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

NMFS Tracking No.: 2006/00472

September 22, 2008

Mr. Mark Eberlein
Regional Environmental Officer
U.S. Department of Homeland Security
Federal Emergency Management Agency
Region X
130-228th Street SW
Bothell, Washington 98021-97963755

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the on-going National Flood Insurance Program carried out in the Puget Sound area in Washington State. HUC 17110020 Puget Sound.

Dear Mr. Eberlein:

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 of 1973, as amended (16 U.S.C. 1531 et seq.), on the effects of certain on-going elements of the National Flood Insurance Program throughout Puget Sound in Washington State. This biological opinion is provided to the Federal Emergency Management Agency in accordance with the judicial order in *NWF v. FEMA,* 345 F. Supp. 2d 1151 (W.D. Wash. 2004). This biological opinion is based on the information provided in the February 2006 Biological Evaluation, numerous meetings, and phone calls, emails, and letters exchanged on the program. A complete administrative record of this consultation is on file at the National Marine Fisheries Service's Washington State Habitat Office in Lacey, Washington.

The National Marine Fisheries Service provides this biological opinion following consultation with the Federal Emergency Management Agency on effects of the National Flood Insurance Program on listed species found within the Puget Sound region, which are Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*), Puget Sound steelhead (*O. mykiss*), Hood Canal summer-run chum salmon (*O. keta*), Lake Ozette sockeye salmon (*O. nerka)*, and Southern Resident killer whales (*Orcinus orca*). In the biological opinion, the National Marine Fisheries Service concludes that the proposed action is likely to jeopardize the continued existence of Puget Sound Chinook salmon, Puget Sound steelhead, Hood Canal summer-run chum salmon, and Southern Resident killer whales, and is likely to adversely modify Puget Sound Chinook salmon, Hood Canal summer-run chum salmon, and Southern Resident killer whale critical habitat (Puget Sound steelhead critical habitat is not designated at this time). The proposed action is not likely to jeopardize Lake Ozette sockeye salmon or adversely modify Lake Ozette sockeye salmon critical habitat.

As required under the Endangered Species Act for consultations concluding with Jeopardy and Adverse Modification determinations, the National Marine Fisheries Service discussed with the Federal Emergency Management Agency, the availability of a reasonable and prudent alternative that the Federal Emergency Management Agency can take to avoid violation of the Federal Emergency Management Agency's Endangered Species Act section 7(a)(2) responsibilities (50 CFR 402.14(g)(5)). Reasonable and prudent alternatives refer to alternative actions identified during formal consultation that 1) can be implemented in a manner consistent with the intended purpose of the action, 2) that can be implemented consistent with the scope of the Federal agency's legal authority and jurisdiction, 3) that is economically and technologically feasible, and 4) that the Director believes would avoid the likelihood of jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of critical habitat (50 CFR 402.02) The biological opinion includes a reasonable and prudent alternative which can be implemented to avoid jeopardy and adverse modification of critical habitat, while meeting each of the other requirements listed above. Accordingly, the National Marine Fisheries Service prepared an Incidental Take Statement describing and exempting the extent of incidental take reasonably certain to occur under the reasonable and prudent alternative.

If you have questions, please contact DeeAnn Kirkpatrick of National Marine Fisheries Service's Washington State Habitat Office at (206) 526-4452 or via email at deeann.kirkpatrick@noaa.gov.

Sincerely,

D. Robert Lohn
Regional Administrator

Enclosure

Endangered Species Act – Section 7 Consultation
Final Biological Opinion

And

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

Implementation of the National Flood Insurance Program in the State of Washington
Phase One Document – Puget Sound Region

Lead Action Agency: Federal Emergency Management Agency

Consultation
Conducted By: National Marine Fisheries Service
Northwest Region

Date Issued: September 22, 2008

Issued by: D. Robert Lohn
D. Robert Lohn
Regional Administrator

NMFS Tracking No.: 2006-00472

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ACRONYMS AND ABBREVIATIONS

BE	Biological Evaluation
BFE	Base Flood Elevation
BRT	Biological Review Team
CAC	Community Assistance Contacts
CAV	Community Assistance Visits
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CHART	Critical Habitat Area Review Teams
CLOMA	Conditional Letter of Map Amendment
CLOMR	Conditional Letter of Map Revision
CLOMR-F	Conditional Letter of Map Revision Based on Fill
CMZ	Channel Migration Zone
COE	U.S. Army Corps of Engineers
CRS	Community Rating System
CWA	Clean Water Act
DPS	Distinct Population Segment
EFH	Essential Fish Habitat
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FBFM	Flood Boundary Floodway Map
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FR	Federal Register
GDU	Genetic Diversity Units
GMA	Growth Management Act
HCCC	Hood Canal Coordinating Council
HUC	Hydrologic Unit Code
LID	Low Impact Development
LOMA	Letter of Map Amendment
LOMC	Letter of Map Change
LOMR	Letter of Map Revision
LOMR-F	Letter of Map Revision Based on Fill
LWD	Large woody debris
MPG	Major Population Group
MSA	Magnuson-Stevens Fishery and Management Act
NFIA	National Flood Insurance Act of 1968
NFIP	National Flood Insurance Program
NMFS	National Marine Fisheries Service

ACRONYMS AND ABBREVIATIONS (continued)

NOAA	National Oceanic and Atmospheric Administration
NWF	National Wildlife Federation
NWP	Nationwide Permit
Opinion	Biological Opinion
PAHs	Polycyclic Aromatic Hydrocarbons
PCEs	Primary Constituent Elements
PCSRF	Pacific Coastal Salmon Recovery Fund
PBE	Programmatic Biological Evaluation
PFMC	Pacific Fishery Management Council
PL	Public Law
PMR	Physical Map Revision
PSM	Pre-Spawn Mortality
PSTRT	Puget Sound Technical Recovery Team
PWMP	Portland Watershed Management Plan
RCW	Revised Code of Washington
RIP	Rehabilitation and Inspection Program
RM	River Mile
RPA	Reasonable and Prudent Alternatives
SASSI	Salmon and Steelhead Stock Inventory
SFHA	Special Flood Hazard Area
SMA	Shoreline Management Act
SOMA	Summary of Map Amendments
SRKW	Southern Resident Killer Whale
U.S.C.	United States Code
UGA	Urban Growth Area
USFWS	U.S. Fish and Wildlife Service
VSP	Viable Salmonid Population
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WRIA	Watershed Resource Inventory Area
WDOE	Washington State Department of Ecology
WOFM	Washington State Office of Financial Management

INTRODUCTION

This final biological opinion (Opinion) was 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. With respect to designated critical habitat, the analysis below relies only on the statutory provisions of the ESA, and not on the regulatory definition of "destruction or adverse modification" at 50 CFR 402.02.

The Essential Fish Habitat (EFH) portion of this document 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 administrative record for this consultation is on file at the Washington State Habitat Office, in Lacey, Washington.

Background and Consultation History

On February 14, 2006, the Federal Emergency Management Agency (FEMA) submitted a Biological Evaluation (BE) evaluating the effects of the National Flood Insurance Program (NFIP). With the BE was a letter concluding that these program elements are not likely to adversely affect listed salmon or steelhead species in the state of Washington, but requesting formal consultation consistent with the judicial order in *NWF v. FEMA,* 345 F. Supp. 2d 1151 (W.D. Wash. 2004).

The FEMA also submitted at that time a request for consultation on the effects of implementing the NFIP on EFH in Washington State, under the requirements of the MSA.

Numerous meetings were held, communications exchanged, and documents provided to gather information additional to that contained in the BE, in order for NMFS to conduct its analysis with sufficient understanding of the proposed action and its range of effects throughout the action area. A record of these is contained with the docket, held at NMFS' Washington State Habitat Office in Lacey, Washington. On January 11, 2007, NMFS began preparing its Opinion on the effects of the three discretionary NFIP elements on 18 species and designated critical habitat in Washington State.

Pursuant to a request from FEMA to ensure consistency with the Court's directions in *NWF v. FEMA*, NMFS is documenting the statewide consultation in two phases: in phase one, NMFS is providing a Opinion on the effects of the NFIP on listed species found within the Puget Sound region, which are Puget Sound (PS) Chinook salmon (*Oncorhyncus tshawytscha*), PS steelhead (*O. mykiss*), Hood Canal summer-run chum salmon (*O. keta*), Lake Ozette sockeye salmon (*O. nerka)* and the Distinct Population Segment (DPS) of endangered Southern Resident killer whales (SRKW) (*Orcinus orca*). In phase two, NMFS will provide an Opinion on the effects of the NFIP on species found throughout the remainder of the State, including 13 additional listed salmonid species. This document is the Phase One Biological Opinion.

Description of the Proposed Action

The FEMA proposes to continue to administer the NFIP in the Puget Sound Region. The administration of the NFIP has three discretionary components (as found by the district court in *NWF v. FEMA*), which are the subject of this consultation.[1] These are:

- the floodplain mapping program,
- the minimum floodplain management criteria for community (states, cities, towns, counties, tribal reservations, etc.) inclusion in the NFIP, and
- the community rating system (CRS).

The FEMA's authority to administer the NFIP comes from the National Flood Insurance Act of 1968 (42 U.S.C. 4001 et seq.), as amended (NFIA). Purposes of the NFIA include:

- to authorize a flood insurance program through which flood insurance can be made available on a nationwide basis;
- to encourage State and local governments to make appropriate land use adjustments to constrict the development of land which is exposed to flood damage and minimize damage caused by flood losses;
- to guide the development of proposed future construction, where practicable, away from locations which are threatened by flood hazards; and
- to identify flood risks and provide flood risk information to the public.[2]

The NFIP is intended to reduce federal expenditures for flood losses and disaster assistance by providing flood insurance at reasonable rates within communities that choose to participate in the program. In order to qualify for the program, communities must adopt land use controls at least as restrictive as the minimum criteria established by FEMA. See 42 U.S.C. 4012(c), 4102(c). To encourage communities to participate in the program, the NFIA prohibits federally-regulated banks or lenders, or federal agencies, from providing loans or other financial assistance for acquisition or development within the flood-hazard areas (floodplains) of non-participating communities and requires the purchase of flood insurance as a precondition for such financial assistance. Also, communities that do not participate in the NFIP are not eligible for certain types of federal flood disaster relief. In enacting the NFIA, Congress recognized that, although the NFIP is a voluntary program, "the availability of Federal loans, grants, guarantees, insurance, and other forms of financial assistance are often determining factors in the utilization of land and the location and construction of public and private industrial, commercial, and residential facilities." 42 U.S.C. 4002(a)(2).

The NFIP is a nationwide program that consists of a wide variety of administrative and regulatory activities. The Court's order in *NWF v. FEMA* identified the three main program

[1] The Court in *NWF v. FEMA* concluded that a fourth component of the program, the actual sale of flood insurance, is not discretionary within the meaning of the National Flood Insurance Act and the Endangered Species Act, so that program element was not evaluated in this consultation.
[2] 42 U.S.C. 4001; Pub. L. 108-264, 2.

areas requiring ESA consultation: mapping, minimum floodplain management criteria, and the CRS. Each of these three program areas is comprised of a number of different activities. An initial question for this consultation was identifying the specific, discretionary program activities that result in floodplain and related impacts that affect listed species. After examining the discretionary program elements identified in FEMA's letter requesting formal consultation, as subsequently modified through the analysis provided in FEMA's BE, NMFS determined that certain discretionary elements of the program would not contribute significantly to the program's effects on listed species, and focused on other elements, such as fill and levees, as having the primary adverse effects.

A second question for this consultation was whether implementing these activities can be said to "cause" floodplain development that affects listed salmon and steelhead. The Court in *NWF v. FEMA* concluded that "even though FEMA does not directly authorize development, Congress and FEMA have both recognized a connection between the NFIP and development in the floodplains." The intervenors in the lawsuit also demonstrated the close connection between the NFIP and floodplain development in the Puget Sound region. The Washington Association of Realtors represented that "the inability to obtain NFIP [insurance] would effectively shut down new housing in affected areas" because "[m]ost real estate purchasers cannot purchase property without obtaining financing, and in areas where it applies, flood insurance is a prerequisite to obtain financing." Similarly, Piazza Construction, Inc. contended that financing for its construction projects is contingent on obtaining flood insurance, and that flood insurance for past projects has been provided through the NFIP. Finally, the Home Builders Association of Kitsap County noted that its approximately 560 builder and developer members rely on the NFIP to obtain financing for projects. These statements demonstrate the strong incentive for communities to participate in the NFIP and comply with the minimum floodplain management criteria and other program elements established by FEMA. The FEMA has also recognized, in its Final Environmental Impact Statement for its NFIP regulations, that if a community chooses not to participate in the NFIP, economic development in the flood hazard area may be severely restricted.

More recently, the Eleventh Circuit Court of Appeals held that "FEMA has the authority in its administration of the NFIP to prevent the indirect effects of its issuance of flood insurance by, for example, tailoring the eligibility criteria that it develops to prevent jeopardy to listed species. Therefore, its administration of the NFIP is a relevant cause of jeopardy to the listed species." *Florida Key Deer v. Paulison*, Order dated Apr. 1, 2008, at 21 (11th Cir. 2008). Also FEMA's regulations implementing Executive Order 11988 (Floodplain Management) broadly define the "indirect impacts" of agency action as "an indirect result of an action whenever the action induces or makes possible related activities which effect the natural values and functions of floodplains or wetlands." 44 CFR 9.4.

The NMFS's analysis during the consultation supports the conclusion that FEMA's activities do lead to floodplain development in Washington State, some of which affects the habitat of listed species. Communities that participate in the NFIP must comply with the NFIP's minimum floodplain management criteria, which permit development in the floodplain as long as structures are placed on fill or stem walls at or above the base flood elevation, or BFE (which is the water surface elevation associated with a one percent chance per year flood, also referred to as a 100-

year flood). Also, FEMA's regulations allow properties within the floodplain to avoid the mandatory flood insurance purchase requirement through the placement of fill above the BFE.

Significant development within the floodplain boundaries of NFIP jurisdictions in Washington has occurred and is expected to continue. Of Washington State's NFIP participating communities that have urban growth boundaries, the majority include floodplain lands within the boundary that are slated for future growth. The percentage of floodplain area within these urban growth areas generally ranges from two-ten percent (Jerry Franklin pers. comm. 3/27/08, and 6/26/08). Even where flood risk is well established (for example, in Lewis County on the Chehalis River), the NFIP's current implementation does not significantly restrict floodplain development or encourage the preservation of floodplain natural and beneficial values; the City of Chehalis has nine percent of its Urban Growth Area in mapped floodplain, and Centralia has 21 percent of its Urban Growth Area in mapped floodplain (pers. comm. Dan Sokol 3/26/08). This is despite the fact that Washington's Growth Management Act (GMA) requires identification of frequently flooded areas as critical areas, and defines frequently flooded areas as those identified by FEMA as 100 year floodplains. Moreover, the GMA requires jurisdictions with frequently flooded areas to adopt ordinances governing land use in frequently flooded areas, and the majority of jurisdictions submit their locally adopted versions of the NFIP minimum criteria to meet this requirement.

Separate from the question of new development, the NFIP minimum standards allow existing buildings to be improved or reconstructed without meeting more stringent standards for new development (e.g., elevation) for the whole structure, as long as the project does not exceed 50 percent of the building's value. This means that floodplain homes and businesses can be remodeled or expanded to displace a larger portion of the floodplain, without complying with standards for new development (EDAW 2006).

In a broader analysis, FEMA organized an independent review (Rosenbaum 2005) to examine the literature available on the relationship of the NFIP to environmental (and habitat) changes. Rosenmbaum reached two broad conclusions: that most of the literature related to the NFIP's environmental and developmental impacts suggests that the program encourages, in some manner, the development and environmental transformation of wetlands and coastal areas, or that it does little to impede these impacts; and that, where NFIP participating communities adopt regulatory standards more stringent than the NFIP minimum standards, floodplain development is impeded.

