorted and interstitial flow is adequate.

Riprap prevents channel migration and reduces the amount and quality of habitat within the reach. The Skagit River was a naturally highly dynamic system, in which floods periodically created new channels. Periodic flooding created diversity in flow, substrate size, depths, channel widths, riparian age, and other habitat features that resulted in higher productivity throughout the system.

Riprap affects rearing and migration as well as spawning. The Lower Skagit River is severely limited in rearing potential as a result of channelized banks created by riprap, and limited riparian buffers. Riprapped banks without wood or roughness supports lower forage densities for salmonids and velocity refuge is practically non-existent. Some sloughs, braids, and side channels exists in the mainstem action areas that may provide productive rearing habitat for juvenile salmonids but historic channelization and riprapping of banks has reduced the historical

mainstem are by 31 percent, and reduced the habitat area (wetland and floodplain) in the non-tidal delta by 98 percent. Eighty-five percent of the non-tidal edge habitat has been hydromodified, resulting in the elimination of natural banks and backwaters in at least 60 percent of the river banks from Sedro Woolley to the mouth of the Skagit River (Beamer et al. 2005b). Studies have documented that juvenile salmonid abundance is lower at riprap banks than at natural banks. Juvenile Chinook salmon densities (fish per meter squared) within the Skagit River in riprapped banks was 0.348, compared to 1.78 in backwaters, and 0.97 in natural channels (Hayman et al., 1996). Bank stabilization precludes the formation of under-cut banks, the recruitment of large wood, and often the growth of riparian vegetation. It also inhibits access to, and the formation of lower velocity off channel habitat that can feature enhanced feeding opportunities and refuge from high flows that can result in premature displacement to downstream areas, including the estuary and ocean.

Based on a historical estimation of unrestricted floodplain presented by Collins (2000), riprap from RM 22.5 to the most downstream end of the project in both forks contributes to the isolation of about 106 square miles (67,480 acres) of floodplain. This estimate is based on the COE and FEMA's estimated 100-year flood inundation zone, and NMFS' best professional judgment considering free flowing conditions, sediment composition and bank erosion, and channel forming processes.

Unconfined and unblocked, floodplains provide areas where sloughs and channels can form off of the mainstem river. Regularly inundated or periodically inundated during high flows, these channels provide habitat for rearing and migrating juvenile fish. Unblocked floodplains also allow for the lateral movement of the main channel and provide storage for floodwaters, sediment, macroinvertebrate production (food), and large woody debris. Natural floodplains that support side channels provide additional channel area for salmon, where confined or isolated floodplains do not, thereby increasing the length of channel and the amount of edge habitat available to rearing juveniles and spawning adults. Side channels not only increase the amount of habitat available to salmon, they also provide unique functions that may be unavailable in mainstems like refugia during high flows, and may be used by rearing salmonids for long periods of time, especially for over-wintering juvenile Chinook salmon (Benda et al. 2001). Off-channel areas provide an abundance of food with fewer predators than would typically be found in the river, and provide habitat for juvenile salmonids to hide from predators and conserve energy (Sandercock 1991). The importance of floodplain habitat to salmonids cannot be overstated. In the Skagit and Stillaguamish Basins, more than half of the total salmonid habitat is contained within the floodplain and estuarine deltas, while this habitat encompasses only ten percent of the total basin area (Beechie et al. 2001).

2.3.1 The 2007 Levee Repairs

The 2007 repairs that are part of this action had short-term construction-related effects, such as turbidity and noise, and long-term effects. Effects to date are considered part of the baseline, whereas future long-term effects are considered as effects of this action. The short-term effects, specifically turbidity and noise, have dissipated and are not currently part of the environmental baseline. In the long term, the effects of the 2007 levee maintenance include the enabling the persistence of conditions that limit the quantity and quality of salmonid habitat in the Skagit

River lowland. Like other rivers, the Skagit actively erodes its banks, especially during floods, and even those hardened with riprap and rock structure. Sections of the levee identified in tables (1) and (2) were/are actively eroding and were identified by the COE to repair to keep the levee system intact. Therefore, the continuing effects of the levees are attributable to some extent to the 2007 repairs. It is not possible to accurately predict the changes that would occur in the river and floodplain if specific repairs were not conducted. Presumably, the river system would gradually return to its state prior to the construction of the levees. However, the pace at which this would occur given the lack of particular levee repairs, and potentially harmful indirect effects of allowing the river to migrate outside the existing channel, especially given the highly altered condition of the floodplain in which development, agriculture, and timber harvest have taken place for decades, are impossible to predict. For this reason, attempting to describe these effects in more than very general terms is speculative.

As described above, the existing levee system degrades the environmental baseline within the action area by restricting channel migration, restricting erosion and sediment input, increasing flows and depth, and reducing the quality of edge habitat throughout the reach. The action maintains this degraded baseline, which limits salmonid use in the action area and salmonid production in the watershed.

The 2007 placement of riprap affects both estuarine and freshwater spawning, rearing, and migration habitat for PS Chinook and steelhead. About half of the riprap placed for the portion of the proposed action that is already completed was placed within the North and South forks of the Skagit delta. The most downstream sites in this project are within areas that salmonids use for estuarine residence which allows growth, predator avoidance and smoltification. All six Skagit Chinook salmon populations use the estuary and each function listed above is facilitated by tidal dispersion. Numerous studies have characterized juvenile salmonid rearing within estuarine habitat, ranging from time of arrival and emigration, length of residence, dietary analysis and growth rates, and use of particular habitat types. Among all salmonid species, Chinook salmon juveniles within estuaries are most obligate. Chinook salmon, particularly ocean-type fish, take longer to adjust to increasing saline gradients, and rear and grow in estuaries greater relative to all other salmonid species (Thorpe 1994). In contrast, steelhead are seldom captured in estuaries and it is thought that steelhead presence in the estuary is more transient, or primarily used for feeding and less for salt water transitioning.

The other half of the riprap placed prior to consultation is located upriver of the present delta. However, this section of the river does occur within the historical delta, estimated to begin near RM 22.5, in the Skagit lowland. In this area the landscape flattens out, total water input increases and freshwater inputs dominate the waterway and the width of total channel increases while tidal influence decreases upriver. The Skagit lowland supports juvenile rearing and migration for PS Chinook salmon and PS steelhead. Rarely, redds are observed in the lower river.