The NFIP, through its mapping component, also influences the way flood control structures, such as levees, are constructed, operated, and maintained. If a levee is constructed to withstand a base flood and meets FEMA operation and maintenance standards, FEMA will "map out" of the floodplain the areas protected by the levee. Therefore, the protected areas are not subject to the flood insurance purchase requirement or other NFIP criteria. Levees diminish floodplain storage of water during floods, and confine the river within a walled in channel, pushing the flooding farther downstream, and adding pressure to extend the levee. As a result, the river can no longer move across the floodplain and no longer support the natural processes of channel migration that create the side channels and off-channel areas that shelter juvenile salmon. Flood control efforts also often exacerbate flood hazards by encouraging human occupation of flood-prone areas.

Once levees stop the annual high flows from reaching the floodplain, development typically spreads across the floodplain right up to the levee. Heavier flooding puts development at risk when the levees are overtopped or they fail (Montgomery 2003).

The NFIA requires flood insurance for buildings within the 100 year floodplain as a prerequisite for government-backed financing for purchase or construction of such buildings. When flood insurance is required to obtain financial assistance for construction within a particular area in Washington, property owners obtain that insurance primarily through the NFIP. Therefore, the NFIP affects the extent and type of development that occurs in the floodplain. Rosenbaum (2005) and Cross (1989) support the fact that the NFIP contributes to development of areas at risk of flooding (Merrick Burden, Economist, NMFS 6/22/2006). Cross (1989) found that new residential construction in flood zones increased after Monroe County in Florida joined the NFIP. An ordinance introduced in late 1974 was enacted as a requirement for the County to enter the NFIP. Between the time this ordinance was adopted and the publication of Cross's paper (less than 15 years), the population in Monroe County nearly doubled. Over 61 percent of surveyed Realtors and nearly two-thirds of homeowners believed it was easier to sell property within flood hazard zones with the availability of flood insurance (Cross 1989). Thus, although the NFIP is a voluntary program, communities have a strong incentive to participate in the program and regulate their floodplain development in accordance with standards established by FEMA in the NFIP.

Human actions frequently dictate the character of the riverine landscape (Church 2002). The NFIP mapping activities, minimum criteria, and CRS often guide land use and development in floodplains (FEMA 2002, Larson et al. 2003, Task Force on the Natural and Beneficial Functions of the Floodplain 2002). The NFIP provides incentive and guidance for the placement of fill in floodplains to elevate land so it is no longer subject to the NFIP (42 U.S.C. 4002, 5154a(a), EDAW 2006, Task Force on the Natural and Beneficial Functions of the Floodplain 2002, FEMA 2001, Pinter 2005). Levee construction and maintenance also relates to whether land is mapped as floodplain subject to the NFIP's standards. Considering the foregoing, NMFS determined that the proposed action does lead to environmental effects on the habitat of listed species of salmon, steelhead, and killer whales.

Floodplain Mapping

The NIFA requires FEMA to identify and publish information on floodplain areas nationwide that have special flood hazards and to establish flood risk zone data, which is used to set flood insurance rates. 42 U.S.C. 4101. Flood hazard identification is the backbone of the NFIP and is critical to managing development of the floodplain. The NFIA does not provide specific guidance on how FEMA is to implement its mapping functions. By regulation, FEMA has defined the following terms, which are key to FEMA's mapping and rate-setting activities:

- the "floodplain" is any land area subject to inundation;
- the "base flood" is the flood having a one percent chance of being equaled or exceeded in any given year (also referred to as the 100-year flood);
- the "area of special flood hazard" (referred to as the special flood hazard area, or SFHA) is that area within the flood plain inundated during a 100-year flood event; and

- a "floodway" is the channel of a river or watercourse and adjacent land areas that must be reserved in order to discharge a base flood without cumulatively increasing the water surface elevation more than a designated height.

See 44 CFR 59.1.

The FEMA identifies and publishes flood hazards and risk zone data on maps known as Flood Insurance Rate Maps (FIRMs). The FEMA prepares a FIRM after completing a flood insurance study (FIS) for a community. 44 CFR 64.3. The study determines the BFE and develops data for use by communities in adopting floodways as part of their floodplain management programs. The FIRMs graphically represent the floodplain within a community and may also show regulatory floodway boundaries,[3] BFEs, and insurance risk zones. Prior to finalizing a FIRM, the NFIA requires that FEMA publish for comment the proposed BFEs. 42 U.S.C. 4104.

The FEMA designates the floodplain based on engineering computer models that estimate hydrologic and hydraulic conditions. This delineation of the floodplain does not account for all of the dynamic hydrological, geomorphological, and climatological processes that create a shifting mosaic of habitat patterns in floodplain ecosystems (Hall et al 2007). The FEMA maps can also designate a floodway. The floodway generally includes the river channel and adjacent floodplain areas that often contain riparian habitat including forests and wetlands (FEMA 2002). Floodways are shown on FEMA maps as including the area in and adjacent to the channel where water velocities are high, and water volumes are large during flood events. A floodway is "designed" with the expectation that it will convey floodwaters, even if the floodplain is filled for development. Development can continue in the floodplain until the elevation of the base flood in the floodway will rise by no more than one foot.

The FEMA has mapped flood hazard areas in 323 communities in Washington. The majority of these maps were completed in the late 1970s or 1980s.[4] The FEMA is in the process of completing a map modernization ("Map Mod") effort (converting existing maps to a digital format) and conducting flood updates for 17 counties and all jurisdictions within those counties in Washington. A total of 252 Washington jurisdictions currently participate in the NFIP, including 39 counties, over 200 cities and towns, and 2 tribal reservations.

The FEMA maps are used by states and communities in implementing their floodplain management regulations, by lenders in implementing the mandatory flood insurance purchase requirement, by federal agencies that implement Executive Order 11988 (directing Federal agencies to "reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by

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[3] The regulatory floodway is an engineering construct defined as the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water-surface elevation more than a designated height. In other words, it is an area specifically for conveyance capacity sufficient to move floodwaters in a one hundred year flood event, and is not necessarily a reflection of topographic and hydrologic conditions.

[4] The NFIA requires that FEMA assess the need to revise and update flood maps at least once every five years. 42 U.S.C. 4101(e). The FEMA must revise and update maps as FEMA determines necessary or upon the request of a participating community.

floodplains," E.O. 11988, sec. 1), and by local governments in land use planning and management.

Detailed Versus Approximate Maps

Flood maps may be either "approximate" or detailed, depending on the level of data gathered for a particular flood study. The "approximate" approach to mapping may use any available flood event information or photos and rudimentary hydrologic and hydraulic analyses. This approach allows FEMA to determine the general boundaries of the SFHA, but not develop BFEs or a floodway. In areas with approximate maps, some local communities use the available data and local knowledge of flooding in the area to determine floodplain management practices. Other local communities may require the private landowner to complete a more detailed flood study and develop an estimate of BFEs before permitting development.

Detailed study methods typically employ the use of engineering computer models, current topographic mapping, and river channel geometry. The FEMA has approved several computer programs for detailed flood mapping. Detailed maps include SFHAs, BFEs or flood depths, and/or floodways.[5] Local floodplain administrators must adopt these BFEs in their local floodplain management ordinances. And, for each level of additional detail provided, additional minimum requirements are established in the floodplain ordinance that the community must follow.

Determining the level of study performed on a flooding source, and designating BFEs and regulatory floodways is discretionary (FEMA 2006). The decision whether to use the approximate or detailed methods is generally based on existing and anticipated development in and near the floodplain. However, other considerations, including funding, are included in this decision. Currently, 16 NFIP communities in Puget Sound are mapped with approximate flood zones instead of detailed studies. Of these, five do not have SFHAs designated.

Flood maps are an essential tool by which States and communities evaluate their flood risks to manage development in the floodplain, insurance agents properly rate flood insurance policies, and lending institutions determine flood insurance requirements. For a community to make wise land use decisions, flood risk must be accurately identified. However, flood maps in many communities are outdated and may not reflect current flooding conditions due to physical, climatological, model methodology, or other changes since the time of the initial study, often resulting in an underestimate of flood hazards and risks (FEMA 2006). In many cases, regulatory floodplains were designated after development had already occurred, and some communities have never been mapped (Floodplain Management Forum 2000).

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[5] There are several levels of detailed studies which result in BFEs shown on the FIRM. The most basic detailed study is a hydrologic and hydraulic analysis of only the base flood (and no other recurrence intervals). Typically, however, the hydrological and hydraulic analysis is performed on four recurrence intervals (10%, 2%, 1%, and .2% annual chance recurrence intervals). This results in flood profiles being provided for all recurrence intervals in the FIS, as well as the 1% (100-year) and .2% annual chance floodplains and BFEs being shown on the FIRMs. In some, but not all, cases, a floodway is also determined during a flood study. This results in the floodway being shown on the FIRM as well as a Floodway Data Table provided in the FIS.

Mapping Process

In addition to conducting a new or revised FIS, there are several different ways FEMA revises maps. Changes to the maps or FIS can be initiated from either the community or FEMA. The FEMA updates maps when data are submitted from participating jurisdictions and agencies. As mentioned above, FEMA recently completed a map modernization project to convert existing maps into a digital format (digital maps do not necessarily contain updated information). In Washington, FEMA is updating maps in 17 counties and all jurisdictions within those counties through the Map Modernization program.

The following are terms used by FEMA to describe types of flood map update processes:

- Conditional letter of Map Amendment (CLOMA): The FEMA's comment on a proposed structure or group of structures that upon construction, will be located on existing natural ground above the base (one-percent annual chance) flood elevation on a portion of a legally defined parcel of land that is partially inundated by the base flood.

- Conditional letter of Map Revision (CLOMR): The FEMA's comment on a proposed project that upon construction will affect the hydrologic or hydraulic characteristics of a flooding source and thus result in the modification of the existing effective BFEs, the SFHA, or the regulatory floodway. A CLOMR is only required when an encroachment in the SFHA or SFHA and floodway results in increases in BFEs of a certain amount based on the regulations.

- Conditional letter of Map Revision based on fill (CLOMR-F): The FEMA's comment on a proposed project that upon construction will result in a modification of the SFHA through the placement of fill outside the regulatory floodway.

- Flood Insurance Study (FIS): An examination, evaluation, and determination of flood hazards and, if appropriate, corresponding water surface elevations.

- Letter of Map Amendment (LOMA): An administrative process that corrects inadvertent inclusions in the floodplain by amending the FEMA map, based on reviewing technical data submitted by the property owner. The owner would then receive A letter from FEMA stating that an existing structure or parcel of land that has not been elevated by fill would not be inundated by the base flood.

- Letter of Map Change (LOMC): Includes all categories of map changes.

- Letter of Map Revision (LOMR): The FEMA's modification to an effective FIRM or Flood Boundary and Floodway Map (FBFM), or both, based on the implementation of physical measures that affect the hydrologic or hydraulic characteristics of a flooding source and thus result in the modification of the existing regulatory floodway, the effective BFEs, or the SFHA. The LOMR officially revises the FIRM or FBFM, and sometimes the FIS report, and when appropriate, includes a description of the modifications. The LOMR is generally accompanied by an annotated copy of the affected portions of the FIRM, FBFM, or FIS report.

- Letter of Map Revision based on fill (LOMR-F): The FEMA's modification of the SFHA shown on the FIRM based on the placement of fill outside the regulatory floodway. A LOMR-F is submitted for properties on which fill has been placed to raise the structure or lot to or above the BFE. NFIP regulations require that the lowest adjacent grade of the structure be at or above the BFE for a LOMR-F to be issued removing the structure from the SFHA (FEMA 2006).

- Physical Map Revision (PMR): The FEMA's revision and republication of an effective FIRM, FBFM, or FIS report based on physical measures that affect the hydrologic or hydraulic characteristics of a flooding source and thus result in the modification of the existing regulatory floodway, the effective BFEs, or the SFHA.

- Summary of Map Amendments (SOMA): The FEMA's summary which describes the revised FIRM panels in relation to previously issued LOMCs.

Review and issuance of CLOMRs, CLOMR-Fs, and CLOMAs, and the requirements associated with LOMRs and LOMR-Fs are discretionary actions for FEMA.

Map Changes Based on Placing Fill in the Floodplain

Placing fill in the floodplain can trigger map changes. The FEMA will remove a property from the SFHA where a property owner has elevated property above the BFE by placing fill.[6] Benefits to property owners that result from removing parcels from the mapped floodplain include avoiding flood insurance requirements, reduced flood risk of flood damage to real and personal property, and greater flexibility for financing. Additional fill may be placed in the floodplain for infrastructure that supports floodplain development, for example, bridges, culverts, and facilities such as water and wastewater treatment plants.

When FEMA removes a parcel from the mapped floodplain based on fill, they do not collect information on the amount of fill that occurs or the number of acres removed from flood maps. (FEMA 2001, FEMA 2004, June 8, 2006 email from Mark Eberlein). However, the number and type of LOMCs issued by FEMA in Washington State were provided to NMFS during this consultation. Since implementing the NFIP in Washington in 1974, FEMA has issued 2262 LOMCs. Of these, FEMA identified 158 as having been from placing fill in the floodplain. As a result of individual consultations on NFIP map revisions during the consultation for this Biological Opinion, NMFS obtained specific information on four projects describing the acreage of floodplain removed or anticipated for removal, through placement of fill, or as part of the map revision protocols under the NFIP regulations. These examples demonstrate part of the range of

[6] The Court in *NWF v. FEMA* observed that: "There is nothing in the NFIA authorizing, let alone requiring, FEMA to authorize filling activities to change the contours of the natural floodplain. Indeed, such regulations may be counterproductive to the enabling statute's purpose of discouraging development in areas threatened by flood hazards." Order dated Nov. 15, 2004, at 34.

floodplain losses that accrue as local jurisdictions comply with the NFIP requirements and mapping protocols.

In a recent case on the Puyallup River, 11.5 acres of the existing floodplain were filled, thus removing a large area of functional floodplain habitat through a LOMR-F map revision. In the City of Carnation, 318 acres were recently removed from the 100-year floodplain with a LOMA. Although the area affected by the map change is projected to flood based on modeling, it was removed from the floodplain because water depths are projected to be less than one foot during a 100-year flood event and therefore would cause less flood damage. In a third example, in April 2007 FEMA remapped an area within the floodplain of the Snohomish River estuary that had previously been filled (FEMA case number 07-10-0433A). The site where the fill occurred is an area where designated critical habitat for Puget Sound Chinook salmon includes estuarine areas contiguous with the shoreline up to the level of extreme high water (Sept. 2, 2005, 70 FR 52630). In remapping this area, FEMA mapped lands as outside the floodplain that would have previously been critical habitat for PS Chinook. The site was an intertidally influenced area within the Snohomish River estuary, important to listed salmon. (Rowse and Fresh 2003, Snohomish Basin Salmon Recovery Forum. 2005, Tanner et al. 2002). In a fourth example, a Snohomish County hydraulic study based on a requested CLOMR indicates that 290 acres would be removed from the floodplain as a result of placing fill to expand the Harvey Airfield Industrial Area. This last example demonstrates that the NFIP enables extensive filling to avoid inclusion in mapped floodplains, as the project would entail fill eight to twelve feet deep (approximately 150,000,000 cubic feet or 80 trailer loads of fill, delivered 5 days a week for 2 years (pers. comm. Barb Bailey 1/25/08)).

Map changes can also modify the floodway designated on FEMA maps.[7] In jurisdictions that don't have a mapped floodway, development in the floodway is allowed by FEMA if an analysis provided by the applicant demonstrates in a "cumulative rise analysis" that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point within the community (EDAW 2006). In areas with mapped floodways FEMA allows development in the mapped floodway so long as, the local jurisdiction can redraw the floodway to an alternate location in order to maintain conveyance of the base flood. By redrawing the floodway through a map change, development can be placed in an area that was previously identified as floodway, without a technical violation of FEMA prohibitions against development being placed in the floodway (Dan Sokol pers. comm. 11/2/07). Conveyance of "base flood" waters is the only criteria evaluated for such map changes.

Map revisions can also be based on flood control structures, such as levees. Pursuant to FEMA's regulations, if a community demonstrates that a levee provides protection against a base (100-year) flood and meets FEMA design, operation, and maintenance standards, then FEMA will "map out" of the SFHA the area protected by the levee. This means that properties behind the levee do not need to purchase flood insurance or comply with other NFIP requirements. See 44

[7] Floodway revisions of this type have occurred in Brinnon (Dan Sokol Pers Comm.11/01/07), and in Vancouver for The Landings gated-community (Dan Sokol pers comm. 3/7/08).