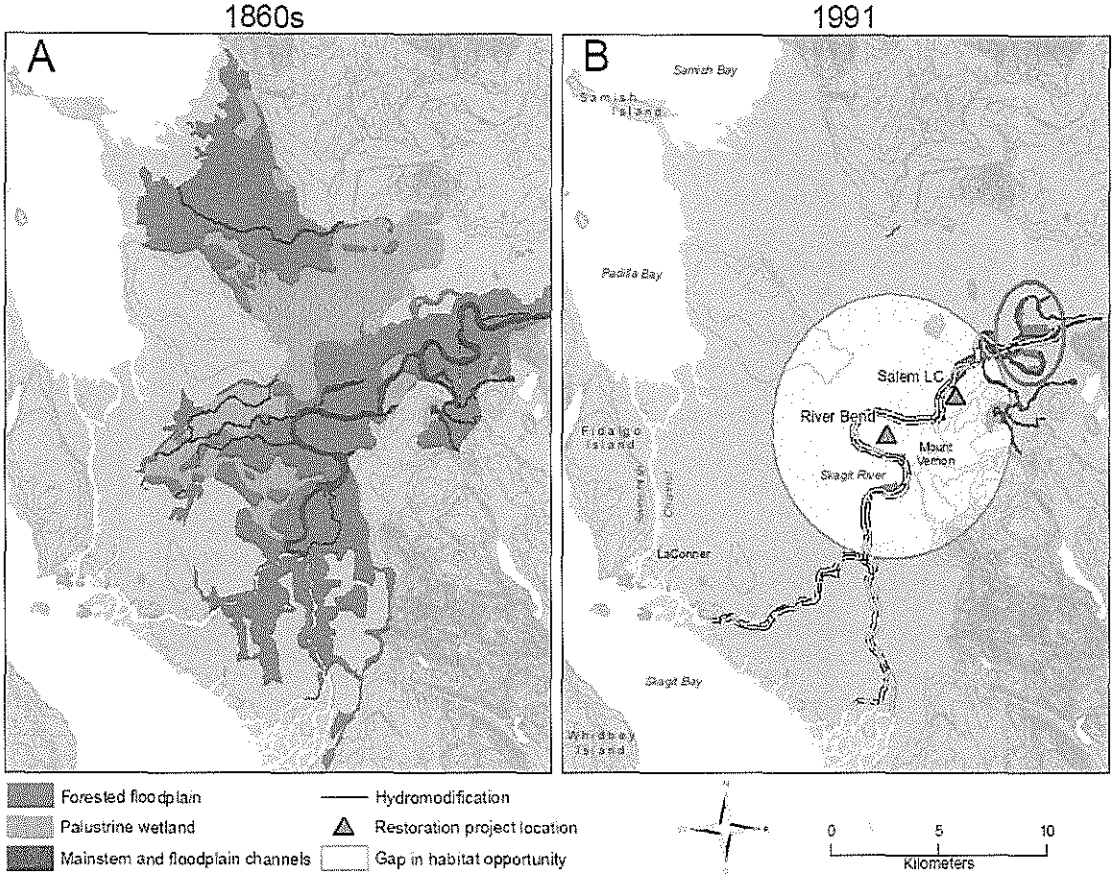
2.3.2 Salmonid Populations in the Action Area

The action area's location in the lower Skagit River means that Chinook salmon from all six independent populations and steelhead from all six populations are present in the mainstem

action area for some portion of their life history. The six Chinook salmon populations include the Lower Sauk, Upper Sauk, Suiattle, Upper Cascade River, Lower Skagit, and Upper Skagit populations (PSTRT 2006). In terms of overall abundance, the fish from these populations comprise one-fourth of all fish in the entire Puget Sound Chinook salmon ESU. Annual outmigrant populations of PS Chinook salmon from the Skagit watershed range from 2 million to 7.1 million smolts.

The six steelhead populations include the Mainstem Skagit/Tributaries-winter, Finney Creek-summer, Sauk-summer, Sauk-winter, Cascade-summer, and Cascade-winter populations. Only one of the six stocks, the mainstem Skagit/ Tributaries-winter steelhead, spawns in the Skagit River, but the remaining stocks use the river system for migration, rearing, and adult holding. The adult steelhead migrate through the lower Skagit to spawn in the mainstem Skagit and Sauk rivers. The success of steelhead spawning habitat is based on water temperature, sediment type and size, and current velocity, and changes as the channel migrates or is altered. Three stocks of winter-run and three stocks of summer-run steelhead occur in the area, using it for rearing. While population abundance is low in several basins throughout the DPS, the Skagit River populations are relatively healthy.

Figure 2. Comparison of the Skagit River mainstem before and after the COE's initial channelization just downstream of Sedro Woolley.



As described above, the existence of the levee system has reduced the amount of habitat available to Chinook salmon. Habitat availability for rearing juvenile salmon in the tidal delta and lower river appear to be limiting Skagit River Basin populations. Beamer et al. (2005b) estimated the present tidal delta (present day forks only) supports 2,249,581 tidal delta migrants. This is based on a model that predicted 5,100,000 sub-yearling Chinook salmon use the tidal delta. Beamer et al. (2005b) then subtracted 1,329,419 parr migrants (average parr data from 1997-2002), and 1,530,000 fry migrants (an estimate of 30 percent based on Beamer's field studies) from the total to arrive at 2,249,581 tidal delta migrants[6].

[6] The estimate of 2,249,581 tidal migrants accounts for the lower section of the action area where only half of the project sites are located and is therefore, an underestimate of the total carrying capacity of the entire action area. An estimate for the remaining 12 miles from the forks to the upstream end of the levee (Highway 9 bridge) was not calculated. Even if the upper 12 miles is roughly half of the action area and comparable in size to the tidal delta, NMFS will not attempt to estimate a number due to different conditions of habitat and the different functions the lower river provides which will not be considered during this consultation. All extrapolations using the 2,249,581 figure are underrepresenting the total effect of the levee system.

Considering density dependence (the concept of limitation of a population by factors such as crowding, predators, and competition), it appears that all remaining migrants lack adequate rearing habitat. Habitat limitations in freshwater habitat and the tidal delta are forcing out fry migrants. According to Beamer (2005b), an average 1,530,000 rearing juvenile Chinook salmon per year leave the Skagit River with little or no freshwater rearing. A portion of these juveniles are naturally fry migrants and leave the estuary by choice. Based on available data, each Skagit population outmigrant group consist of at least 10 percent fry migrants, thus losses of adult returns would occur to each stock. However, a larger portion of the fry migrants leave the system prematurely either being blown through the estuary during floods, or forced to migrate through when they cannot find adequate rearing habitat. On average, 1,377,000 juvenile Chinook salmon are prematurely entering Skagit Bay due to lack of rearing habitat or lack of holding habitat that would prevent them from being blown out during floods. The ongoing maintenance of the Lower Skagit River levee system accounts for almost all tidal delta rearing limitations and considering the condition of freshwater rearing habitat elsewhere, it likely accounts for limiting most freshwater rearing capacity as well.

The channelized nature of the action area limits this carrying capacity in numerous ways. One simple measure is the limitation of channels throughout the area. Predeveloped floodplain appears to have been at least twice the current wetted area (Figure 2). Hayman et al. (1996) estimated that natural mainstems supported twice the off channel habitat density of isolated mainstems. Conservatively, NMFS estimates the effect of the levee is cutting off half the channels and other open water rearing area that should be available to juvenile salmonids.

By cutting off side channels, slow water areas, freshwater marshes, floodplains, and other flood storage areas, the levee system is forcing an average[7] of over 1 million parr and delta migrants per year prematurely into Skagit Bay, and the 2007 repairs contribute to maintaining this condition. Beamer et al. (2005b) also mentions that the initial number 1,530,000 of fry migrants may be an underestimate because the assumptions the model based on the findings may have not considered survival rates which may be lower for fry migrants, speed of migration, or number of days rearing. The model also did not include the effect on yearlings, as yearlings are not expected to use the tidal delta for rearing. More than half of this project is upstream of the tidal delta.

As will be discussed in the Effects section below, the levee system has similar impacts to steelhead as to Chinook, but to a somewhat lesser extent because steelhead do not spend as much of their early life cycle in freshwater habitat.