CFR 65.10. Conversely, if FEMA determines that a levee no longer meets its regulatory criteria, it may revise the community's flood map so that the area behind the levee becomes designated as a SFHA subject to NFIP requirements. An example of this is the action taken by FEMA in 2007, when they notified the City of Bothell that "based on coordination with the U.S. Army Corps of Engineers (COE), it has been determined that the North Creek Levees no longer provide protection from the base flood." The letter indicated that FEMA would initiate a map revision to re-designate the formerly protected areas as flood-prone. (FEMA 2007). In response to this notice, the property owner proposed cutting down over 800 trees in the riparian zone of North Creek, as a way to avoid decertification of the levee.[8]

Other map revisions are based on improved topographical, hydrological, and/or hydraulic information. New higher quality data has become available in recent times, especially topographic data, which is incorporated into existing studies to improve their accuracy.[9] Because of anthropogenic changes in a watershed and imprecise mapping methods, revised maps frequently identify larger SFHAs (Dan Wrye, electronic comm. 7/28/08). Recently, in Pierce County, mapping revisions show an increase of 92 structures in the floodway when compared to the original 1987 FEMA map for unincorporated Pierce County. Increased topographic accuracy allowed redelineation with greater precision, which indicated 2223 structures did not belong in the 100 year floodplain, but 2315 structures were found now to be within the 100 year floodplain, meaning that greater precision in mapping meant 4538 structures have changed status. In addition, 200 structures were identified in the floodway on the old map, and 700 were identified in floodway in the latest map version, because the levee was de-accredited from the 1987 map status, due to freeboard issues. (Pers. Comm. Dennis Dixon 9/08/08). Specifically, the left bank lower Puyallup has 780 homes now in floodplain 806 in the floodway for the first time.

Upon receipt of an application for a map revision, FEMA determines if the application meets all applicable NFIP mapping criteria and requirements. When requesting changes to maps and reports, the community, property owners, and developers are required to submit adequate supporting data (FEMA 2002). The applicant must use a model and provide information on the project location. Prior to revising a map based on fill, FEMA requires that the property owner provide sufficient scientific and technical information demonstrating that the required elevation has been obtained. And FEMA requires surveys by a Registered Land surveyor to ensure the fill is placed above BFE. However, FEMA does not collect information on the overall extent of fill placed in floodplain areas, or on the amount and extent of floodplain habitat and storage functions that are lost or displaced, or the effects on listed salmon. The NFIA requires that new

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[8] The Effects Section of this document discusses riparian habitat issues associated with FEMA's and COE's levee maintenance standards. According to FEMA, there are significant structural problems with the North Creek Levees in addition to potential vegetation issues. The levee sponsor is currently working with FEMA to resolve these issues.

[9] HEC-RAS (Hydrologic Engineering Center – River Analysis System) is a hydraulic model developed by the COE to simulate the flow of water through natural rivers and other channels. HEC-RAS is a one-dimensional model, meaning that the flow of water is only considered in one direction, downhill. It does not model the hydraulic effect of cross section shape changes, bends, and other two- and three-dimensional aspects of flow. HEC-RAS can be run in both steady-state or unsteady state. Unsteady-state models consider storage effects. Due to the dynamic nature of rivers and streams, flood studies need to be evaluated periodically to ensure that published information remains accurate.

maps be subject to appeal before going into effect, and this has at times delayed use of new maps for years (Rob Flaners, pers. Comm. 1/22/07).

When a community's BFE has been adjusted, existing pre-FIRM buildings (constructed in the floodplain before a FIRM was developed) with damage or improvements exceeding 50 percent of market value may be required to meet NFIP standards. If the damage or improvement is less than 50 percent, the existing development is not required to comply with the NFIP elevation standards because of grandfathering clauses.

Development in the Floodplain Following Fill

The usual purpose of placing fill is to enable construction and property development. Placement of sufficient fill allows a map revision so that the property owner is removed from both the floodplain and the obligation to obtain flood insurance. Elevation on other types of structures (e.g. stemwalls, piling and platform) is not sufficient to allow map revisions, or remove the owner's obligation to obtain flood insurance.

Development is subject to regulation at all levels of government, and many of the regulatory schemes are linked to or depend on FEMA flood maps. Flood maps are used by states and communities in implementing their floodplain management regulations, by lenders in implementing the mandatory flood insurance purchase requirement, by federal agencies in implementing Executive Order 11988 and other environmental requirements, and by all levels of government in land use and emergency planning and management (EDAW 2006). The effects on listed salmonids from development associated with fill are discussed in more detail in the Minimum Criteria and Effects of the Action sections of this document.

Levee Maintenance Issues Associated with Mapping in the National Flood Insurance Program

As discussed above, communities protected by levees meeting FEMA standards can be excluded from the mapped floodplain and avoid the need to purchase flood insurance and other NFIP requirements. The incentive to avoid NFIP requirements creates a relationship between the NFIP and levee maintenance. The Joint ESA Consultation regulations (50 CFR 401, et seq) define interrelated activities as those actions that are part of the proposed action and depend on the proposed action for their justification (50 CFR 402.02). In some circumstances, levee maintenance to FEMA standards constitutes an interrelated action, the effects of which are analyzed in the "Effects of the Action" section, below.

The FEMA has promulgated regulatory criteria that determine whether a levee is sufficiently designed, operated, and maintained to provide protection against a base flood. If a levee sponsor demonstrates that its levee meets the regulatory requirements, FEMA removes the areas protected by the levee from the designated floodplain. The FEMA enforces the regulatory and procedural requirements that are used to determine whether a completed levee provides 100-year flood protection on a FIRM or DFIRM. The FEMA's regulations require that a levee sponsor obtain a certification – either from a professional engineer or an authorized federal agency (generally the COE) – that the levee meets FEMA's design standards (44 CFR 65.10(e)). In practice, FEMA works closely with the COE to determine whether levees meet NFIP requirements. The NFIA authorizes FEMA to work with other federal agencies, including the COE, in identifying flood hazards and flood risks (42 U.S.C. 4014(b), 4101(a)).

While FEMA and the COE describe participation in the NFIP and maintenance of levees as strictly voluntary, fiscal ramifications to local communities if such voluntary measures are ignored can have severe economic consequences. Flood prone communities that do not participate in the NFIP cannot avail themselves of federal guarantees in property financing, and are not eligible for disaster relief for flood damage (FEMA 2002b). The COE will not authorize emergency funds to be expended for flood emergency preparation, flood fighting and rescue operations, or repair or restoration of flood control works if levees do not comply with vegetation management standards and are therefore are not eligible for the PL 84-99 program (33 CFR Part 203). In addition, if levees are certified by the COE, funding for the certification process if often available from the COE, whereas, levee certification performed by private registered engineers must be paid for the levee owner/operator. Therefore the combined fiscal incentive is for local jurisdictions to request COE certification and remove vegetation, thus aquatic species and rivers bear the costs of levee maintenance in these reaches.

In Washington State the COE certifies most levees. Only one levee, that was not certified by the COE (North Creek in Bothell, Washington) has ever been recognized by FEMA (Mark Eberlein, pers. comm. 5/30/08). Instead, the vast majority of levees in Washington State that are recognized by FEMA are federal levees that also participate in the COE's Rehabilitation and Inspection Program (RIP), also known as the P.L. 84-99 program. (33 U.S.C. 701n; 33 CFR 203.12). The COE coordinates with FEMA to provide information from its RIP inspections to FEMA for use in determining continued compliance with the NFIP levee requirements. In coordinating these programs, FEMA incorporates certain RIP standards into the NFIP, particularly the COE's vegetation management requirements. The COE regularly inspects levees in the RIP to determine if they meet the requirements for continued eligibility in the program. A levee must obtain a rating of "acceptable" or "minimally acceptable" to remain active in the RIP (33 CFR 203.48(e)). The COE identifies in their levee inventory, 115 levees in Puget Sound, with nine currently identified as potentially providing 100-year protection or greater (Dahlia Kasperski, pers. comm.). Under the RIP, certified levees are eligible for federal funds to repair damage caused by flooding.

The FEMA's levee regulation (44 CFR 65.10) includes general maintenance standards, but does not provide standards for vegetation management. Nor has FEMA issued regulatory guidance on vegetation management. The COE, however, has adopted vegetation maintenance standards for RIP purposes, which generally require removal of trees greater than two inches in diameter. (U.S. Army Corps of Engineers', Levee Owner's Manual, at 17). The COE Seattle District has adopted a variance to this standard, which permits slightly larger trees (up to four inches in diameter) and identifies types of suitable and unsuitable vegetation.[10] (U.S. Army Corps of Engineer's Seattle Dist., Information Paper, PL 84-99 Levee Vegetation Management, Feb. 28, 1995). However, with the removal of trees that meet or exceed four inches in diameter, the

[10] In 1996, Congress directed the Corps to undertake a comprehensive review of its levee vegetation management guidelines "in view of the varied interests in providing flood control, preserving, protecting, and enhancing natural resources, protecting the rights of Native Americans pursuant to treaty and statute, and such other factors as the Secretary considers appropriate." WRDA of 1996, § 202(g), Pub. L. 104-303.

removal of shrubs and smaller vegetation on the levee face, and the requirement for root-free zones on the levee face (COE 2000), most native riparian vegetation is removed under the COE's maintenance criteria.

The FEMA does not have its own standards or guidance on levee vegetation, and accepts the COE's standards as satisfying the FEMA levee requirements for levees that do not participate in the RIP (Mark Eberlein, pers. comm. 6/6/08). The FEMA also accepts COE standards on levees that do participate in the P.L. 84-99 program. When the COE notifies a P.L. 84-99 levee sponsor that it must remove vegetation to remain active in the program, COE forwards a deficiency notice to FEMA. The FEMA treats these deficiency notices from COE as also constituting a deficiency for purposes of the NFIP levee standards. Whether participating in the RIP or not, levees managed according to the vegetation maintenance standards expressed in that program will have minimal or no streamside vegetation of significance that would provide the habitat forming processes usually supplied in the riparian area alongside streams and rivers. The effects of the absence of vegetation are described in detail in the "Effects of the Action" section below.

Minimum Criteria

The NFIA directs FEMA to develop comprehensive criteria "from time to time," to encourage State and local measures to prevent flood damage. The statutory purposes of the comprehensive criteria are to:

- constrict the development of land which is exposed to flood damage where appropriate;
- guide development of proposed construction away from locations threatened by flood hazards;
- assist in reducing damage caused by floods; and
- otherwise improve the long-range land management and use of flood-prone areas.

See 42 U.S.C. 4102(c).

To participate in the NFIP, communities must adopt land use regulations at least as restrictive as those contained in FEMA's comprehensive criteria in order to participate in the NFIP, and FEMA may not issue flood insurance to property owners if a local floodplain ordinance is not in place that meets these minimum criteria. Similarly, if a community fails to maintain and implement a floodplain ordinance or adopts an ordinance that does not meet established guidelines, that community could be placed on probation or suspended from the program. The FEMA has promulgated regulations containing the minimum criteria at 44 CFR 60.3. The FEMA's regulations preserve FEMA's authority to revise the minimum criteria "as experience is acquired under the Program and new information becomes available." 44 CFR 60.7. If FEMA revises the criteria, communities are given six months within which to revise their flood plain management regulations consistent with the new criteria.

The FEMA's minimum criteria separate a river and adjacent areas into two components, the floodway and the floodplain (also known as the flood fringe). The floodway is the active portion of the river channel and adjacent areas, presumably the area with the greatest water velocities and highest depths, which must be reserved to convey the base flood without cumulatively increasing the water surface elevation by more than a designated height. When establishing a floodway line, hydraulic engineers consider continuous floodplain encroachments until, on average, the flood levels increase 1 foot. The flood fringe comprises the rest of the floodplain area on both sides of the floodway, and generally stores water, at shallower depths and lower velocities, during a flood. Current FEMA criteria allow development in the flood fringe regardless of potential flooding depth and velocity and restrict, but do not prohibit, development in the floodway.

The primary element of FEMA's minimum criteria that affects listed salmonids and their habitats is the requirement to elevate structures so that the lowest floor of construction is at or above the BFE (the discussion in this paper focuses on riverine examples, but there are similar standards for coastal areas). The placement of fill in the floodplain displaces salmonid habitat, and the associated development results in the placement of additional fill to support infrastructure and in increased pollution, stormwater runoff, vegetation removal, and other adverse effects. Other elements of the NFIP as it is currently administered exacerbate the potential loss of habitat. For example, when establishing BFEs, FEMA's current methodology generally does not account for waves or to future increases in the level of the one-percent-chance flood. The increased future flood level is usually the result of increased runoff from developing watersheds, floodplain encroachment that occurs under the current regulations, and climate change that is not accounted for by the models currently in use. The FEMA has recently issued guidance allowing future built-out conditions to be mapped on FIRMs.[11]

Communities have a strong incentive to participate in the NFIP and comply with FEMA's minimum criteria in order to ensure the availability of flood insurance available for properties within the floodplain. Additional incentive for community participation in the NFIP are federal restrictions on receipt of federal disaster assistance for flood damage for non-participating communities, and restrictions on federal financing or federally secured financing for commercial or residential property located in a floodplain without flood insurance. Communities can chose to adopt criteria that go beyond FEMA's minimum criteria in providing flood protection. In Washington State, several communities, including King and Pierce counties, have adopted criteria that exceed FEMA's minimum criteria.

The FEMA has promulgated five different sets of minimum criteria, the applicability of which depends on the level of floodplain information available for a given community and whether the community is subject to coastal flood hazards. For example, where FEMA has not defined the SFHA within a community or provided water surface elevation data, the applicable criteria require, generally, that buildings (including subdivisions and manufactured home parks) be "reasonably safe from flooding", and that all public utilities such as water, sewage, electrical,

[11] "The minimum NFIP standards do not contain measures to protect existing development. New construction causing increased runoff and higher BFEs is a common culprit in exacerbating the hazard for existing construction, but can most effectively be dealt with through stormwater management regulations. However, increases in hydrology do occur with filling in the flood fringes, a practice that is allowed by the minimum NFIP regulations. It is recommended that this be addressed by instituting regulations that either prohibit fill in the fringes or require compensatory cut and fill provisions." Statement of Charles Steele, Floodplain Management Specialist, Washington State Department of Ecology, July 3, 2003.

and gas be located to minimize flood damage. 44 CFR 60.3(a). Where FEMA has identified the flood hazard area, established BFEs, and provided a community with the data needed to designate a regulatory floodway, the applicable criteria require that new construction to be elevated to or above the BFE and that the community designate and prohibit encroachment on a floodway, among other requirements (44 CFR 60.3(d)). All sets of criteria require that the community issue permits for floodplain development and ensure that all other necessary development permits, including any permits needed for filling, grading, paving, or dredging, are obtained.

For areas that have SFHAs but no BFEs or floodway designated, developers or property owners must provide elevation data for developments greater than 50 lots or 5 acres, whichever is lesser. There is also a requirement to notify, in riverine situations, adjacent communities and the State prior to alteration or relocation of a watercourse (the flood carrying capacity of the altered watercourse is to be maintained) (44 CFR 60.3(b)). When the flood elevation is available for some of the SFHA, it is required that all new construction and substantial improvement of residential structures have the lowest floor elevated to or above the base flood level. Non-residential construction must be designed so parts below the base flood levels are watertight. Fully enclosed areas must be designed to automatically equalize hydrostatic flood forces. Also, new construction and substantial improvements in SFHAs must have the lowest floor at least as high as the flood water depth specified on the FIRM (or at least two feet if no depth is specified). Recreational vehicles must be licensed and ready for highway use and not be parked in certain zones for more than 180 days (44 CFR 60.3(c)).