2.3.3 Actions in the Action Area having Completed Consultations

As defined in 50 CFR 402.02, environmental baseline emphasizes past, present, and all proposed Federal projects in the action area that have already undergone formal or early Section 7

[7] The project does not affect over 1 million juvenile Chinook salmon every year. This is an average. Some years, when only 2 million juveniles emerge and survive, all existing habitat within the action area will not be fully occupied. In other years when over 8 million juveniles enter the system, more than 4 million will be forced out prematurely.

consultation, and the impact of state or private actions which are contemporaneous with the consultation in process. For this consultation, such actions include:

Lower Skagit River Levee Rehabilitation (NMFS No. 2005/03612) – After-the-fact consultation for the build-out of nearly four linear miles of non-contiguous riprap placement on the levees and revetments on the river's edge ranging from RM 20, down both forks. Draft opinion in review. Many of the project sites in this action overlap or are directly downstream from the 2005/03612 sites.

Skagit River Dike District 12 Revetment Repairs, Skagit County (NMFS No. 2005/03394) – After-the-fact consultation for the build-out of five revetment sites, including a 600 foot riprap bank on the hairpin bend near RM 19. Consultation complete. Some DD12 and DD17 sites are directly downstream or on the opposite bank of these sites.

Milltown Island Restoration Project (NMFS No. 2006/02599) – Restoration project that breached levees and created a off-channel sloughs. Consultation and implementation complete.

Mount Vernon Downtown Flood Protection (NMFS No. 2008/01983) – Consultation is complete but build-out is not. The project will raise levees but draw back from the river's edge and remove some buildings that are close to the bank.

Wetland Fill and Creation of Habitat Side Channels (Nookachamps LLC) Skagit County (NMFS No. 2004/00801) – Consultation for the creation of the wetland mitigation bank near the mouth of Nookachamps Creek.

Edgewater Park Off-Channel Slough Restoration, Skagit County, (NMFS No. 2004/00391) - Restoration project that created an off-channel slough near RM 12.

Skagit Delta Tidegates and Fish Initiative Implementation (NMFS No. 2008/03803) – Consultation is completed but build-out is not. When build-out is complete, 2,700 acres of delta habitat will be restored and accessible for listed salmonids.

Implementation of the National Flood Insurance Program in the State of Washington Phase One Document – Puget Sound Region (NMFS No. 2006/00472) – A relevant consultation which described the effects of floodplain function throughout Puget Sound, including the Skagit River lowlands.

2.4 Effects of the Action on the Species and its Designated Critical Habitat

Elements of the proposed action likely to adversely affect PS Chinook salmon and PS steelhead are discussed below. The effects of the proposed action are analyzed in terms of how changes to habitat affect individual fish in the action area. The analysis then turns to whether effects of the action on individual fish influence the viability of the populations to which they belong. Whether or not the local effects of the action influence population viability the analysis then considers those effects with the status of the each species, the effects in the baseline, and

cumulative effects to make a final determination as to whether or not the proposed action jeopardizes those species.

Similarly for the critical habitat analysis for PS Chinook salmon, the analysis first focuses on the effects of the proposed action on the essential elements of the PCEs of critical habitat in the action area. The analysis then turns to whether or not action area effects are appreciable in the watershed in which the action area is located to discern whether the action influences the conservation value or role of critical habitat in the action area. Finally, the analysis considers whether changes (if any) in the conservation value of the affected watershed, when considered with the status of critical habitat, effects on critical habitat in the baseline, and cumulative effects, will adversely modify or destroy designated critical habitat.

Habitat and population level consequences of the proposed action are informed, in part, by the comprehensive data set regarding PS Chinook salmon distribution within the Skagit River. This body of data contributes to a scientifically based framework from which NMFS can analyze the biological ramifications of the placement of bank stabilization on the Skagit River. The consequences to the individual populations and the PS Chinook salmon ESU are generally framed within the VSP assessment characteristics in McElhany et al., (2000). The VSP characteristics, which include the abundance, productivity, distribution and diversity of salmonid population are generally analogous to a species' reproduction, numbers, or distribution.

Repairing the levee at all 35 locations described in the proposed action perpetuates the existing condition of limiting normal channel and floodplain function at those sites, described in detail in the Environmental Baseline section. However, as also described above, it would be speculative to attempt to quantify the extent to which the repairs covered in this Opinion are responsible for the overall future effects of the entire levee system. To address the long-term effects of the repairs, the COE has proposed offsetting measures as described in the proposed action. None of the offsetting measures provided by the COE or their applicants address the absence of channel migration. However, the offsetting measures will counteract the persistent effects of maintaining a channelized river by providing local elements that contribute to the processes that create and maintain a modicum of habitat function in a largely modified action area.

2.4.1 Effects on Puget Sound Chinook Salmon

The proposed construction work will be completed prior to peak upstream migration of PS Chinook salmon. Contractors will complete the work primarily from land during summer low flow to minimize the amount of in-water placement of material. During late summer, young-of-the-year juvenile Chinook salmon, which are most vulnerable to disturbance and displacement are not in the action area.

Individual Puget Sound Chinook salmon are likely to be in the action area during construction and may be exposed to short-term effects during construction. The Skagit River boasts the most diverse collection of salmonid populations within Puget Sound with all five Pacific salmon species and all native trout and char species. Migration timing, spawning timing, incubation time, and juvenile life history strategies are variable among the PS Chinook salmon populations throughout Skagit Basin. The Skagit River populations also collectively produce a higher

percentage of overwintering juveniles than most river populations within the ESU. Therefore, adult or older juvenile salmon are likely to be in the action area during construction. Larger juvenile and adult salmon are believed to be capable of avoiding or tolerating areas being disturbed by human activity including noise and turbidity. However, even these larger fish may suffer some limited effects from construction-related effects, as described below.

The primary short-term construction-related effects of this action are noise and turbidity. The COE will minimize disturbance and turbidity by individually placing rocks and logs with excavators, loaders, and other heavy equipment. Despite the proposed measures to reduce effects there will be an increase in suspended sediment and turbidity in the action area during and shortly after construction. The action will include the placement of log structures cabled to boulders which will be partly buried into the river bed. The COE will use clamshell buckets to excavate holes into the river bed, which will suspend sediments.

Juvenile fish downstream of construction activities could be harmed from this sediment delivery through gill trauma and other adverse physiological reactions (Newcombe and Jensen 1996). Responses of salmonids to elevated levels of suspended sediments often fall into three major categories: physiological effects, behavioral effects, and habitat effects (Bash et al. 2001). The severity of the effect is a function of concentration and duration (Newcombe and MacDonald 1991; Newcombe and Jensen 1996) so that low concentrations and long exposure periods may be as deleterious as short exposures to high concentrations of suspended sediments. A review by Lloyd (1987) indicated that even relatively small changes in turbidity (10 to 50 Nephelometric Turbidity Units (NTUs)), such as that expected to result from this project, can elicit behavioral responses of salmonids.

These plumes may cause minor physiological stress as described in Newcombe and Jensen (1996) to adult Chinook salmon in the action area. Some adults may suffer moderate physiological stress or impairment of homing. The effects of turbidity are not expected to be so stressful as to prevent successful spawning for a large majority of the affected adults, though it is possible that several fish may not spawn or may spawn less successfully than they would have in the absence of the proposed action. However, since the mainstem Skagit River is relatively large, adults are expected to avoid turbid waters and migrate through the action area with little effort. Likewise, larger smolts and juveniles are capable of temporarily avoiding turbid plumes and are not expected to remain in turbid conditions long enough to expose themselves to sub-lethal harmful effects.

As the sediment is suspended and moves downstream, the concentration levels will be diluted and heavier sediments will be deposited. Likewise, the intensity of exposure diminishes as sediments settle. The types of adverse effects experienced by salmonids exposed to increased turbidity are summarized in Table 5 (USFWS 2010).

Table 5. Summary of adverse affects to fish resulting from elevated sediment levels.

Sediment Impacts to Fish	Summary of Adverse Effects Related to Sediment Impacts
Gill trauma	Clogs gills which impedes circulation of water over the gills and interferes with respiration
Prey base	Disrupts both habitat for and reproductive success of macroinvertebrates and other salmonids that spawn and rear downstream of the construction activities
Feeding efficiency	Reduces visibility and impacts feeding rates and prey selection
Habitat	Fills pools, simplifies and reduces suitable habitat
Physiological	Increases stress, resulting in decreased immunological competence, growth and reproductive success
Behavioral	Results in avoidance and abandonment of preferred habitat

Based on known extent, duration, and intensity of sediment plumes from previous in-stream work, the scale and methods of the proposed project, and the characteristics of the river in the action area, NMFS anticipate that turbidity levels which result in adverse effects to Chinook salmon and steelhead are reasonably certain to occur as far downstream as 300 feet from individual construction sites.

Effects from turbidity are expected to be short-term and temporary in nature. Although short-term, they may be severe and result in the adverse effects described by USFWS (2010).

To address the effects of turbidity, the COE will establish background turbidity levels during each day of sediment-generating activities and will monitor turbidity levels near the work areas during construction. If exceedances occur, the COE will either stop work momentarily or deploy responsive conservation measures to isolate turbidity to the immediate work area and limit fish exposure to turbidity and the extent of turbidity present.

The COE will also remove invasive plants from the banks of the Skagit River near their levee repair sites. Most of the weeds will be removed mechanically and maintained manually. The applicants will use a 1% Imazapyr herbicide and 1% Agridex surfactant solution to chemically treat Japanese knotweed. Four pints per acre of Imazapyr are expected to be applied to the treatment areas. The solution will never be sprayed directly into the water so direct contact with at these concentrations will not occur. Considering the method of bending and spot spraying using backpack and hand sprayers, exposure to salmon would be non-existent to rare. If some of the solution enters the water column indirectly through runoff or wind drift, the concentrations would be so low that it would not likely contribute to sublethal effects that harm salmonids in the action area.

The COE will remove some riparian vegetation at some of the sites. The vegetation ranges from 50-foot tall mature cottonwood trees that provide a substantial amount of function to grasses or

weeds that provides almost none. Smith (2005) considered riparian forests a limiting factor in the lower Skagit River. Reduction in riparian function include loss of large woody debris input, loss of shading and temperature regulation, and loss of organic input and prey (Spence et al. 1996). The COE planted willow (*Salix* sp.) stakes at most of the 2007 repair sites and will plant willow stakes, other native brush and groundcovers, hydroseed grass, convert invasive vegetation into native vegetation, and other vegetation to minimize the effect of removing riparian vegetation during levee reconstruction. There is a time lag between placement of willow stakes and full maturity and considering the COE's levee vegetation management policy to remove trees when they reach four inches at diameter breast height[8], these plantings will never reach the maturity of the cottonwoods being removed from the banks. Therefore the benefits from the willow plantings will be limited in duration. On the other hand, the COE is proposing to plant many banks that presently have little or no riparian vegetation of significant value. The addition of willows to the bank will improve riparian function on the banks by shading the banks and water column, adding leaf litter and organic nutrients to the system, and supporting insects and other important forage for rearing juvenile salmonids.

As discussed above and in the Environmental Baseline section, the proposed action maintains the function of the levee at the sites of repairs and potentially throughout the action area. The result of maintaining the levee is long-lasting effects on salmonid habitat throughout the action area. The effects of the levee system as a whole are described in the Environmental Baseline section of this opinion. Maintaining the conditions described in the Environmental Baseline, including those that will result from the proposed action are the presence of a hardened river bank, reducing the natural functions of the river system, precluding bank erosion, movement of the river and development of bankside vegetation. As discussed above, the existing levee system restricts channel migration, prevents bank erosion and sediment input, increases flows and depth, and reduces the quality of edge habitat throughout the reach. The implications of the continued existence of the levees for fish is discussed in detail in the Environmental Baseline section, but is summarized here. The continued presence of the levees prevents channel migration which would allow for the creation of side channels with slower water velocity that could serve as rearing habitat, prevents the growth of riparian vegetation that could contribute large woody debris and provide shade, plant material, and insects to the river, and results in faster water velocity that limits the ability of juvenile fish to rear in the river. At least in some part due to the repairs covered by this consultation, these conditions will persist throughout the action area.

Negative effects to the channel morphology and natural sediment regime from placing riprap (e.g., filling potential holding pools, filling bank scarps) are likely to continue to affect normal Chinook salmon spawning, rearing, and migration habitat function. Additionally, placing riprap will reduce the ability of the existing habitat to support Chinook prey, thereby reducing and disrupting foraging opportunities for Chinook salmon. Riprap will persist and is considered permanent.

The offsetting measures proposed by the COE are expected to benefit fish by increasing habitat function in the action area, though these measures will not remedy the continued channelization of the river. The COE is proposing to place anchored logs with root wads, woody debris piles, and other bank softening features creating habitat benefits in the lower river where large wood is

[8] Willow plants are cut at ground level where they are left to re-sprout.

scarce. The wood structures will be placed parallel to banks. The addition of wood into the bank will notably improve edge habitat at the site and will provide juvenile rearing that would not be present on an otherwise bare rock bank. According to Peters et al. (1998) sites stabilized with large woody debris consistently had higher fish densities in spring, summer, and winter than control sites without any stabilization structures and riprap sites consistently had lower densities than control sites. At all sites, fish densities were generally positively correlated with increasing surface area of large woody debris.

The COE is also proposing to implement "laybacks," defined as setting banks to gentle or gradual slopes which are theoretically more conducive to slower water velocities and reducing flow energy. The slower water should provide refuge for salmon and their prey and the gentle gradients should recruit woody debris and vegetation better than steeper slopes. The COE designed laybacks to at least a 3-to-1 width to height ratio which is believed to be more similar to a natural bank than the usual 2-to-1 slope that most levees are set in the lower Skagit River.

Another strategy for improving conditions for salmonids includes the use of rock weirs angled toward river flow. Weir design is intended to redirect flow away from the bank it is placed. Rock weirs will also create eddies immediately downstream. Eddies will eventually scour pools behind the weirs, addressing the lack of lower river pools and benefiting salmonids. All habitat improvement features are experimental and will be monitored by the applicant and the COE to determine if the features are adequately minimizing the effects of levees to the river system by slowing water velocities or providing refuge or feeding areas as designed.

2.4.2 Effects on Puget Sound Steelhead

Although steelhead are behaviorally different and use the action area differently than Chinook salmon, the proposed action will affect individual steelhead as it does PS Chinook salmon. Thus the discussion of effects above is generally applicable to steelhead, though different in significance.