For areas with detailed mapping, BFEs determined, and floodways designated, there are additional requirements:

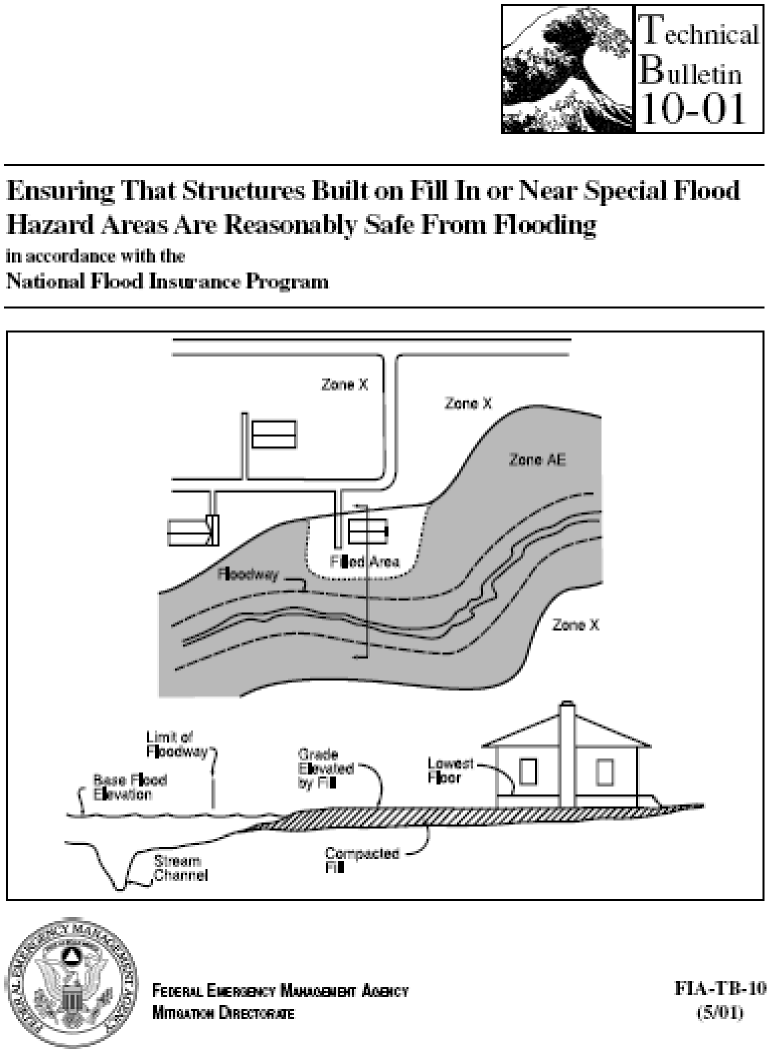
- The area chosen for the floodway must be designed to carry waters of a base flood without increasing the water surface elevation more than one foot at any point.
- Fill and/or encroachments within the floodway must be prohibited unless hydrologic and hydraulic analyses "performed in accordance with standard engineering practice" demonstrate the proposal will not increase flood levels within a community,
- A community may permit encroachments within the adopted regulatory floodway that would result in an increase in BFEs if the community first applies for a conditional FIRM and floodway revision and receives approval (44 CFR 60.3(d)).

The NFIP minimum criteria establish different requirements for properties in A zones (mapped riverine zones) and V zones (mapped coastal flood zones), but specific elevation and structural performance requirements are included for all buildings in the SFHA. Shorelines along Puget Sound are designated as A zones or V zones. When a building is proposed for construction in the mapped floodplain, the NFIP minimum floodplain management regulations require that new construction or substantially improved or substantially damaged existing buildings in A Zones must have their lowest floor (including basement) elevated to or above the BFE. New or substantially improved or substantially damaged non-residential structures in A Zones can be either elevated or dry floodproofed (made watertight). Substantial improvement means any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structures.

Substantial damage means damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structures before the damage occurred (44 CFR 59.1).

In addition to the above requirements, communities are required to designate a regulatory floodway in riverine A Zones. The area chosen for the regulatory floodway must be designed to carry the waters of the one-percent-annual-chance flood without increasing the water surface elevation of that flood more than one foot at any point. Once the floodway is designated, the community "should restrict" development in the floodway, and must prohibit development within the regulatory floodway when it would increase flood heights. Because the floodway is an engineering construct for floodwater conveyance purposes, construction may be undertaken in the floodway so long as the floodway is "adjusted" to a new location in order to maintain conveyance of high velocity and volume floodwaters.

The elevation and structural requirements set forth in the minimum criteria form the foundation of floodplain management in a community and, consequently, greatly influence acceptable development in the floodplain (EDAW 2006). The NFIP provides technical guidance for filling floodplains (FEMA 2001) as shown in Figure 1.



Technical Bulletin 10-01

Ensuring That Structures Built on Fill In or Near Special Flood Hazard Areas Are Reasonably Safe From Flooding
in accordance with the
National Flood Insurance Program

FEDERAL EMERGENCY MANAGEMENT AGENCY
MITIGATION DIRECTORATE

FIA-TB-10
(5/01)

Figure 1. Cover of FEMA Technical Guidance Document

Once FEMA provides a community with the flood hazard information upon which floodplain management regulations are based, the community is required to adopt a floodplain management ordinance that meets or exceeds the applicable minimum criteria of the NFIP. The FEMA then reviews the community's floodplain ordinance to determine if the community meets the floodplain management minimum requirements. If sufficient, FEMA will approve the community's adopted ordinance. If not, FEMA can suspend a community for failure to adopt or maintain a compliant floodplain management ordinance (procedures for suspension are established in the NFIP regulations at 44 CFR 59.24(a) and (d)).

After FEMA approves an ordinance, they monitor the community to ensure that the ordinance is adopted and that the community is effectively enforcing it. The FEMA, or States on their behalf, conduct Community Assistance Visits (CAVs) and Community Assistance Contacts (CACs) to monitor community compliance. The CAV is a scheduled site visit to conduct a comprehensive assessment of the program including a tour of the floodplain, meeting with floodplain management staff, and examining floodplain permits and variances. During CAV's FEMA also checks to make sure that floodplain development permits are in compliance with Section 9 of the ESA and all Federal and State permits have been obtained. Possible deficiencies are identified in a follow-up letter, and the community is responsible for remedying any deficiencies. If FEMA identifies deficiencies or violations, a community is given reasonable time to correct program deficiencies and to remedy any violations. As long as a community is making progress to resolving problems identified during a CAV, FEMA will not initiate a formal enforcement action.

If the community does not make adequate progress in enforcing their floodplain management regulations, formal probation will be initiated. During this time policyholders are surcharged a $50 fee on their premiums, but selling and renewing policies is not affected. But, if a community does not address FEMA's concerns within the probation period, the community may be suspended from the program. During suspension, existing policies cannot be renewed or new policies sold, creating an incentive for communities to comply with FEMA's minimum criteria (FEMA 2006). In Washington State, there has been a small number of suspensions (Clallam County, Kittitas County, Mason County, City of Port Orchard, City of Davenport (still suspended)) (Dan Sokol pers. comm. 1/31/2008).

The CACs are less comprehensive interactions, and are used to identify any problems and/or offer assistance. They can be conducted by a phone call or brief visit. Because of resource limitation in conducting both CAVs and CACs, FEMA has established criteria for prioritizing community visits or contacts. CAVs are conducted in communities with known or suspected program deficiencies or violations, or floodplain development. The CACs are used as a screening tool to determine if a community needs a CAV.

The FEMA can also monitor enforcement through applications for flood insurance policies, which identify buildings that are potentially in violation of the minimum floodplain management requirements. In addition, FEMA can monitor enforcement through the LOMR process. Requests to remove land from the floodplain through the LOMR process may indicate that floodplain areas have been improperly filled. The FEMA will follow-up with the community to determine compliance or conduct a CAV if needed. In addition, FEMA can take actions against individual properties for failure to comply with the community's ordinance if the community refers the noncompliance to FEMA.

The NFIP minimum criteria, like the mapping process described above, leads to land use change and construction in the floodplain, as guided by the criteria. The effect of that development on listed species and their habitats is discussed in the "Effects of the Action" section.

The Community Rating System

The NFIA requires that FEMA establish a voluntary CRS, which allows participating communities to receive discounted flood insurance premiums for adopting land-use controls in excess of FEMA's minimum criteria. The statutory purposes of the CRS are to:

- provide incentives for measures that reduce flood and erosion damage;
- encourage the adoption of more effective measures that protect natural and beneficial floodplain functions;
- encourage floodplain and erosion management; and
- reduce federal flood insurance losses.

(See 42 U.S.C. 4022(b)). Communities that exceed the NFIP's minimum standards may apply for a rating from Class 1 to Class 10, based on the number of points they accumulate for various CRS activities. The more points they receive, the lower are policyholders' premiums in those communities. Premium discounts range from 5 percent to 45 percent. Class 1 communities receive the greatest insurance premium discount of 45 percent and Class 9 communities receive a percentage insurance premium discount. Class 10 communities do not receive a premium discount (FEMA 2002).

Through an application process, communities must demonstrate which and how criteria are being met. Data to support the conclusions must be provided to FEMA. In reviewing applications, FEMA utilizes a five-step process to determine the number of credits given to a community. The criteria and credit rating system included in the CRS are largely discretionary (EDAW 2006). A FEMA contractor reviews the community's CRS program every 3 or 5 years, and CRS communities annually submit evidence they are implementing all their CRS activities.

The CRS includes a list of activities that are intended to reduce the likelihood or severity of flooding within a community, which jurisdictions may elect to incorporate as community codes or ordinances. Some CRS activities are environmentally protective activities such as preserving open space, creating higher regulatory standards for storm water management, and preserving the natural and beneficial functions of floodplains (Rosenbaum, 2005). Others CRS activities are not environmentally benign. For example, in order to qualify for credits under CRS activity 620 (Levee Safety), FEMA requires that levees comply with the COE's vegetation management requirements, which require the removal of larger trees.

Twenty-five communities participate in CRS in Washington State, most of which are counties and larger communities in the Puget Sound area. Specific activities are described in the Effects section, below.

Action Area

The first phase of consultation on FEMA's implementation of the NFIP in includes all areas affected by mapping, the CRS, and the minimum criteria of the NFIP, in the Puget Sound Region - Whatcom, Skagit, Snohomish, King, Pierce, Thurston, Mason, Kitsap, Clallam, Jefferson, Island, and San Juan Counties, and the municipal jurisdictions therein. This includes floodways and SFHAs (otherwise known as the one percent chance floodplain or the 100 year floodplain) of rivers and streams throughout these counties, as well as adjacent estuarine and marine areas affected by these programs. The riverine, estuarine, marine, and lacustrine systems together with their floodplains, form an extensive network of habitat for multiple salmonid Evolutionarily Significant Units (ESUs) and DPSs[12], - PS Chinook salmon, PS steelhead, Hood Canal Summer Run chum salmon, Lake Ozette Sockeye salmon, as well as pink salmon and coho salmon, use differing portions of that habitat network for spawning, rearing, holding, refuge, in-migration, and out-migration. Thus, the action area for this consultation covers freshwater, estuarine and marine areas and their associated floodplains, within 12 counties, together with the following NFIP participating cities, towns, Tribes:

(Jurisdictions relying exclusively on the NFIP minimum criteria are noted in italics)

- in *Clallam County - Forks,* Lower Elwha Tribe, *Port Angeles, Quilueute Tribe, Sequim*
- in *Island County - Coupeville, Langley, Oak Harbor*
- in Jefferson County - Port Townsend, *Hoh Tribe*
- in King County - Algona, *Auburn, Bellevue*, Black Diamond, *Bothell, Burien*, Carnation, *Covington, Des Moines*, *Duvall*, Enumclaw, Federal Way, *Issaquah, Kenmore, Kent, Kirkland*, Lake Forest Park, *Medina, Mercer Island*, Milton, Normandy Park, *North Bend*, Pacific, *Redmond, Renton, Sammamish, Seattle, Shoreline*, Skykomish, *Snoqualmie*, Tukwila, *Woodinville*
- in *Kitsap County - Bainbridge Island, Bremerton, Port Orchard*, Poulsbo
- in Mason County - *Shelton, Skokomish Tribe*
- in Pierce County - *Bonney Lake*, Buckley, *Edgewood, Fife*, Fircrest, Gig Harbor, *Lakewood,* Orting, Puyallup, Roy, South Prairie, Steilacoom, Sumner, Tacoma, University Place, Wilkeson
- in *San Juan County* - None
- in Skagit County - Anacortes, *Burlington,* Concrete, Hamilton, *LaConner,* Lyman, *Mount Vernon*, Sedro Woolley
- in Snohomish County - *Arlington*, Brier, *Darrington, Edmonds*, Everett, *Gold Bar*, Granite Falls, Index, Lake Stevens, *Lynnwood*, Marysville, *Monroe, Mountlake Terrace*, Mukilteo, Snohomish, *Stanwood, Sultan*

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[12] "An 'evolutionarily significant unit' (ESU) of Pacific salmon (Waples 1991) and a 'distinct population segment' (DPS) of steelhead (final steelhead FR notice) are considered to be 'species,' as defined in Section 3 of the ESA."

- in Thurston County - *Bucoda*, Lacey, *Olympia*, Rainier, *Tenino*, Tumwater, Yelm

- in Whatcom County - Bellingham, Blaine, *Everson*, Ferndale, Lummi Tribe, Lynden, Nooksack, *Sumas*

Of the four ESA listed salmonid ESUs and DPSs in the action area, Chinook salmon, and steelhead both have life history strategies that rely on floodplains during juvenile life stages. Chum salmon use adjacent floodplain areas for spawning, then soon after emergence use the riverine system to rapidly reach the estuary, where they mature, rear, and migrate. Species regulated under the MSA (in addition to Chinook salmon, the MSA governs coho and pink salmon) also have habitat throughout the Puget Sound region, including floodplain and channel areas that are affected by floodplain development. Pink salmon, like chum salmon, and sockeye salmon use the riverine systems as juvenile outmigrants to rapidly reach the estuary, and therefore have very low levels of reliance on riverine floodplains. Coho salmon use floodplain landscape extensively for rearing. Estuarine floodplains can provide value to juveniles of all species once they reach the saltwater-freshwater interface.

Using watersheds as a naturally delineated sub-component, the Puget Sound Region has been divided into 18 areas known as Watershed Resource Inventory Areas (WRIAs). All of these provide habitat to at least one listed salmonid ESU or DPS. Of the watersheds (otherwise called Fifth Field Hydrologic Unit Codes – HUCs) that lie within these WRIAs, all provide some level of biological support to listed salmonids. These watersheds have been ranked as to the conservation value they contribute to listed salmonids. Conservation values were determined by Critical Habitat Area Review Teams (CHARTs), which based their conclusions on a variety of factors, including habitat quality and quantity available, lifestage use, population dynamics, and Viable Salmonid Population (VSP) parameters. To determine the conservation value of each watershed to ESU viability, they 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).

To assess the effects of the proposed action on the SRKW DPS, we considered the geographic area of overlap in the marine distribution of the ESA-listed salmonids affected by the action, and the range of SRKWs. The marine range of the salmonids overlaps with the core area of the whales' range in inland marine waters from the southern Strait of Georgia (below Vancouver and Nanaimo B.C.) to southern Puget Sound and the Strait of Juan de Fuca. This area is designated as critical habitat for Southern Residents, which are likely to occur in this area in summer and early fall (The Whale Museum 2007, NMFS 2008a and NMFS - NWFSC unpubl. data). Additionally, the marine range of the salmonids also overlaps with a portion of the coastal range of Southern Residents, from the mouth of the Strait of Juan de Fuca to the southern west coast of Vancouver Island (Myers et al. 1998, NMFS - NWFSC unpublished data). The coastal range of

Southern Residents is not designated as critical habitat. This analysis considers the indirect effects of the NFIP causing a reduction in available prey.

In accordance with FEMA's request and direction from the Court in *NWF v. FEMA*, this Phase One document limits the analysis of effects of NFIP implementation to the Puget Sound Region, the four listed salmonids species of the Puget Sound Region, and SRKWs which rely on salmon as part of their diet. It also evaluates effects on the critical habitat of PS Chinook salmon, Hood Canal summer run chum salmon, Lake Ozette sockeye salmon, and SRKWs. The PS Steelhead DPS does not have critical habitat designated at this time.