Life history strategies and behavior of *O. mykiss* throughout the Pacific vary widely. Rainbow trout/steelhead in Puget Sound often rear in freshwater for two years. Young-of-the-year steelhead rear close to their redds for up to a year. By the time juvenile steelhead migrate into the lower mainstem, they are most likely at least a year old and large and strong enough to use mainstem habitat and often use faster water than other salmonids of similar size. Bisson et al. (1988) described steelhead having a more cylindrical body shape with short median fins and relatively large paired fins, attributes that appear well adapted to holding a position in swift water.

Steelhead are likely to be present in the action area during construction and are likely to experience the same adverse effects of turbidity and disturbance as Chinook salmon, which is described in section 2.4.1. Steelhead in the action area are likely to be at least one-year old smolts or adults, who are capable of avoiding turbid areas and other construction-related disturbance. Unlike juvenile Chinook salmon, steelhead using the lower river are less likely to use the edges near banks where turbidity tends to remain.

The long-term effects of the proposed action on steelhead are generally similar to those for Chinook but are more mixed in nature. According to Beamer and Henderson (1998), steelhead yearling use in riprap was actually higher than in natural banks. This could be because there is lack of competition for space at those sites, behavior difference among salmonids, or size and dominance. However, discussions with the authors and other experts (pers. com. Brett Barkdull, WDFW) mention that riprap can prevent channel migration which would provide more habitat than the linear face of the bank. The formation of side channels and other additional habitat would increase the amount of rearing capacity for steelhead.

Functional floodplains and floodplain connectivity to provide important habitat is important for steelhead as it is for Chinook. Studies on the Skeena River in B.C. have documented juvenile steelhead (1+ and some 2+) in floodplain habitats frequently, in systems with large, intact and available floodplains. They are most abundant in the main channel sites, but are seen in the periodically connected springs too. The juveniles emerge from redds in the main channel of the Lower Skeena floodplain demonstrating that the floodplain serves as vital spawning and rearing habitat for some of the Skeena watershed steelhead populations (pers. comm. Tom Bansak, 11/6/07). When compared to juvenile Chinook salmon, steelhead have lower, but still significant use of floodplain habitat (64 percent of the steelhead juveniles collected were in the main channel, 36 percent were in the off channel habitats like springs and ponds). Comparatively, Chinook salmon 40 percent were in the main channel and 60 percent were in the off channel habitats (pers. comm. Tom Bansak 2/25/08).

Similar steelhead use of floodplain habitat has been found in the Puget Sound area, where studies have shown that steelhead use of the floodplain is not as great as other species because they are generalists, but their use in floodplains can be quite high (pers. comm. George Pess 4/19/08). Studies on the Elwha River showed that steelhead use the mainstem margins and floodplain channels on the lower river. On the Skagit, age 0 and age-1 or older steelhead were found to be equally distributed between back water areas and channel bank and bar areas (Beechie et al. 2005). In a study of habitat changes on the Skagit, Stillaguamish, and Snohomish, which summarized 60 references on habitat use by salmonids, steelhead age +1 and +2 use of side channel and ponds was slightly less than use of the mainstem and tributary habitat, but steelhead use of these off-channel areas was still significant (Pess et al. 2002).

Unlike estimates on juvenile Chinook salmon using the lower river, estimates of the amount of steelhead rearing in the Skagit River have not been published. Likewise, in recovery plans, estimates for Chinook salmon were presented, but potential steelhead use of side channels were not. This makes estimating opportunity loss difficult but the result of cutting off side channel formation has some effect on steelhead because it reduces the amount of habitat available to them. Steelhead generally are capable of and readily use mainstem habitat for rearing and may use riprapped banks. Based on observations from Bansak and Pess, abundance in side channels in the action area would be lower than for Chinook salmon. Nonetheless, a reduction in available habitat in the action area reduces steelhead rearing in the action area, albeit at a lower scale. The effect of the levee is described above, reducing the amount of channel habitat into at least one half of what an unconstructed channel would provide.

Recent and historic rearing habitat reduction in the lower Skagit in the form of reduced channel migration, increased channel slope, and added unnatural riprap into the habitat limits steelhead population productivity. The maintenance of the levee perpetuates a reduced capacity by keeping the river in its degraded state. Juvenile steelhead remain in freshwater until they have reached the size that ensures their survival in the marine waters, and juvenile steelhead are not forced out to the estuary by density dependent actions and crowding. Juvenile steelhead access floodplains during flood events, likely increasing their rate of survival and improving their level of fitness. In addition, since steelhead spend their first year or two in freshwater, off-channel and side habitats provide important rearing habitats for steelhead (Pess et al 2002). When components of freshwater habitat are reduced, the potential productivity is also reduced. Therefore, NMFS believes that Skagit River steelhead populations have declined and continue to be limited by the lack of channels due to the COE's maintenance of the levee in the Lower Skagit River.

2.4.3 Effects on Puget Sound Chinook Salmon Critical Habitat

Effects to designated Critical Habitat and the Primary Constituent Elements (PCEs) are presented in terms of how the proposed action alters the value and function of PCEs for habitat in the action area. Critical habitat consists of six PCEs for the PS Chinook salmon Evolutionary Significant Unit, four of which has been determined to be associated with the action area.

- Puget Sound Chinook salmon PCE #1 - Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development.

- Puget Sound Chinook salmon PCE #2 - Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and 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.

- Puget Sound Chinook salmon PCE #3 - Freshwater migration corridors free of obstruction 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.

- Puget Sound Chinook salmon PCE #4 - 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.

To conduct this analysis, NMFS analyzed the effects of the action within the action area, the magnitude (or severity) of the action area effects on the overall watershed (or habitat unit), and the importance of the watershed (or habitat unit) to the entire area of designated critical habitat.

The proposed action will temporarily reduce critical habitat water quality, affecting the extent and quality of rearing habitat and migration corridors in the action area. All construction-related effects including turbidity, noise, and especially isolating and dewatering, will temporarily reduce the ability of the essential elements of the PCEs in the action area to support the normal behaviors of fish in the action area, for as long as those effects are present.

Of greater significance, maintaining the levees through the described repair actions perpetuates the existence of physical changes throughout the action area, which will adversely affect the function of the essential elements of each of the PCEs in the action area. The long term effect of maintaining the levee ensures continued low function of freshwater spawning habitat in the action area because it increases the slope of the river and hinders gravel recruitment in the reaches. Although rare in the action area, substrate and water quantity are sufficient in the action area to support spawning. But changed hydrodynamics in the baseline, combined with the effects of maintaining those altered dynamics lead to frequent flooding which scours substrate and eliminates redd function.

As discussed in the Environmental Baseline, the effects of maintaining levees on the Skagit River ensures persistence of conditions that limit floodplain connectivity and physical habitat conditions and support juvenile growth and mobility; decrease forage supporting juvenile development; and ensure the existence of little natural cover such as shade in the Skagit estuary and lower river reducing the function of the freshwater rearing PCE. Considering again the density dependence argument that there is too little forage for too many juvenile fish ensures competition for rearing capacity undermining the conservation role of the action area. Likewise, the lack of holding areas in a constricted floodplain limits the amount of slow water areas that are necessary for juvenile salmon to hold during floods. This affects the suitability of the action area for the migration PCE as juvenile salmon that lack refuge are swept out to sea prematurely, reducing survival.

To address these effects of the action on critical habitat in the action area, the COE will incorporate habitat improvements into their project. Planting the banks along most of the levees will improve riparian corridors along the Lower Skagit River. This improves riparian function within the action area, which is lacking. Placing logs and resloping the banks will improve bank edge habitat and likely increase rearing quality and quantity in the action area from the present baseline and will provide additional holding areas for juvenile salmon during floods.

The COE and their applicants have incorporated features into the bank stabilization design that incrementally improves a degraded environmental baseline. While the lower river and estuary remains degraded and the PCEs in the action area are barely meeting the conservation needs of the PS Chinook salmon ESU, the COE and the applicants continue to work with NMFS to improve habitat conditions in the action area. As maintenance of the levee continues, the COE and the applicants will continue to revise designs and incorporate habitat features that will increase the quality and quantity of PCEs within the action area.

2.5 Cumulative Effects

"Cumulative effects" are 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 (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

By the year 2025, the projected human population growth for Skagit County is 61,818 people; an increase in county population of 60 percent (Redman et al. 2005). From such a population increase, NMFS assumes that future private and state actions will continue within the action area, increasing as population density rises. As the human population in the action area continues to grow, demand for agricultural, commercial, or residential development is also likely to grow. New development is likely to further reduce the conservation value of habitat within the watershed through water withdrawals, stormwater quality degradation and increased volumes, loss of riparian functions, and encroachment to floodplains.

Cumulative effects of actions that destabilize fluvial systems are harmful to salmon. Channelization is an immediate and complete disruption of the riparian and aquatic communities that colonize rivers. In many cases, biological communities will reestablish themselves within channelized reaches. However, maintenance dredging, removing vegetation along channel walls, and adding riprap and concrete can completely prevent restoration of biological communities and lead to long-term or permanent disruption (Mount 1995).

The NMFS believes that the existing Skagit County regulatory mechanisms to minimize and avoid impacts to watershed function from future commercial, industrial, and residential development are generally not adequate, and/or not implemented sufficiently. Thus, while these existing regulations could decrease adverse effects to watershed function, they still allow incremental degradation to occur, which accumulate over time, and when added to the degraded environmental baseline, further degrade habitat conditions, and reduce habitat quality and suitability for PS Chinook salmon and PS steelhead.

The Skagit Chinook Salmon Recovery Chapter within the overall Puget Sound Chinook Salmon Recovery plan builds on a robust and empirically based analysis of limiting factors within the basin and its nearshore waters. This plan, while scientifically sound, will require significant political will and commitments from local government, diking districts, Tribes, State and federal agencies, as well as various interest groups and private property owners to succeed. In particular, actions necessary to avoid and reduce habitat degradation into the future are in large part driven by local governments, however, the future degree of implementation of locally driven enhancement of habitat protection and restoration actions is unknown. In the last five years since the first draft of the plan, several projects identified in the plan have been completed. Notably, the Wiley Slough restoration project is completed and the Nature Conservancy, with the SRSC, NOAA Restoration Center and other contributors, is constructing the Fisher Slough project. However, two major limiting factors in implementing these projects appear to be funding and landowner agreement (i.e., land purchases). Future projects, including those which may be

purchased with the intent on creating future conservation banks are often determined by property owners' willingness to sell, which is presently uncertain, at best.

2.6 Integration and Synthesis

The Integration and Synthesis section is the final step of NMFS' assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5) to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) result in appreciable reductions in the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species and critical habitat (Section 2.2).

Short-term effects associated with construction, including turbidity and general disturbance have nominal effects to populations and ESUs and DPSs. Construction-related effects are temporary in nature (turbidity and noise) and conditions within the construction areas will return to ambient levels shortly after construction ends. Construction is timed to avoid life stages of PS Chinook salmon and PS steelhead that are most sensitive to construction-related effects. Even if some individuals of the listed species are adversely affected by construction-related effects, it represents a fraction of the entire cohort migrating through the action area. Most migrating fish will survive increased turbidity or disturbance and the effects will not carry through to the following years.

The long-term effects associated with maintaining the existing levee are more profound than short-term effects of construction. Replacing riprap where it was temporarily absent restores baseline conditions under which bank erosion could not occur and hydrology was modified in ways that are unfavorable for salmonid migration and rearing. Thus effects of riprap presence are maintained at the repair sites. Maintaining the levee system as a whole keeps the river channel in place where it restricts channel migration, reduces bank edge habitat, reduces riparian forests, large woody debris input and recruitment, and reduces habitat diversity within the lower 22.5 miles of river. However, as described above, the extent to which the effects of the levee system generally are attributable to these repairs cannot be accurately quantified.

The banks of the Skagit River are failing in non-contiguous sections throughout the system. The COE is repairing each site and including habitat improvement features that are designed to improve aquatic habitat at each site. While these habitat improvement features will not relieve the lower river from the effects of channelization caused by the levees, they will increase habitat value and function within an already modified river environment. These changes will likely result in increasing smolt to adult survival for all Chinook salmon and steelhead populations within the Skagit Basin.

According to the COE's HCMT, the proposed action calls for a total 27,603 (past and present) feet of bank repair and stabilization; the total lineal extent of repairs to the levee system. The COE incorporated mitigating features described in this opinion into the action. The COE

calculated and designed the offsetting features to cover 19 percent more habitat than the 27,603 linear feet estimated according to their HCMT. This overcompensation accounts for the experimental nature of some of these mitigation methods, and the degraded environmental baseline.

2.6.1 Species at Population and ESU/DPS Scale

The action area of this proposed project is important to the survival and recovery of PS Chinook salmon because it supports six of 22 extant populations of Chinook salmon and collectively produces almost half of the natural origin recruits within the ESU. All six populations are currently considered to be tier 1 populations, which are considered most important for recovery. Similarly, six extant populations of PS steelhead occur throughout the basin and use the action area. The Skagit steelhead populations collectively are considered "strongholds" within the Puget Sound steelhead DPS and is important for the survival and recovery of the species. All Chinook salmon populations within the Skagit Basin have a lambda at or above 1.0, indicating at least stable, if not slightly positive population growth rates (Ford, et al 2010). In 2005, steelhead populations in the Skagit Basin were trending downward since the first status of the species review ten years earlier (Busby 1996, PSSBRT 2005).

The proposed action is expected to harm very few adults and juveniles that may experience and avoid construction-related turbidity and noise. The number of fish affected by these construction effects is expected to be very small compared to the numbers of adults and juveniles normally present in the Skagit River populations of Chinook and steelhead, and is therefore not expected to have a perceptible effect at the population level.

The proposed action continues low function (albeit minimized) at the river's edge and disconnected floodplains, and therefore retains most of the impaired habitat conditions that support the current level of productivity, abundance, and spatial structure of the affected populations. However, the improvement of edge habitat and riparian habitat will increase the quality and quantity of rearing habitat for juvenile salmonids. Supporting more smolts in the lower river or tidal delta with higher quality habitat will increase their survival in the ocean life history stage, increasing their likelihood of returning as adults. In summary, the proposed action is not expected to alter existing population viability characteristics, and is therefore not expected to appreciably reduce the likelihood of survival and recovery of either PS Chinook salmon or PS steelhead.