ENDANGERED SPECIES ACT

The ESA establishes a national program to conserve 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 U.S. Fish and Wildlife Service (USFWS), 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 habitats. Section 7(b)(4) requires the provision of an incidental take statement that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts.

Biological Opinion

This Opinion presents NMFS' review of the status of each listed species of Pacific salmon and steelhead considered in this consultation, the condition of habitat designated as critical for each of those species, the environmental baseline for the action area, all the effects of the action as proposed, including effects from interrelated and interdependent activities, and cumulative effects in the action area (50 CFR 402.14(g)). For the jeopardy analysis, NMFS analyzes those combined factors to conclude whether the proposed action is likely to appreciably reduce the likelihood of the survival and recovery of the affected listed species.

In the critical habitat analysis, NMFS examines any change in the conservation value of the essential features of that critical habitat in order to determine whether the proposed action is likely to destroy or adversely modify habitat designated as critical for the listed species. The regulatory definition of "destruction or adverse modification" at 50 CFR 402.02 is not used in this Opinion. Instead, this analysis relies on statutory provisions of the ESA, including those in section 3 that define "critical habitat" and "conservation," in section 4 that describe the designation process, and in section 7 that sets forth the substantive protections and procedural aspects of consultation, and on agency guidance for application of the "destruction or adverse modification" standard.[13]

[13] 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).

Status of the Species

The status of a species indicates its current level of risk of extinction. Extinction risk is a product of multiple habitat and population factors. Thus, NMFS' range-wide status review uses the criteria that describe a "Viable Salmonid Population" (VSP) (McElhany et al., 2000). A VSP has abundance, productivity, spatial structure, and genetic diversity at levels that enhance its capacity to adapt to various environmental conditions and allow it to become self-sustaining in the natural environment. These attributes are influenced by survival, behavior, and experiences throughout the entire life cycle, characteristics that are influenced in turn by habitat and other environmental conditions.

Salmon and steelhead habitat must provide a variety of physical and biological conditions, depending on the lifestage present and the natural range of variation present within that system (Groot and Margolis 1991, NRC 1996, Spence et al., 1996). Because this action area includes all waterbodies and their floodplains throughout Washington State, the biological requirements of all lifestages will be considered. Eggs and alevin require clean cold water, free of sediment and of contaminants, and stable but not embedded gravel and cobble substrate. Habitat requirements for juvenile rearing include seasonally suitable microhabitats for holding, feeding, and resting, allowing growth, maturation, and predator avoidance before outmigration. Migration of juveniles to rearing areas, whether the ocean, nearshore areas, estuaries, lakes, or other stream reaches, requires unobstructed access to these habitats. Physical (barriers, flows, volume, velocity), chemical, and thermal conditions may all impede migrations of juvenile fish. Juveniles require estuarine and nearshore habitat with adequate shelter and food in order to become saltwater adapted. Adults require functional passage (streams, rivers, and lakes with sufficient flow, volume, velocity, cool water, and free of obstruction,) to reach spawning habitat, and sufficient spawning area and conditions to support productivity.

For a species to be considered viable (with a negligible risk of extinction due to threats from demographic variation, local environmental variation, and genetic diversity changes over the long term) an ESU or DPS should: (1) contain multiple populations so that a single catastrophic event is less likely to cause the ESU/DPS to become extinct, and so that the ESU/DPS may function as a "metapopulation" as necessary to sustain population-level extinction and recolonization processes. Multiple populations within an ESU/DPS also increase the likelihood that a diversity of phenotypic and genotypic characteristics will be maintained, thus allowing natural evolutionary processes to operate and increase the ESU/DPSs long-term viability. (2) Have some populations that are relatively large and productive to further reduce the risk of extinction in response to a single catastrophic event that affects all populations. If an ESU consists of only one population, that population must be as large and productive ("resilient") as possible. (3) Have some populations that are geographically widespread to reduce the risk that spatially-correlated environmental catastrophes will drive the ESU/DPS to extinction. (4) Have other populations in the same ESU/DPS that are geographically close to each other to increase connectivity between existing populations and encourage metapopulation function. (5) Have populations with diverse life-histories and phenotypes in each ESU/DPS to further reduce the risk of correlated environmental catastrophes or changes in environmental conditions that occur too rapidly for an evolutionary response, and to maintain genetic diversity that allows natural evolutionary processes to operate within an ESU/DPS.

Where possible, the status of the ESU or DPS is presented below with a level of risk for each viability attribute (abundance, productivity, spatial distribution, genetic diversity). The present risk faced by each ESU and DPS informs NMFS' determination of whether additional risk will "appreciably reduce" the likelihood that an ESU/DPS will survive and recover in the wild. The greater the present risk, the more likely that any additional risk resulting from the proposed action's effects on the population size, productivity (growth rate), distribution, or genetic diversity of the ESU/DPS will be an appreciable reduction (see McElhany et al., 2000).

Ozette Lake Sockeye Salmon

The Ozette Lake sockeye salmon ESU includes all naturally spawned populations of sockeye salmon in Ozette Lake and streams and tributaries flowing into Ozette Lake, Washington (March 25, 1999, 64 FR 14528). Umbrella Creek and Big River sockeye hatchery programs are part of the ESU and 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 2005a).

The Puget Sound Technical Recovery Team (PSTRT) considers the Lake Ozette sockeye salmon ESU to be composed of one historical population, with substantial substructuring of individuals into multiple spawning aggregations. The primary existing spawning aggregations occur in two beach locations—Allen's and Olsen's beaches, and in two tributaries, Umbrella Creek and Big River (both tributary-spawning groups were initiated through a hatchery introduction program). Recently, mature adults have been observed at other beach locations within the lake (e.g., Umbrella Beach, Ericson's Bay, Baby Island, and Boot Bay), but whether spawning occurred in those locations is not known (Makah Fisheries Management 2000). Similarly, occasional spawners are found sporadically in other tributaries to the lake, but not in as high numbers or as consistently as in Umbrella Creek. The two remaining beach-spawning aggregations are probably fewer than the number of aggregations that occurred historically, but there is insufficient evidence to determine how many subpopulations occurred in the ESU historically. Much of the existing spawning in recent years occurs in the spawning aggregation created via fry releases into Umbrella Creek. Although the program has a beneficial effect on ESU abundance and spatial structure, it has neutral or uncertain effects on ESU productivity and diversity (NMFS 2005a).

The Biological Review Team (BRT) expressed concern that the reduction in the number of spawning aggregations poses risks for ESU spatial structure and diversity. Primary sources of threats to VSP parameters include: loss of adequate quality and quantity of spawning and rearing habitat, predation and disruption of natural predator-prey relationships, introduction of nonnative fish and plant species, past overexploitation, poor ocean conditions, and interactions among those factors (Good et al 2005).

Many factors likely contributed to the decline of Ozette Lake sockeye salmon. Poor marine survival caused by natural environmental fluctuations was likely an important causative factor for the population decline. However, the decline in productivity of Ozette Lake sockeye salmon is thought to be primarily attributed to reduced area and quality of spawning and incubation habitat. It is clear that anthropogenic factors have considerably altered critical freshwater habitat, and also played an important role in the decline of the stock.

Puget Sound Chinook Salmon

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 (64 FR 14208, March 24, 1999). The PS Chinook salmon ESU is composed of 31 historically quasi-independent populations, 22 of which are believed to be extant (PSTRT 2001). The populations presumed extinct are mostly early returning fish; most of these are in mid- to southern Puget Sound or Hood Canal and the Strait of Juan de Fuca. The ESU populations with the greatest estimated fractions of hatchery fish tend to be in mid- to southern Puget Sound, Hood Canal, and the Strait of Juan de Fuca.

Twenty-six artificial propagation programs are part of the ESU. Eight of the programs are directed at conservation, and are specifically implemented to preserve and increase the abundance of native populations in their natal watersheds where habitat needed to sustain the populations naturally at viable levels has been lost or degraded. The remaining programs 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. 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, 2005a).

Assessing extinction risk for the PS Chinook salmon ESU is complicated by high levels of hatchery production and a limited availability of information on the fraction of natural spawners that are of hatchery-origin. Most populations have a recent five-year mean abundance of fewer than 1,500 natural spawners, with the Upper Skagit population being a notable exception (the recent five-year mean abundance for the Upper Skagit population approaches 10,000 natural spawners). Currently observed abundances of natural spawners in the ESU are several orders of magnitude lower than estimated historical spawner capacity, and well below peak historical abundance (approximately 690,000 spawners in the early 1900s). Recent five-year and long-term productivity trends remain below replacement for the majority of the 22 extant populations of PS Chinook salmon. The BRT was concerned about the concentration of the majority of natural production in just a few subbasins, the disproportionate loss of early run populations, and the pervasive use of Green River stock and stocks subsequently derived from the Green River stock. Together these factors may reduce the genetic diversity and fitness throughout the ESU.

In terms of productivity, the hatchery programs collectively do not substantially reduce the extinction risk of the ESU in-total (NMFS, 2004). Long-term trends in abundance for naturally spawning populations of Chinook salmon in Puget Sound indicate that approximately half the populations are declining, and half are increasing in abundance over the length of available time series. The median over all populations of long-term trend in abundance is 1.0 (range 0.92–1.2), indicating that most populations are just replacing themselves. Those populations with the greatest long-term population growth rates are the North Fork Nooksack and White rivers. White River spring Chinook salmon life history is adapted to glacial runoff patterns. This life history distinguishes the White River spring Chinook salmon from most of the other PS Chinook salmon populations increasing their importance to recovery of PS Chinook salmon for their contribution to life history diversity within the ESU. The BRT found moderately high risks for all VSP categories (Good et al., 2005).

Factors for decline of PS Chinook salmon include a variety of human activities that have degraded extensive areas of Chinook salmon spawning and rearing habitat in Puget Sound. Development activities have limited access to historical spawning grounds and altered downstream flow and thermal conditions. Urbanization effects many part of the aquatic environment. It has caused direct loss of riparian vegetation and soils, significantly altered hydrologic and erosional rates and processes by creating impermeable surfaces (roads, buildings, parking lots, sidewalks etc.), and polluting waterways. Watershed development and associated urbanization throughout the Puget Sound, Hood Canal, and Strait of Juan de Fuca regions have increased sedimentation, raised water temperatures, decreased large woody debris (LWD) recruitment, decreased gravel recruitment, reduced river pools and spawning areas, and dredged and filled estuarine rearing areas (Bishop and Morgan 1996). Large areas of lower river meanders (formerly mixing zones between fresh and salt water) have been channelized and diked for flood control and to protect agricultural, industrial and residential development. In spite of this, habitat degradation in upstream areas has exacerbated flood events in these areas—with adverse effects on Chinook salmon populations (NMFS 1998).

Habitat was identified throughout the PS Chinook salmon ESU as blocked or degraded. In general, forest practices impacted upper tributaries, and agriculture or urbanization impacted lower tributaries and mainstem rivers. The WDF et al. (1993) cited diking for flood control, draining and filling of freshwater and estuarine wetlands, and sedimentation due to forest practices and urban development as problems throughout the ESU. Blockages by dams, water diversions, and shifts in flow regime due to hydroelectric development and flood control projects are major habitat problems in several basins. Bishop and Morgan (1996) identified a variety of critical habitat issues for streams in the range of this ESU, including changes in flow regime (all basins), sedimentation (all basins), high temperatures (Dungeness, Elwha, Green/Duwamish, Skagit, Snohomish, and Stillaguamish rivers), streambed instability (most basins), estuarine loss (most basins), loss of LWD (Elwha, Snohomish, and White rivers), loss of pool habitat (Nooksack, Snohomish, and Stillaguamish rivers), and blockage or passage problems associated with dams or other structures (Cedar, Elwha, Green/Duwamish, Snohomish, and White rivers).

Hood Canal Summer-run Chum Salmon

The Hood Canal summer-run chum salmon includes all naturally spawned populations of summer-run chum salmon in Hood Canal and its tributaries as well as populations in Olympic Peninsula rivers between Hood Canal and Dungeness Bay, Washington (March 25, 1999, 64 FR 14508). Eight artificial propagation programs are considered to be part of the ESU. 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, 2005a).

The NMFS' assessment of the effects of artificial propagation on ESU extinction risk concluded that these hatchery programs collectively do not substantially reduce the extinction risk of the ESU in-total (NMFS 2004). The hatchery programs are reducing risks to ESU abundance. Several of the programs have likely prevented further population extirpations in the ESU. The contribution of hatchery programs to the productivity of the ESU in-total is uncertain, but are benefiting ESU spatial structure by increasing the spawning area utilized in several watersheds and by increasing the geographic range of the ESU. These programs also provide benefits to ESU diversity, and likely stemmed adverse genetic effects for populations at critically low levels.

The recent five-year mean abundance is variable among populations in the ESU, ranging from one fish to nearly 4,500 fish. Most populations remain depressed and long-term trends in productivity are above replacement for only the Quilcene and Union River populations. Of an estimated 16 historical populations in the ESU, seven populations are believed to have been extirpated or nearly extirpated. Most of these extirpations have occurred in populations on the eastern side of Hood Canal, generating additional concern for ESU spatial structure. The widespread loss of estuary and lower floodplain habitat was noted by the BRT as a continuing threat to ESU spatial structure and connectivity. The BRT found high risks for each of the VSP categories (Good et al., 2005). Good et al. (2005) reviewed threats to the ESU and concluded that habitat threats remain the major risk to the ESU, particularly the widespread loss of estuary and lower floodplain habitats.

The main factors for the decline of the Hood Canal summer chum salmon are fishery exploitation (harvest) and cumulative habitat loss. Washington state and tribal co-managers completed an assessment which concludes that a variety of habitat- and land-use practices have had a detrimental impact on chum salmon (WDF and WWTIT 1993). For example, they identified gravel aggradation (due to logging in some areas), channel shifting, and diking as habitat risk agents in Hood Canal. Good et al. (2005) concluded that habitat threats, particularly the widespread loss of estuary and lower floodplain habitats, remain the major risk to the ESU. The recent five-year mean abundance is variable among populations in the ESU, ranging from one fish to nearly 4,500 fish. Most populations remain depressed and long-term trends in productivity are above replacement for only the Quilcene and Union River populations. Of an estimated 16 historical populations in the ESU, seven populations are believed to have been extirpated or nearly extirpated. Most of these extirpations have occurred in populations on the eastern side of Hood Canal, generating additional concern for ESU spatial structure. The widespread loss of estuary and lower floodplain habitat was noted by the BRT as a continuing threat to ESU spatial structure and connectivity. The BRT found high risks for each of the VSP categories (Good et al. 2005).

The NMFS' 2005 Report to Congress on the Pacific Coastal Salmon Recovery Fund (PCSRF) described habitat-related factors for decline as the following: (1) degraded floodplain and mainstem river channel structure; (2) degraded estuarine conditions and loss of estuarine habitat; (3) riparian area degradation and loss of in-river LWD in mainstem; (4) excessive sediment in spawning gravels; (5) reduced stream flow in migration areas; (6) degraded nearshore conditions (August 16, 2006, 71 FR 47180-47184). The Hood Canal Coordinating Council (HCCC) Plan states that because summer chum salmon rely on a complex mix of different habitat types in different seasons during their various life stages, long-term habitat loss and degradation have affected the chum salmon's productivity and life history diversity as well as abundance. The areas that most directly affect survival and persistence of Hood Canal summer chum populations are the freshwater habitats (typically lower river spawning areas), and the immediate nearshore marine habitat. Thus, loss of channel complexity, altered sediment dynamics, riparian degradation, estuarine habitat loss and degradation from diking, filling, log storage, and road causeways, and alteration of the nearshore environment from shoreline development are factors limiting the ESU's survival.

Puget Sound Steelhead

Puget Sound steelhead was listed as threatened on May 11, 2007 (72 FR 26722). The DPS includes all naturally spawned anadromous winter-run and summer-run steelhead populations, in streams in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington, bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive), as well as the Green River natural and Hamma Hamma winter-run steelhead hatchery stocks. The majority of hatchery stocks are not considered part of this DPS because they are more than moderately diverged from the local native populations (NMFS, 2005a). Resident steelhead occur within the range of PS steelhead but are not part of the DPS due to marked differences in physical, physiological, ecological, and behavioral characteristics (71 FR 15666; March 29, 2006). The PS steelhead DPS includes more than 50 stocks of summer- and winter-run fish.

No estimates of historical (pre-1960s) abundance specific to the PS steelhead DPS are available. Of the 21 independent stocks for which adequate escapement information exists, 17 stocks have been declining and four increasing over the available data series, with a range from 18 percent annual decline (Lake Washington winter steelhead) to seven percent annual increase (Skykomish River winter steelhead). Eleven of these trends (nine negative, two positive) were significantly different from zero. The two basins producing the largest numbers of steelhead (Skagit and Snohomish Rivers) both have overall upward trends. Hatchery fish in this DPS are widespread, spawn naturally throughout the region, and are largely derived from a single stock (Chambers Creek). The proportion of spawning escapement comprised of hatchery fish ranged from less than one percent (Nisqually River) to 51 percent (Morse Creek). In general, hatchery proportions are higher in Hood Canal and the Strait of Juan de Fuca than in Puget Sound proper. Most of the hatchery fish in this region originated from stocks indigenous to the DPS, but are generally not native to local river basins. Summer steelhead stocks within this DPS are all small, occupy limited habitat, and most are subject to introgression by hatchery fish.

Specifically, the BRT concluded that there is: (1) A high risk to the viability of PS steelhead due to declining productivity and abundance; (2) a moderate risk due to reduced spatial complexity of, and connectivity among, populations; and (3) a moderate risk due to the reduced life-history diversity of populations and the potential threats posed by artificial propagation and harvest practices in Puget Sound.

The principal factor for decline for PS steelhead is the present or threatened destruction, modification, or curtailment of its habitat or range. Barriers to fish passage and adverse effects on water quality and quantity resulting from dams, the loss of wetland and riparian habitats, and agricultural and urban development activities have contributed and continue to contribute to the loss and degradation of steelhead habitats in Puget Sound. Existing regulatory mechanisms inadequately protect steelhead habitats as evidenced by the historical and continued threat posed by the loss and degradation of nearshore, estuarine, and lowland habitats due to agricultural activities and urbanization. Ocean and climate conditions can have profound impacts on the continued existence of steelhead populations. (72 FR 26722, May 11, 2007)

Southern Resident Killer Whales

The SRKW DPS consists of three pods, identified as J, K, and L pods. In this section, NMFS summarizes the status of the SRKWs throughout their range. Although the entire Southern Resident DPS has potential to occur anywhere within their range across the year, occurrence in inland waters of their range is most likely summer to early-fall, and is more likely in coastal waters from late-fall to spring. The final recovery plan for Southern Residents was issued in January, 2008 (NMFS 2008a). This section summarizes information taken largely from the recovery plan, as well as new data that became available more recently. For more detailed information about this population, please refer to the Final Recovery Plan for SRKWs, which can be found on the internet at www.nwr.noaa.gov.

Status and trends. Although there is little information available regarding the historical abundance of SRKWs, two methods have been used to estimate a historical population size of 140 to 200. The minimum estimate (~140) is the number of whales killed or removed for public display in the 1960s and 1970s added to the remaining population at the time of the captures. The maximum estimate (~200) is based on genetic analysis of microsatellite DNA (68 FR 31980; May 29, 2003).

At present, the Southern Resident population has declined to essentially the same size that was estimated during the early 1960s, when it was considered as likely depleted (Olesiuk et al. 1990) (Figure 2). Since censuses began in 1974, J and K pods have steadily increased their sizes, however the population suffered an almost 20 percent decline from 1996-2001, largely driven by declines in L pod. There have been recent increases in the population from 2002-2006 indicating that L pod's decline may have ended, however such a conclusion is premature. The 2007 census counted 87 SRKWs, 25 in J pod, 19 in K pod and 43 in L pod.

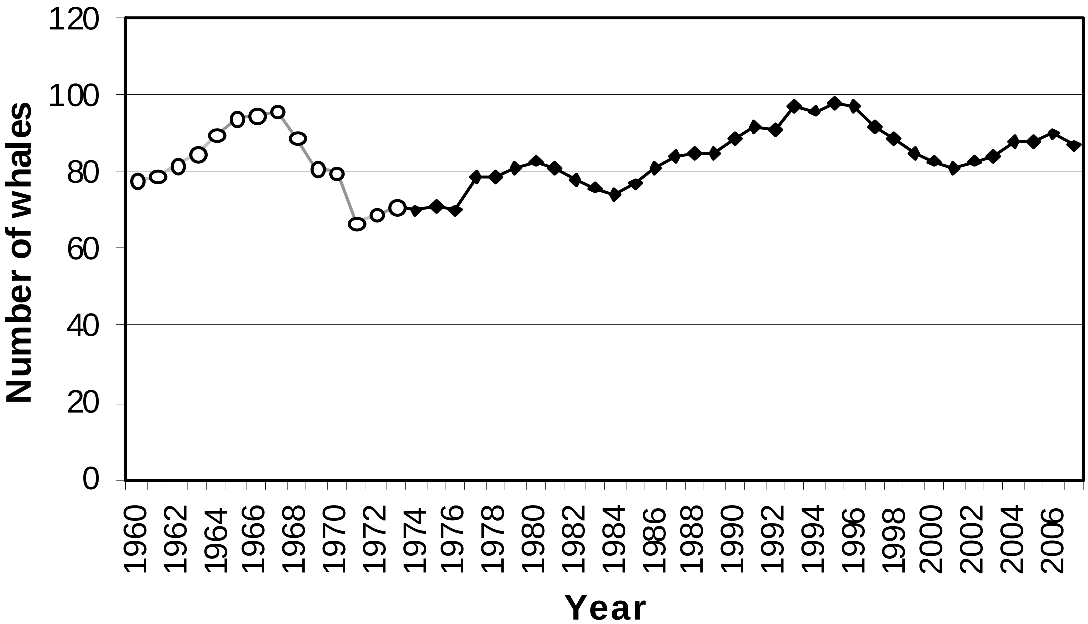


Figure2. Population size and trend of Southern Resident killer whales, 1960-2007. Data from 1960-1973 (open circles, gray line) are number projections from the matrix model of Olesiuk et al. (1990). Data from 1974-2007 (diamonds, black line) were obtained through photo-identification surveys of the three pods (J, K, and L) in this community and were provided by the Center for Whale Research (unpubl. data). Data for these years represent the number of whales present at the end of each calendar year except for 2007, when data extend only through October.

Listing Status. The NMFS listed the SRKW DPS as endangered under the ESA on November 18, 2005 (70 FR 69903). The final rule included information on the population decline in the 1990s and identified several potential factors that may have caused the decline or may be limiting recovery. These are: quantity and quality of prey, toxic chemicals that accumulate in top predators, and disturbance from sound and vessel traffic. The rule also identified oil spills as a potential risk factor for this species. Southern Residents are designated as "depleted" and "strategic" under the Marine Mammal Protection Act (68 FR 31980; May 29, 2003). Critical habitat for the SRKW DPS was proposed on June 15, 2006 (71 FR 34571) and the final designation of critical habitat was published November 29, 2006 (71 FR 69054). Critical habitat includes approximately 2,560 square miles of inland waters in three specific areas (1) the Summer Core Area in Haro Strait and waters around the San Juan Islands; (2) Puget Sound; and (3) the Strait of Juan de Fuca.

Range and Distribution. Southern Residents are found throughout the coastal waters of Washington, Oregon, and Vancouver Island and are known to travel as far south as central California and as far north as the Queen Charlotte Islands, British Columbia (Figure 3). Their range also includes inland waters of Washington and British Columbia (Figure 3). There is limited information on the distribution and habitat use of Southern Residents along the outer Pacific Coast. Southern Residents are highly mobile and can travel up to 86 nmi (160 km) in a single day (Erickson 1978, Baird 2000). To date, there is no evidence that Southern Residents travel further than 50 km offshore (Ford et al. 2005).

Figure 3. Geographic Range (light shading) of the Southern Resident Killer Whale Population. Reprinted from Wiles (2004).

Southern Residents spend the majority of their time from late spring to early autumn in inland waterways of Washington State and British Columbia (southern Strait of Georgia, Strait of Juan de Fuca, and Puget Sound) (Bigg 1982, Ford et al. 2000, Krahn et al. 2002) (Figure 4). The best available sighting data in inland waters extends from the southern Strait of Georgia (line below Nanaimo and Vancouver, B.C), south to southern Puget Sound and west to the mouth of the Strait of Juan de Fuca (The Whale Museum 2007). Typically, J, K and L pods arrive in May or June and spend most of their time in the core area of Georgia Basin and Puget Sound until departing in October or November. K and L pods also make frequent trips to the outer coasts of Washington and southern Vancouver Island during this time, and trips can last a few days (Ford et al. 2000).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976				J,K								
1977												
1978			J,K									
1979											J,K	
1980												
1981				J,K								
1982						J,K				J,K		
1983										J,K	J,K	
1984						J,K						

1985						J,K						
1986					J,K							
1987										J,K	J,K	J,K
1988					J,K							
1989			J,K							J,K	J,K	J,K
1990												
1991					J,K					J,K		
1992												
1993					J,K							
1994										J,L		
1995												
1996										J,K	J,K	
1997										J,L	J,L	J,K
1998											J,K	
1999												
2000												
2001												
2002			J,K,L?									
2003												J,K
2004					J,L	J,L						J,K
2005		J?			J,L							
2006	J?											
2007	none					J,L						

Only J Pod present		Two pods present, as indicated		J, K, and L pods present		Data not available	

Figure 4. Monthly occurrence of the three Southern Resident killer whale pods (J, K, and L) in the inland waters of Washington and British Columbia, 1976-2005. This geographic area is defined as the region east of Race Rocks at the southern end of Vancouver Island and Port Angeles on the Olympic Peninsula. Pods were recorded as present during a month if they were sighted on at least one day (NMFS 2008a and NWFSC unpubl. data).

Late summer and early fall movements of Southern Residents in the Georgia Basin have remained fairly consistent since the early 1970s, with strong site fidelity shown to the region as a whole. However presence in inland waters in the fall has increased in recent years (NMFS 2008a). During early autumn, J pod in particular expands their routine movements into Puget Sound, likely to take advantage of chum and Chinook salmon runs (Osborne 1999). During late fall, winter, and early spring, the ranges and movements of the Southern Residents are less well known. Sightings through the Strait of Juan de Fuca in late fall suggest that activity shifts to the outer coasts of Vancouver Island and Washington (Krahn et al. 2002).

The Southern Residents were formerly thought to range southward along the coast to about Grays Harbor (Bigg et al. 1990) or the mouth of the Columbia River (Ford et al. 2000). However, recent sightings of members of K and L pods in Oregon (in 1999 and 2000) and California (in 2000, 2003, 2005, 2006 and 2008) have considerably extended the southern limit of their known range (NMFS 2008). There have been 45 verified sightings or strandings of J, K or L pods along the outer coast from 1975 to present with most made from January through April (Table 1). These include 16 records off Vancouver Island and the Queen Charlottes, 15 off Washington, 4 off Oregon, and 10 off central California. Most records have occurred since 1996, but this is more likely because of increased viewing effort along the coast for this time of year. Sightings in Monterey Bay, California coincided with large runs of salmon, with feeding witnessed in 2000 (Black et al. 2001). L pod was also seen feeding on unidentified salmon off Westport, Washington, in March 2004 during the spring Chinook salmon run in the Columbia River (M. B. Hanson, pers. obs., in Krahn et al. 2004).

Table 1. Known sightings of Southern Resident killer whales along the outer Pacific Ocean coast (NMFS 2008a).

Date	Location	Identification	Source	Comments
British Columbia outer coast				
31 Jan 1982	Barkley Sound, west coast of Vancouver Island	L pod	J. Ford, PBS/DFO	Off shore of Sound
21 Oct 1987	Coal Harbor, north Vancouver Island	Part of L pod	J. Ford, PBS/DFO	Were way up inlet a long distance from open ocean
3 May 1989	Tofino, west coast of Vancouver Island	K pod	WMSA	--
4 July 1995	Hippa Is., south Queen Charlotte Islands	Southern Resident	J. Ford PBS/DFO	Carcass found on beach, ID only by genetics
May 1996	Cape Scott, north Vancouver Island	Southern Resident	J. Ford PBS/DFO	Carcass found on beach, ID only by genetics
4 Sep 1997	Off Carmanah Point, sw Vancouver Island	L pod	Observed by P. Gearin, NMML	Identified by D. Ellifrit
14 Apr 2001	Tofino, west coast of Vancouver Island	L pod	J. Ford PBS/DFO	
27 Apr 2002	Tofino, west coast of Vancouver Island	L pod	J. Ford PBS/DFO	
12 May 2002	Tofino, west coast of Vancouver Island	L pod	J. Ford PBS/DFO	
30 May 2003	Langara Is., Queen Charlotte Islands	L pod	M. Joyce, DFO	
17 May 2004	Tofino, west coast of Vancouver Island	K and L pods	M. Joyce, DFO	
9 June 2005	West of Cape Flattery, Washington in Canadian waters	L pod	SWFSC	Whales were exiting the Strait of Juan de Fuca
7 Sep 2005	West of Cape Flattery, Washington in Canadian waters	L pod	NWFSC	Whales were exiting the Strait of Juan de Fuca
18 Mar 2006	North of Neah Bay, Washington in Canadian waters	J pod	NWFSC	Whales were exiting the Strait of Juan de Fuca
8 May 2006	Off Brooks Peninsula, west coast of Vancouver Island	L pod	J. Ford PBS/DFO	
1 Dec 2006	Johnstone Strait	L pod	J. Ford PBS/DFO	
Washington Outer Coast				
4 Apr 1986	Off Westport/Grays Harbor	L pod	J. Ford, PBS/DFO	
13 Sep 1989	West of Cape Flattery	L pod	J. Calambokidis, Cascadia Research	
17 Mar 1996	3 km offshore Grays Harbor	L pod	J. Calambokidis, Cascadia Research	
20 Sep 1996	Off Sand Point (29 km south of Cape Flattery)	L pod	Observed by P. Gearin, NMML	Identified by D. Ellifrit
15 Apr 2002	Long Beach	L60	D. Duffield, Portland State Univ.	Stranded whale identified by K. Balcomb, CWR
11 Mar 2004 **13 Mar 2004**	Grays Harbor Off Cape Flattery	L pod J pod	B. Hanson, NWFSC B. Hanson, NWFSC	Whales were exiting Strait of Juan de Fuca

Date	Location	Identification	Source	Comments
22 Mar 2005	Fort Canby-North Head	L pod	J. Zamon, NWFSC	
23 Oct 2005	Off Columbia River	K pod	SWFSC, Cscape	
29 Oct 2005	Off Columbia River	K and L pods	SWFSC, Cscape	
1 Apr 2006	Westport	L pods	PAL	
6 Apr 2006	Westport	K and L pods	Cascadia Research	
13 May 2006	Westport	K and L pods	PAL	
26 May 2006	Westport	K pod	PAL	
29 May 2006	Westport	K pod	PAL	
Oregon				
Apr 1999	Off Depoe Bay	L pod	J. Ford, PBS/DFO	
Mar 2000	Off Yaquina Bay	L pod	J. Ford, PBS/DFO	Seen week of Mar 20
14 Apr 2000	Off Depoe Bay	Southern Residents	K. Balcomb, CWR	
30 Mar 2006	Off Columbia River	K and L pods	B. Hanson, NWFSC	
California				
29 Jan 2000	Monterey Bay	K and L pods	N. Black, MBWW	Seen and photographed feeding on fish
13 Mar 2002	Monterey Bay	L pod	N. Black, MBWW	
16 Feb 2005	Farallon Is	L pod	K. Balcomb, CWR	
26 Jan 2006	Pt. Reyes	L pod	S. Allen	
24 Jan 2007	San Francisco Bay	K pod	N. Black, MBWW	
18 Mar 2007	Fort Bragg	L pod		Reported on CWR website
24-25 Mar 2007	Monterey	K and L pods		Reported on CWR website
30 Oct 2007	Bodega Bay	L pod	Cascadia Research	
27 Jan 2008	Monterey	L pod	N. Black/K. Balcomb	
2 Feb 2008	Monterey	K and L pods	N. Black/K. Balcomb	

Life history. Southern Resident killer whales are a long lived species, with late onset of sexual maturity (review in NMFS 2008a). Females produce a low number of surviving calves over the course of their reproductive life span (5.4 surviving calves over 25 years) (Olesiuk et al. 1990, Bain 1990). Mothers and offspring maintain highly stable social bonds throughout their lives, which is the basis for the matrilineal social structure in the Southern Resident population (Bigg et al. 1990, Baird 2000, Ford et al. 2000). Groups of related matrilines form pods. Three pods – J, K, and L, make up the Southern Resident community. Clans are composed of pods with similar vocal dialects and all three pods of the Southern Residents are part of J clan.