2.6.2 Critical Habitat at Watershed Scale

Construction effects are expected to be temporary in nature and will not affect the ability of critical habitat to function. The same effects of the proposed action that will have an adverse affect on listed salmon and steelhead will also have an adverse affect on critical habitat PCEs for Puget Sound Chinook salmon (i.e., channelization and floodplain disconnectivity). The existing channelized condition in the action area has been in place for at least eight decades, dating back to the 1920's when the COE first began channelizing the river. Although the proposed action will retain this isolation from the floodplain, it will also improve edge habitat, riparian function, pool frequency, and large woody debris – all of which are scarce in the action area. These

effects are likely to cause an incremental increase in the conservation value of critical habitat PCEs in the Lower Skagit River, or the designated critical habitat as a whole. Therefore, it is likely that critical habitat will remain functional and retain the current ability for PCEs to become functionally established, to serve the intended conservation role for the species.

2.7 Conclusion

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, NMFS concludes that the proposed action will not adversely influence population viability for any of the six populations of PS Chinook salmon in the Skagit River and therefore will not jeopardize the continued existence of the PS Chinook Salmon ESU. Similarly, the action will not adversely influence the population viability of any of the six populations of PS steelhead in the Skagit River and will not, therefore, jeopardize the continued existence of the PS steelhead DPS. Furthermore, the NMFS concludes that the proposed action will not appreciably diminish the conservation role or value of critical habitat in the Skagit River System and therefore, is not likely to destroy or adversely modify designated critical habitat of PS Chinook salmon.

2.8. Incidental Take Statement

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by regulation to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. For purposes of this consultation, we interpret "harass" to mean an intentional or negligent action that has the potential to injure an animal or disrupt its normal behaviors to a point where such behaviors are abandoned or significantly altered.[9] Section 7(b)(4) and Section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA, if that action is performed in compliance with the terms and conditions of this incidental take statement.

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[9] NMFS has not adopted a regulatory definition of harassment under the ESA. The World English Dictionary defines harass as "to trouble, torment, or confuse by continual persistent attacks, questions, etc." The U.S. Fish and Wildlife Service defines "harass" in its regulations 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 behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3).

The interpretation we adopt in this consultation is consistent with our understanding of the dictionary definition of harass and is consistent with the U.S. Fish and Wildlife interpretation of the term.

2.8.1 Amount or Extent of Take

An indeterminate number of fish will be exposed to the effects of the action and respond to that exposure by at least changing their normal behavioral patterns such that they will be actually injured or killed. Therefore, take from habitat modification causing harm is reasonably certain to occur. The proposed action causes harm from both the short-term effects of forthcoming construction activities and from the long-term results of causing the persistence low functioning habitat in the lower Skagit River through levee maintenance.

NMFS' ability to quantify the amount of take in numbers of fish depends on whether NMFS has sufficient information to determine the number of fish that will be exposed, the manner in which each exposed fish will respond to exposure, and whether those responses will fall into one of the categories of take, listed above. For take in the form of harm, this assessment can be difficult if not impossible to accomplish because of the range of individual fish responses to habitat change. Some will encounter changed habitat and merely react by seeking out a different place in which to express their present life history. Others might change their behavior, causing them to express more energy, suffer stress, or otherwise respond in ways that impair their present or subsequent life histories. Yet others will experience changed habitat in way that kills them.

For the short term effects of the action, NMFS cannot predict the number of fish that would be exposed to the effects of construction. Likewise, for the long-term effects of the action, as discussed in previous sections, it is impossible to predict exactly how the levee repairs affect individual fish, and how many fish are affected. While estimates of the effects of the levee system on the carrying capacity of the lower Skagit River exist, the precise number of fish affected by conditions resulting from these specific repairs cannot be determined.

While this uncertainty makes it impossible to quantify take in the form of harm in terms of numbers of animals injured or killed, the extent of habitat change to which present and future generations of fish will be exposed is readily discernable and presents a reliable measure of the extent of take that can be monitored and tracked. Therefore, when the specific number of individuals "harmed" cannot be predicted, NMFS quantifies the extent of take based on the extent of habitat modified (51 FR 19926 at 19954; June 3, 1986).

Therefore, to assess the extent of take from the exposure of individual PS Chinook salmon and PS steelhead to the short term effects of the action (turbidity, noise, disturbance), NMFS referred to the likely extent of habitat affected by these factors during construction. These short-term changes in habitat will harm some individuals in the affected areas estimated no larger than 300 feet downstream of each construction site for the projects described as 2011 actions, for the width of the river at those sites. The extent of take from construction effects therefore includes the linear area in which construction will take place, the width of the river at those linear sites, and an area 300 feet downstream of each construction site.

For the effects of the action from the long-term effect of maintaining the levee structures, NMFS also referred to the extent of habitat modified by the repair actions, consistent with the total length of repaired levee plus the extent of the action area downstream of the repaired levee in which altered channel function manifests in lost carrying capacity for affected fish. The COE

stabilized 17,460 linear feet and proposes to stabilize 10,143 more for a total of 27,603 linear feet (5.2 miles). The extent of changes to hydrology is the entire reach of the Skagit River affected by the proposed action (RM 22.5 through both forks to the mouth of the rivers), bankfull to both banks, and associated vertical, horizontal, and interstitial extents of the hydrological influence, which is described in the action area section of this document. The structures at this site are expected to be permanent and take will occur for the foreseeable future.

While the proposed action is expected to impact conditions in the reach described above, it would be speculative to attempt to quantify the precise extent of this impact. The anticipated changes to hydrology are site-specific and cannot be specified without extensive study. Changes to riparian habitat, the extent, location and timing of channel migration, and other effects of perpetuating the existing channelization cannot be determined with specificity. Therefore, the linear extent of of habitat modified by the proposed action (27,603 lineal feet) to represent the extent of take exempted in this statement for this consultation.

This proposed project includes efforts by the COE, and the applicants to reduce those impacts by redesigning bank stabilization projects and adding features that will improve habitat for juvenile salmon. While it is anticipated that these improvements are likely to improve habitat conditions for Chinook and steelhead, and could result in increased fish density, such improvements are not certain nor are they quantifiable without further monitoring and study.

2.8.2 Effect of the Take

The importance of the action area to the PS Chinook salmon ESU is well documented in the Salmon Recovery Plan and this opinion. The respective populations within the Skagit Basin are native, diverse, and some populations are relatively plentiful. All six Chinook salmon populations were rated Tier 1 populations, which are important for recovery. The Skagit River steelhead populations are among the most abundant within the PS steelhead DPS. All populations are limited by the maintenance of the Lower Skagit River levee system. Those limitations are affecting productivity and abundance of all Chinook salmon and steelhead populations within the basin. Without the conservation measures and habitat improvement features incorporated into the proposed action, juvenile salmonid rearing habitat would still be limited in the action area, forcing numerous juvenile salmon, namely Chinook salmon, out to sea prematurely where their likelihood of survival to adulthood is less than one-tenth of normal rearing parr and tidal delta migrants.

The proposed project will not alleviate all effects created by maintaining the entire levee system which, as a whole affects many more individuals than is being accounted for in the proposed action. However, with the habitat improvement features included in the design, we can expect take associated with maintaining the degraded baseline to be reduced. Full scale removal of structures from floodplains throughout the lower Skagit River is not presently feasible and will not be feasible in the near future. Furthermore, considering its recent history, it is reasonably certain that the Skagit River will flood and scour banks in the Lower Skagit River again. Future repairs are certain to occur. The COE and Diking Districts will continue to develop the HCMT and use it to determine appropriate amounts of habitat features to incorporate into future bank stabilizations within the 20 or more mile action area. Bare rock, unvegetated banks, and low

densities of woody debris dominate the bank edges along the entire action area. As more habitat improvements are introduced to the system, edge habitat will incrementally improve and reduce the adverse effects of the levee system to rearing juvenile salmon.