Southern Resident killer whales are known to consume 22 species of fish and one species of squid (Scheffer and Slipp 1948, Ford et al. 1998, 2000, Ford and Ellis 2006, Saulitis et al. 2000). A long-term study of resident killer whale diet identified salmon as their preferred prey (at least 96 percent of prey consumed during spring, summer and fall) (Ford and Ellis 2006). Feeding records for Southern Residents suggest that diet resembles that of the Northern Residents, with a strong preference for Chinook salmon (72 percent of identified prey) during late spring to fall (Ford and Ellis 2006). Chum salmon (23 percent) are also taken in significant amounts, especially in autumn. Other species eaten included coho salmon (*O. kisutch*, 2 percent), pink (3 percent), steelhead and sockeye salmon (*O. mykiss, O. nerka*< 1 percent). The non salmonids include Pacific herring, sablefish, Pacific halibut, quillback and yelloweye rockfish). Chinook salmon were preferred despite the much lower abundance of Chinook salmon in the study area in comparison to other salmonids, probably because of the species' large size, high fat and energy content and year-round occurrence in the area. Killer whales also captured older (i.e., larger) than average Chinook salmon (Ford and Ellis 2006).

Ongoing research continues to identify prey of Southern Residents through direct observation and scale sampling. More recently, researchers have started collecting fecal samples for analysis to address the potential biases of scale sampling. Although studies and analyses are not yet complete, preliminary results of ongoing sampling efforts are the best available information on diet composition of Southern Residents. When Southern Residents are generally concentrated in their "core summer area" (San Juan Islands) from May to September, their diet consists of approximately 86 percent Chinook salmon and 14 percent other salmon species (n=125 samples; Hanson et al. 2007, NMFS - NWFSC unpubl. data). During all months combined their diet is approximately 69 percent Chinook and 31 percent other salmon species (n=160 samples). Sampling indicates an apparent shift to chum salmon in fall months when some Southern Residents are sighted inside Puget Sound (Hanson et al. 2007, NMFS - NWFSC unpubl. data). Early results from genetic analysis of fecal and prey samples indicate that Southern Residents consume Fraser River origin Chinook salmon, as well as salmon from Puget Sound, Washington and Oregon coasts, the Columbia River, and Central Valley California (Hanson et al. 2007 and NMFS - NWFSC unpublished data). As further data are analyzed, they will provide information on which specific runs of salmon the whales are consuming in certain locations and seasons.

There are no fecal or prey samples or direct observations of predation events (where the prey was identified to species) when the whales are in coastal waters. Although less is known about diet preferences of Southern Residents off the Pacific Coast, it is likely that salmon are also important during late fall and winter when Southern Residents more predictably occur in coastal waters.

Based on the best available information, Southern Residents may also prefer Chinook salmon when available in coastal waters. Chemical analyses also support the importance of salmon in the year-round diet of Southern Residents (Krahn et al. 2002, 2007). Krahn et al. (2002), examined the ratios of DDT (and its metabolites) to various PCB compounds in the whales, and concluded that the whales feed primarily on salmon throughout the year rather than other fish species. Krahn et al. (2007) analyzed stable isotopes from tissue samples collected in 1996 and 2004/2006. Carbon and nitrogen stable isotopes indicated that J and L pods consumed prey from similar trophic levels in 2004/2006 and showed no evidence of a large shift in the trophic level of prey consumed by L pod between 1996 and 2004/2006.

The size of individual prey likely influences the relationship of prey needed by the whales relative to prey available. NMFS is not able to assess the potential differences in biomass of individual Chinook salmon available to Southern Residents, and thus rely on abundance as a proxy measure. Southern Resident killer whales consume both natural and hatchery salmon (DFO unpubl. data). The best available information does not indicate that Southern Residents would be affected differently by consuming natural or hatchery salmon (i.e., no general pattern of differences in size, run-timing, or ocean distribution [e.g., Nickum et al. 2004, NMFS 2008b, Weitkamp and Neely 2002]).

Researchers have estimated the energy requirements of killer whales and caloric values for salmon to calculate the number of fish needed per day. Salmon differ significantly in size across species and runs, and prey preference among salmon would affect annual consumption rates. Fewer salmon per day would be required from a larger preferred prey species such as Chinook salmon. The NMFS provides an estimate of the biological requirements of Southern Residents using the best available information on metabolic needs of the Southern Resident population and the caloric content of salmon, as described in more detail below (see Biological Requirements).

Although estimates for biological requirements take the best available information into consideration, prey abundance or even biomass may not fully address the ability of Southern Residents to find and capture adequate prey resources. Salmon prey is patchily distributed in time and space in the action area. The whales are also mobile and would not be able to intercept every fish moving through the area. The NMFS does not currently have sufficient information to determine the foraging efficiency of the whales, thus estimates of the whales needs relative to prey availability may be improved as future research on salmon and Southern Residents provides new information on predator prey interactions, prey densities and foraging rates.

Biological Requirements of Southern Resident Killer Whales. The NMFS considered the biological requirements or prey needs of Southern Residents in their coastal range by combining information about the status of the species and environmental baseline. This information supports the effects analysis. The primary effect of the proposed action will be on the abundance of the killer whales' preferred prey salmon, and in particular Chinook salmon. This section addresses the whales' biological requirements or prey needs in their inland waters range to provide context for analyzing the consequences of this effect on prey abundance. To do this, NMFS estimated several parameters:

1) Diet composition for Southern Residents killer whales.
2) Metabolic needs of the SRKWs.
3) Caloric content of salmon.
4) Estimated number of salmon needed by the SRKWs.

Diet Composition for Southern Resident Killer Whales. The NMFS' current knowledge of diet composition is limited by small sample sizes, restricted geographic scope and seasons of sampling effort, and the methodologies of studies evaluating diet composition (Ford and Ellis 2006, Hanson et al. 2007, and NMFS - NWFSC unpubl. data). In light of uncertainties and data gaps, NMFS assumed that the entire diet of the Southern Residents consisted of salmon, although there are data indicating that they consume other fish and squid as prey items in small amounts. Based on available data, NMFS provide a detailed analysis, including quantitative evaluation of diet composition, for the inland portion of the Southern Residents' range affected by the action, and a more generalized qualitative evaluation in coastal waters. There is uncertainty regarding the Southern Residents' use of the small area of their coastal range that overlaps with PS Chinook salmon affected by this action.

The available sighting data for Southern Residents indicates substantially increased sightings of the whales from May through September in the San Juan Islands, with intermittent sightings in Puget Sound and the Strait of Juan de Fuca during this time (The Whale Museum 2007). As discussed in the Status of the Species section, most of the available information on diet of Southern Residents is collected during summer months (primarily from May to September) and sampling indicates that Southern Residents prefer Chinook salmon (Ford and Ellis 2006, Hanson et al. 2007), and NMFS - NWFSC unpubl. data). Additionally, Chinook salmon that will spawn in a given year migrate into freshwater streams and rivers by early fall (i.e. October), after which they are no longer available as prey for whales (i.e., PS Chinook salmon returning to inland waters). However, adult Chinook salmon not returning to spawn in a given year would be available in coastal waters year-round, and there are resident Chinook salmon (blackmouth) available in inland waters year-round.

To address the range in potential outcomes from effects of the proposed action in inland waters, the following analysis considers scenarios of Southern Resident diet composition for this area. The NMFS quantitatively evaluated scenarios for a mostly-Chinook salmon diet from May through September (5 months) , and qualitatively assessed a mostly-Chum salmon diet during fall to provide perspective on the range of potential outcomes from the proposed action in inland waters.

The percent of Chinook salmon in the diet was presented as a range of fixed percents, based on the range of possibilities represented in past studies (70 percent Chinook salmon, Ford and Ellis 2006), and preliminary data from on-going research (86 percent Chinook salmon, NMFS - NWFSC unpubl. data). The remaining percent of other salmon species in the diet was allowed to vary randomly (as described in NMFS 2007b), because the low sample sizes of other species make it difficult to fix a likely species composition.

Mostly-Chinook salmon scenarios were:

1) 86 percent Chinook salmon, based on the highest reported estimate of Chinook salmon composition in the diet of Southern Residents (NMFS - NWFSC unpubl. data), and
2) 70 percent Chinook salmon (Ford and Ellis 2006).

Metabolic Needs of the Southern Resident Killer Whales. The NMFS calculated the metabolic needs for all individuals of the SRKW DPS. Recently, Noren (in review) estimated the potential range of daily energy expenditure for SRKWs for all ages and both sexes, taking into account metabolic needs for growth and lactation. Juveniles and adolescent males in particular had higher metabolic rates than previously estimated. Noren (in review) combined this information with the population census data to estimate a minimum and maximum daily energetic requirement for all the members of the Southern Resident DPS based on the sex, age, and estimated body mass of the 85 whales in the population at the end of 2006. The NMFS updated the range of energy expenditure provided by Noren (in review) to reflect births and deaths in the Southern Resident population since 2006 and the current population estimate from 2007 of 87 whales (NMFS 2008a, Center for Whale Research unpubl. data). With these updates, the range of daily energetic expenditure for the entire Southern Resident population is 11,880,341 kcal day^{-1} (minimum) to 14,232,857 kcal day^{-1} (maximum).

Caloric Content of Salmon. The NMFS estimated the caloric content of salmon, and determined how many Chinook salmon were needed when they occur in inland waters. Caloric content and body mass information have been collected from various runs of Chinook, chum and coho salmon (Noren in review, NMFS - NWFSC unpubl. data). The NMFS used an average body mass and caloric content estimate for Chinook salmon in inland waters that has been applied in past consultations (7.4 kg and 13,279 kcal $fish^{-1}$, NMFS 2007b). This estimate for the caloric content of Chinook salmon(13,279 kcal $fish^{-1}$) was used to estimate the prey needs of Southern Residents in inland waters.

For other salmon species, NMFS used data for body mass of from fisheries catch data (NMFS 2007b, 2007c), and estimated caloric content from a regression model (Ylitalo, unpublished data), (chum: 5.4 kg and 6,118 kcal $fish^{-1}$; coho: 2.9 kg and 4,162 kcal $fish^{-1}$; sockeye: 2.7 kg and 4,861 kcal $fish^{-1}$; pink: 1.9 kg and 2,273 kcal $fish^{-1}$; steelhead: 3.5 kg and 6,121 kcal $fish^{-1}$). The estimates of caloric content used represent the best available information, given limited knowledge of the distribution of salmon with different caloric values and their spatial and temporal overlap with Southern Residents in inland waters.

Evaluating Prey Needs of Southern Resident Killer Whales. The NMFS evaluated the prey needs of SRKWs in inland waters by incorporating the parameters described above for the metabolic needs of the entire Southern Resident DPS and the caloric content of salmon in our scenarios of diet composition. The NMFS calculated the number of salmon the entire population needs per day by multiplying the proportion of each salmon species in the diet by the daily prey energy requirement of the Southern Resident DPS (minimum and maximum bioenergetic requirements, Noren in review), divided by the energy values per salmon species. The number of salmon needed per day was multiplied by the number of foraging days (153 days for May through September) (Table 2).

Information is not available on the amount of time Southern Residents spend in the relatively small portion of their coastal range that overlaps with the distribution of the listed salmonids affected by the action. However, the availability of prey resources within the coastal range of Southern Residents is orders of magnitude larger than available in their range within inland waters. Therefore, although NMFS did not quantify the level of prey reduction within the coastal portion of the action area, the effects are diluted from the level quantified in inland waters. Any further conclusions drawn about effects within coastal waters are qualitative and largely based on relative comparison to effects in inland waters.

Table 2.3. Biological Requirements Based on Diet Composition Scenarios and Bioenergetic Needs of Southern Residents in Inland Waters.

Scenarios	Minimum[1] salmon needs for SRKW		Maximum[2] salmon needs for SRKW	
Mostly-Chinook	Chinook	Other Salmon	Chinook	Other Salmon
86% Chinook	117,177	49,080	140,380	58,799
70% Chinook	95,822	102,138	114,797	122,363

[1] Minimum salmon based on the minimum energy requirements for the SRKW DPS stated in the metabolic needs section above.
[2] Maximum salmon based on the maximum energy requirements for the SRKW DPS stated in the metabolic needs section above

Impacts of Human Activity.
Several anthropogenic factors have affected the status of the Southern Resident population and are identified as potential threats to the recovery of this species (NMFS 2008a). The primary risk factors identified in the Southern Resident recovery plan are prey availability, environmental contaminants, vessel effects and sound, and oil spills (NMFS 2008a). Research has yet to identify which threats are most significant to the survival and recovery of Southern Residents. It is likely that multiple threats are acting in concert to impact the whales.

Prey Availability. Healthy killer whale populations depend on adequate prey levels. It is uncertain to what extent long-term or more recent declines in salmon abundance contributed to the decline of the Southern Resident DPS, or whether current levels are adequate to support the survival and recovery of the Southern Residents. When prey is scarce, whales must spend more time foraging than when it is plentiful, leading to relatively lower reproductive rates and relatively higher mortality rates. Food scarcity would cause whales to draw on fat stores, mobilizing contaminants stored in their fat. Human influences have had profound impacts on the abundance of many prey species in the northeastern Pacific during the past 150 years. Foremost among these, many stocks of salmon have declined significantly due to overfishing, harmful artificial propagation practices, and degradation of freshwater and estuarine habitats through habitat conversion from development and urbanization, dam building, and forestry, agricultural, and mining practices (NRC 1996, Slaney et al. 1996, Gregory and Bisson 1997, Lichatowich 1999, Lackey 2003, Pess et al. 2003, Schoonmaker et al. 2003). Populations of other marine species have similarly declined or fluctuated greatly through time.

Salmon declines are particularly prevalent in Washington, Oregon, Idaho, California, and southern British Columbia due to greater human impacts on freshwater and estuarine habitats as well as ocean productivity cycles, whereas populations in Alaska have been little affected (Riddell 1993, Slaney et al. 1996, Nehlsen 1997, Wertheimer 1997, Yoshiyama et al. 1998, Kope and Wainwright 1998, Lackey 2003, Schoonmaker et al. 2003). Coastal Chinook stocks increased from the mid-1960s through the 1970s following a decline in the 1990s, possibly as a result of increased coastal water temperatures related to El Nino events (run-reconstruction in, Johnson et al. 1997). Wild Chinook salmon runs in the region were fairly stable from 1968 until a sharp decline beginning in 1991, as a result of poor ocean survival, habitat alterations, and harvest pressures (run-reconstruction in, Johnson et al. 1997). Since the late 1990s, Canadian and U.S. managers have taken actions to reduce fishery impacts in response to the declines.

Among naturally spawning salmon and steelhead, 30 of the 52 ESUs/DPSs in the western contiguous United States are currently listed as threatened or endangered, or are candidates for listing under the Federal Endangered Species Act. Half or more of all Chinook salmon, steelhead, and chum salmon ESUs/DPSs are listed. Some of the remaining 22 ESUs/DPSs are predicted to become endangered unless specific recovery actions can be accomplished. In addition to naturally produced salmon, killer whales are likely to consume hatchery salmon when available.