2.8.3 Reasonable and Prudent Measures and Terms and Conditions

"Reasonable and prudent measures" are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02). "Terms and conditions" implement the reasonable and prudent measures (50 CFR 402.14). These must be carried out for the exemption in section 7(o)(2) to apply.

Reasonable and Prudent Measures

1. Ensure proper habitat function created by the log structures.
2. Ensure salmonids will not be exposed to harmful chemicals during invasive plant control.
3. Ensure the effectiveness of conservation measures to reduce short-term and long-term effects of the action.

Terms and Conditions

1. To implement Reasonable and Prudent Measure No. 1, the COE shall ensure that woody debris and anchored rootwads continue to function properly as aquatic habitat features. The COE shall ensure that structures retain wood and recruited wood remain on site to provide habitat for rearing juveniles. If accumulated logs at anchored rootwad sites must be removed or disassembled for any reason, the COE shall contact NMFS prior to removal.

2. To implement Reasonable and Prudent Measure No. 2, the COE shall ensure these additional conservation measures are implemented during chemical treatment:

    a. Do not spray when wind exceeds 10 mph
    b. Always direct the spray nozzle away from aquatic areas
    c. Adjust the nozzle to spray only large droplets.
    d. Avoid direct spraying of the sediment
    e. Keep plant runoff to a minimum
    f. No spraying if precipitation is expected within 24 hours.

3. To implement Reasonable and Prudent Measure No. 3, the COE shall:

   a. monitor turbidity as described in the BA. If turbidity exceeds estimates and limits identified in the BA and this opinion, the COE shall stop work and add additional best management practices such as hay bales or silt curtains to contain the suspended sediments.

   b. monitor the development of habitat improvements as defined in the BA addendum. The COE shall monitor velocity changes, photographic monitoring, survival of vegetation, retention of log structures, fish presence, and size of pool formation and send annual reports to NMFS. If habitat improvement features are not meeting their objectives defined in the BA, the COE shall improve designs or eliminate them from consideration for future bank protection projects within the action area.

2.9. Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

1. The COE should continue to pursue other sources of funding, and/or other Acts, laws, or programs such as the Continuing Authorities Program or Section 206 of the Water Resources Development Act to assist in pursuing flood reduction such as levee setbacks, habitat restoration, or non-structural alternatives measures that would reduce flood risk and benefit aquatic habitat as well.

2. The COE should ensure that future bank protection projects in the action area adequately address the extensive loss of habitat associated with maintaining the levee system as a whole. The COE should continue to develop their Habitat Capacity Mitigation Tool with the Diking Districts, NMFS, USFWS, and the SRSC, and continue to use it as guidance to fund and implement adequate habitat improvements to offset future bank stabilization projects in the action area.

3. The COE should ensure that future bank protection projects in the action area adequately address the extensive loss of habitat associated with maintaining the levee system as a whole.

4. The COE should participate in lower river and delta restoration projects that include:
   a. Increase in the lower river and delta rearing capacity by increasing the area of

habitat available to fish either through purchasing land or setting back existing levees;

b. Increase floodplain and delta connectivity by reconnecting floodplains with the mainstem, and allowing inundation, and increasing delta habitat by opening delta distributary channels to provide fish an opportunity to more directly access available habitat;

c. Seek opportunities to purchase credits in habitat banks providing increased floodplain connectivity in the lower Skagit River, when those banks are available.

5. The COE should enhance the economic analysis for projects to help guide longer term and ecologically sustainable designs. Current analyses often assess upfront expenditures of construction of the project, and value of land that benefit from protection from periodic flooding activity, while other factors are ignored, such as:

    a. The expected life of the project;
    b. The repeated costs of repairs;
    c. The cost of repairing nearby sites that fail because of the construction of a nearby project;
    d. The relative 'ecological services' provided, or impacted, by project design and performance. This includes a recognition of the economic value of salmonids as a commercial and sport fishing resource; and,
    e. Incorporate the costs of conducting lengthy planning efforts, involved consultations, implementation of proven off-site conservation measures, and maintenance and monitoring requirements associated with levee repairs into each project's cost-benefit analysis such that the economic benefits of removed levees/added storage are more accurately expressed to the public and regulatory agencies.

6. The COE should work with local governments, landowners, diking districts, and Tribes to remove rock bank stabilization and levees within the Skagit River and estuary. Those banks protection areas that cannot be removed in whole should be retrofitted with large wood, bioengineering methods, and riparian vegetation. This would improve flood storage, floodplain connectivity, and creation of side channels and beneficial habitat for PS Chinook salmon and PS steelhead.

2.10 Reinitiation of Consultation

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action on listed species or designated critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this opinion, or 4) a new species is listed or critical habitat designated that may be affected by the action.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT CONSULTATION

The consultation requirement of section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effects include the direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside EFH, and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by the COE and descriptions of EFH for Pacific coast salmon (PFMC 1999) contained in the fishery management plans developed by the Pacific Fishery Management Council (PFMC) and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The action area includes areas designated as EFH for various life history stages of Chinook, coho, and Puget Sound pink salmon.

	Life history stage
Chinook salmon	Adult, juvenile
Coho salmon	Adult, juvenile
Pink salmon	Adult, juvenile

3.2 Adverse Effects on Essential Fish Habitat

Based on information provided in the BA and the analysis of effects presented in the ESA portion of this document, NMFS concludes that proposed action will have the following adverse effects on EFH designated for coho, Chinook salmon and Puget Sound pink salmon:

As described in sections 2.4 and 2.6, the presence and repair of the levee continues the degradation and the reduction of estuarine, rearing, migration, and spawning habitat by reducing available habitat area, retarding of natural processes including channel erosion and lateral migration, reducing water quality, altering hydrology through changes in channel width, channel depth, and water velocity, and reduction in riparian habitat.

3.3 Essential Fish Habitat Conservation Recommendations

The NMFS believes that the reasonable and prudent measures listed above correspond with the conservation measures necessary to avoid, mitigate, or offset the impact of the proposed action on EFH. Similarly, the conservation recommendations listed in section 2.9 are also necessary for the long-term protection of EFH within the Skagit River mainstem.

NMFS expects that full implementation of these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2 above, approximately 1,818 acres of designated EFH for Chinook, coho, and Puget Sound pink salmon.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the Federal agency must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation from NMFS. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations, unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. 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 NMFS Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects [50 CFR 600.920(k)(1)].

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5 Supplemental Consultation

The (Federal action agency) must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH conservation recommendations [50 CFR 600.920(l)].

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users are the COE and Diking Districts 1, 3, 12, 17, and 22.

Individual copies were provided to the above-listed entities. This consultation will be posted on the NMFS Northwest Region website (http://www.nwr.noaa.gov). The format and naming adheres to conventional standards for style.

4.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

4.3 Objectivity

Information Product Category: Natural Resource Plan.

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA Regulations, 50 CFR 402.01, *et seq.*, and the MSA implementing regulations regarding EFH, 50 CFR 600.920(j).

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the Literature Cited section. The analyses in this Opinion/EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with Northwest Region ESA quality control and assurance processes.

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