Recreational and commercial fisheries also affect prey availability for SRKWs. Fisheries can affect the amount of prey immediately available to the whales in a given year if the fishery removes fish that would otherwise have been available as prey for whales. Fisheries can also affect future abundance of prey if the fishery affects the productivity of a fish population. Commercial and sport fisheries that affect prey resources available in the range of Southern Residents include those managed by the Frasier Panel Salmon Fisheries, Pacific Fisheries Management Council (PFMC), as well as fisheries in Southeast Alaska, northern British Columbia, and along the western coast of Vancouver Island.

Contaminants. Many types of chemicals are toxic when present in high concentrations, including organochlorines, polycyclic aromatic hydrocarbons (PAHs), and heavy metals. Emerging contaminants such as brominated flame retardants and perfluorinated compounds are increasingly being linked to harmful biological impacts as well.

Persistent contaminants, such as organochlorines, are ultimately transported to the oceans, where they enter the marine food chain. Organochlorines are also highly fat soluble, and accumulate in the fatty tissues of animals (O’Shea 1999, Reijnders and Aguilar 2002). Bioaccumulation through trophic transfer allows relatively high concentrations of these compounds to build up in top-level marine predators, such as marine mammals (O'Shea 1999). Killer whales are candidates for accumulating high concentrations of organochlorines because of their high position in the food web and long life expectancy (Ylitalo et al. 2001, Grant and Ross 2002). Their exposure to these compounds occurs exclusively through their diet (Hickie et al. 2007).

High levels of persistent organic pollutants such as PCBs and DDT are documented in SRKWs (Ross et al. 2000, Ylitalo et al. 2001). These and other chemical compounds have the ability to induce immune suppression, impair reproduction, and produce other adverse physiological effects, as observed in studies of other marine mammals (review in NMFS 2008). Immune suppression may be especially likely during periods of stress and resulting weight loss, when stored organochlorines are released from the blubber and become redistributed to other tissues (Krahn et al. 2002). Although the ban of several contaminants, such as DDT, by Canada and the United States in the 1970s resulted in an initial decline in environmental contamination, Southern Residents may be slow to respond to these reductions because of their body size and the long duration of exposure over the course of their life spans (Hickie et al. 2007).

Vessels and Sound. Vessels have the potential to affect whales through the physical presence and activity of the vessel, increased underwater sound levels generated by boat engines or a combination of these factors. Vessel strikes are rare, but do occur and can result in injury or mortality. In addition to vessels, underwater sound can be generated by a variety of other human activities, such as dredging, drilling, construction, seismic testing, and sonar (Richardson et al. 1995, Gordon and Moscrop 1996, NRC 2003). Impacts from these sources can range from serious injury and mortality to changes in behavior.

Killer whale mortalities from vessel strikes have been reported in both Northern and SRKW populations. Although rare, collisions between vessels and killer whales could result in serious injury. Other impacts from vessels are less obvious, but may adversely affect the health of killer whales. The presence of vessels may alter killer whale behavior, including faster swimming, less predictable travel paths, shorter or longer dive times, moving into open water, and altering normal behavioral patterns at the surface (Kruse 1991; Williams et al. 2002a; Bain et al. 2006). Chemicals such as unburned fuel and exhaust may be inhaled or ingested, which could contribute to toxic loads (Bain et al. 2006). Noise from vessel traffic may mask echolocation signals (Bain and Dahlheim 1994, Holt 2008), which reduces foraging efficiency or interferes with communication. The sound from vessels may also contribute to stress (Romano et al. 2003) or affect distribution of animals (Bejder et al 2007).

Southern Resident killer whales are the primary driver for a multi-million dollar whale watching industry in the Pacific Northwest. Commercial whale watching vessels from both the United States and Canada view Southern Residents when they are in inland waters in summer months. Mid-frequency sonar generated by military vessels also has the potential to disturb killer whales. To date, there are no directed studies concerning the impacts of military mid-frequency sonar on killer whales, but observations from an event that occurred in the Strait of Juan de Fuca and Haro Strait in 2003 illustrate that mid-frequency sonar can cause behavioral disturbance (NMFS 2004).

Killer whales rely on their highly developed acoustic sensory system for navigating, locating prey, and communicating with other individuals. Increased levels of anthropogenic sound have the potential to mask echolocation and other signals used by the species, as well as to temporarily or permanently damage hearing sensitivity. Exposure to sound may therefore be detrimental to survival by impairing foraging and other behavior, resulting in a negative energy balance (Bain and Dahlheim 1994, Gordon and Moscrop 1996, Erbe 2002, Williams et al. 2002a, 2002b). In other cetaceans, hormonal changes indicative of stress have been recorded in response to intense sound exposure (Romano et al. 2003). Chronic stress is known to induce harmful physiological conditions including lowered immune function, in terrestrial mammals and likely does so in cetaceans (Gordon and Moscrop 1996).

Oil spills. Exposure to petroleum hydrocarbons released into the marine environment from oil spills and other discharge sources represents another potentially serious health threat for killer whales in the northeastern Pacific. Oil spills are also potentially destructive to prey populations and therefore may adversely affect killer whales by reducing food availability.

Marine mammals are generally able to metabolize and excrete limited amounts of hydrocarbons, but acute or chronic exposure poses greater toxicological risks (Grant and Ross 2002). In marine mammals, acute exposure can cause changes in behavior and reduced activity, inflammation of the mucous membranes, lung congestion, pneumonia, liver disorders, and neurological damage (Geraci and St. Aubin 1990). Vapors inhaled at the water's surface and hydrocarbons ingested during feeding are the likely pathways of exposure. Matkin et al. (1994) reported that killer whales did not attempt to avoid oil-sheened waters following the Exxon Valdez oil spill in Alaska. Retrospective evaluation shows it is highly likely that oil exposure contributed to deaths of resident and transient pods of killer whales that frequented the area of the massive Exxon Valdez oil spill in Prince William Sound, Alaska in 1989 (Matkin et al. 2008). The cohesive social structure of the Southern Residents puts them at risk for a catastrophic oil spill that could affect the entire DPS when they are all in the same place at the same time.

Status of Critical Habitat

Critical habitat is defined as the specific areas within the geographical area occupied by the species, at the time it is listed, on which are found those physical or biological features that are essential to the conservation of the species, and which may require special management considerations or protection. Critical habitat can also include specific areas outside the geographical area occupied by the species at the time it is listed that are determined by the Secretary to be essential for the conservation of the species (Endangered Species Act of 1973, as amended, section 3(5)(A)).

The action area for this consultation contains designated critical habitat. In determining what areas are critical habitat, NMFS must consider those physical and biological features that are essential to the conservation of a given species (referred to as either "essential features" or "primary constituent elements" (PCEs)), and that may require special management considerations or protection. Such requirements include, but are not limited to: (1) Space for individual and population growth, and for normal behavior; (2) Food, water, air, light, minerals, or other nutritional or physiological requirements; (3) Cover or shelter; (4) Sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and generally; (5) Habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species (50 CFR 424.12(b)).

The NMFS reviews the status of designated critical habitat affected by the proposed action by examining the condition and trends of the PCEs throughout the designated area.

After a species is listed as endangered or threatened by extinction, habitat considered critical to the conservation of the species shall be designated within the range that the species currently occupies. The Secretary shall designate as critical habitat areas outside the geographical area presently occupied by a species only when a designation limited to its present range would be inadequate to ensure the conservation of the species (50 CFR 424.12).

Salmon and Steelhead Critical Habitat

Many of the salmonid ESUs/DPSs addressed in this consultation share the same rivers and estuaries, have similar life history characteristics and, therefore, require many of the same PCEs or Essential Features of Habitat. The PCEs are physical features essential to the conservation of the ESU (for example, spawning gravels, good water quality and appropriate water quantity, accessible side channels, sufficient forage species) because these features enable spawning, rearing, migration, and foraging behaviors essential for survival and recovery. Specific types of sites, and the features associated with them, include:

- Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development.
- Freshwater rearing sites with: (i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; (ii) Water quality and forage supporting juvenile development; and (iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.
- Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.
- Estuarine areas free of obstruction and excessive predation with: (i) Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and (iii) Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.
- Nearshore marine areas free of obstruction and excessive predation with: (i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.
- Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

The NMFS defined the lateral extent of designated critical habitat for these salmonids ESUs and DPSs as the width of the stream channel defined by the ordinary high-water line as defined by the COE in 33 CFR 329.11. In areas for which ordinary high-water has not been defined pursuant to 33 CFR 329.11, the width of the stream channel shall be defined by its bankfull elevation. Bankfull elevation is the level at which water begins to leave the channel and move into the floodplain (Rosgen, 1996) and is reached at a discharge which generally has a recurrence interval of 1 to 2 years on the annual flood series (Leopold et al., 1992). Such an interval is commensurate with nearly all of the juvenile freshwater life phases of most salmon and steelhead species. Therefore, it is reasonable to assert that for an occupied stream reach this lateral extent is regularly "occupied." Moreover, the bankfull elevation can be readily discerned for a variety of stream reaches and stream types using recognizable water lines (e.g., marks on rocks) or vegetation boundaries (Rosgen, 1996).

In designating critical habitat in estuarine and nearshore marine areas, NMFS determined that extreme high water is the best descriptor of lateral extent of critical habitat for those areas. For nearshore marine areas NMFS focused particular attention on the geographical area occupied by the PS ESUs (Chinook salmon and Hood Canal summer-run chum salmon) because of the unique ecological setting and well-documented importance of the areas' nearshore habitats to these species. The NMFS designated the area inundated by extreme high tide because it encompasses habitat areas typically inundated and regularly occupied during the spring and summer when juvenile salmon are migrating in the nearshore zone and relying heavily on forage, cover, and refuge qualities provided by these occupied habitats. While critical habitat must contain one or more PCE, this does not mean that all PCEs are present, or that the PCEs present are functioning optimally.

On September 2, 2005 (70 FR 52630), NMFS designated critical habitat for PS Chinook salmon, Hood Canal summer run chum salmon, and Lake Ozette sockeye salmon. Watersheds within designated critical habitat, otherwise called Fifth-field Hydrologic Unit Codes (HUCs) have been ranked as to the conservation value they provide to each listed species they support; conservation rankings are high, medium, or low. To determine the conservation value of each watershed to ESU viability, CHARTs 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).

The PS Chinook salmon ESU has 61 freshwater and 19 marine areas within its range. Of the freshwater watersheds, 41 are rated high conservation value, 12 low conservation value, and 8 received a medium rating. Of the marine areas, all 19 are ranked with high conservation value. Critical Habitat for PS Chinook salmon was designated in Clallam, Jefferson, King, Mason, Pierce, Skagit, Snohomish, Thurston, and Whatcom counties (Figure 5). The Hood Canal Summer-run Chum salmon ESU has 47 watersheds. Of these, 30 are ranked with high conservation value, 13 medium value, and 4 with low value for conservation. Critical Habitat for Hood Canal summer-run chum salmon was designated in Clallam, Jefferson, Kitsap, and Mason counties (Figure 6). Areas outside the geographical area presently occupied by a species are designated as critical habitat only when a designation limited to the present range would be inadequate to ensure the conservation of the species (50 CFR 424.12). At the time of this consultation, the Hood Canal summer-run chum salmon ESU is the only ESU/DPS for which presently unoccupied habitat was designated as critical habitat. This habitat includes approximately 8 miles (12.9 km) of unoccupied (but historically utilized) stream reaches determined to be essential for the conservation of this ESU. The Ozette Lake Sockeye salmon ESU is limited the Ozette Lake subbasin, a single watershed located in Clallam County, Washington, in the northwest corner of the Olympic Peninsula (Figure 7). The watershed encompasses approximately 101 mi^2 and approximately 317 miles of streams; Ozette Lake is a dominant feature of the watershed. Fish distribution and habitat use type data from the Washington Department of Fish and Wildlife (WDFW) identify approximately 40 miles of occupied riverine/estuarine habitat in this watershed (WDFW 1993). In addition, Ozette Lake covers approximately 12 square miles and contains important spawning beaches and rearing areas. The CHART concluded that all of these occupied areas have high conservation value. The PS steelhead DPS does not have critical habitat designated at this time.

Puget Sound Chinook salmon habitat was designated as critical in Clallam, Jefferson, King, Mason, Pierce, Skagit, Snohomish, Thurston, and Whatcom counties. HUC conservation rankings appear in the Figure 5 below.

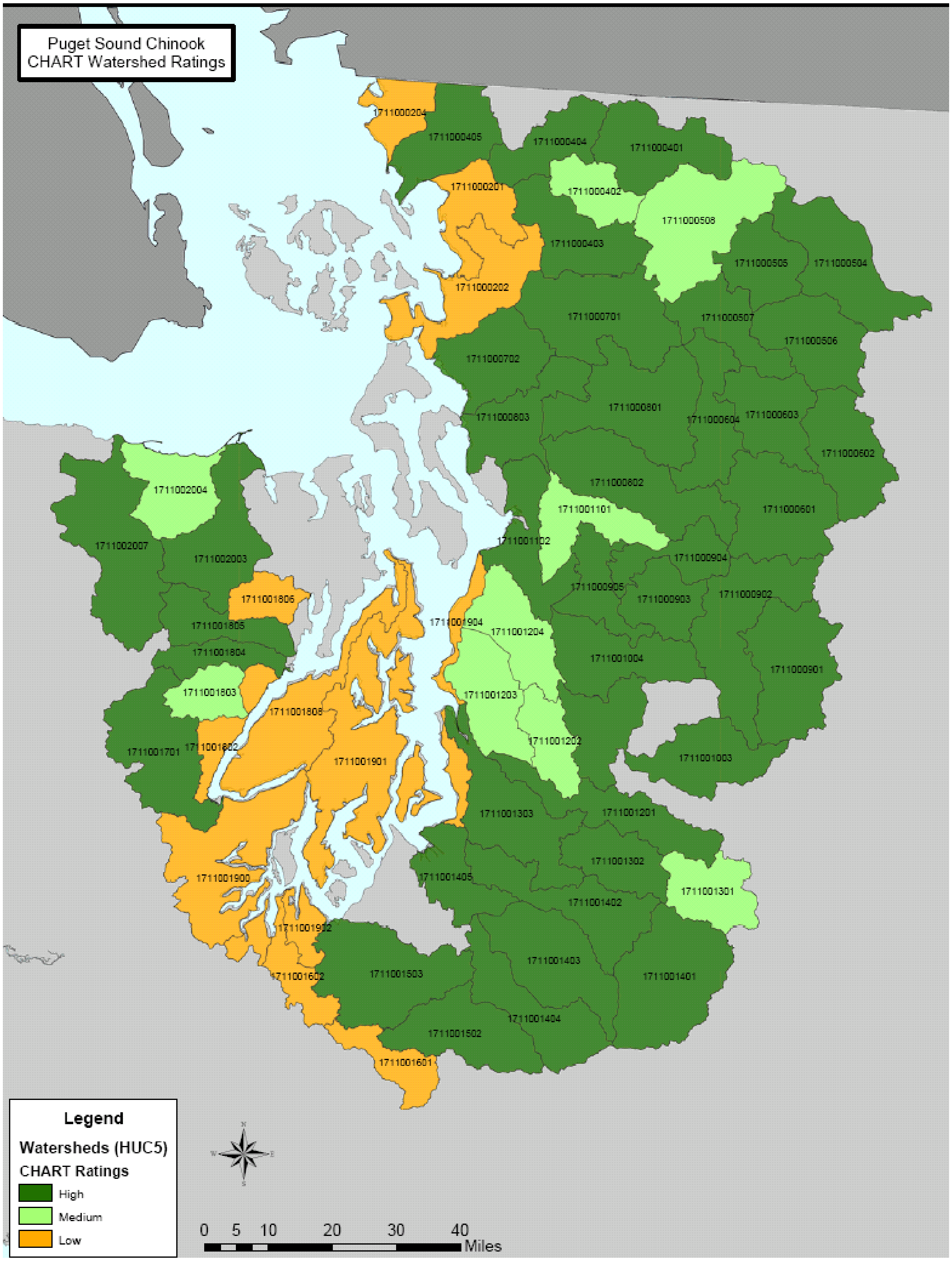


Figure 5. CHART ratings for Puget Sound 5th Field Watersheds

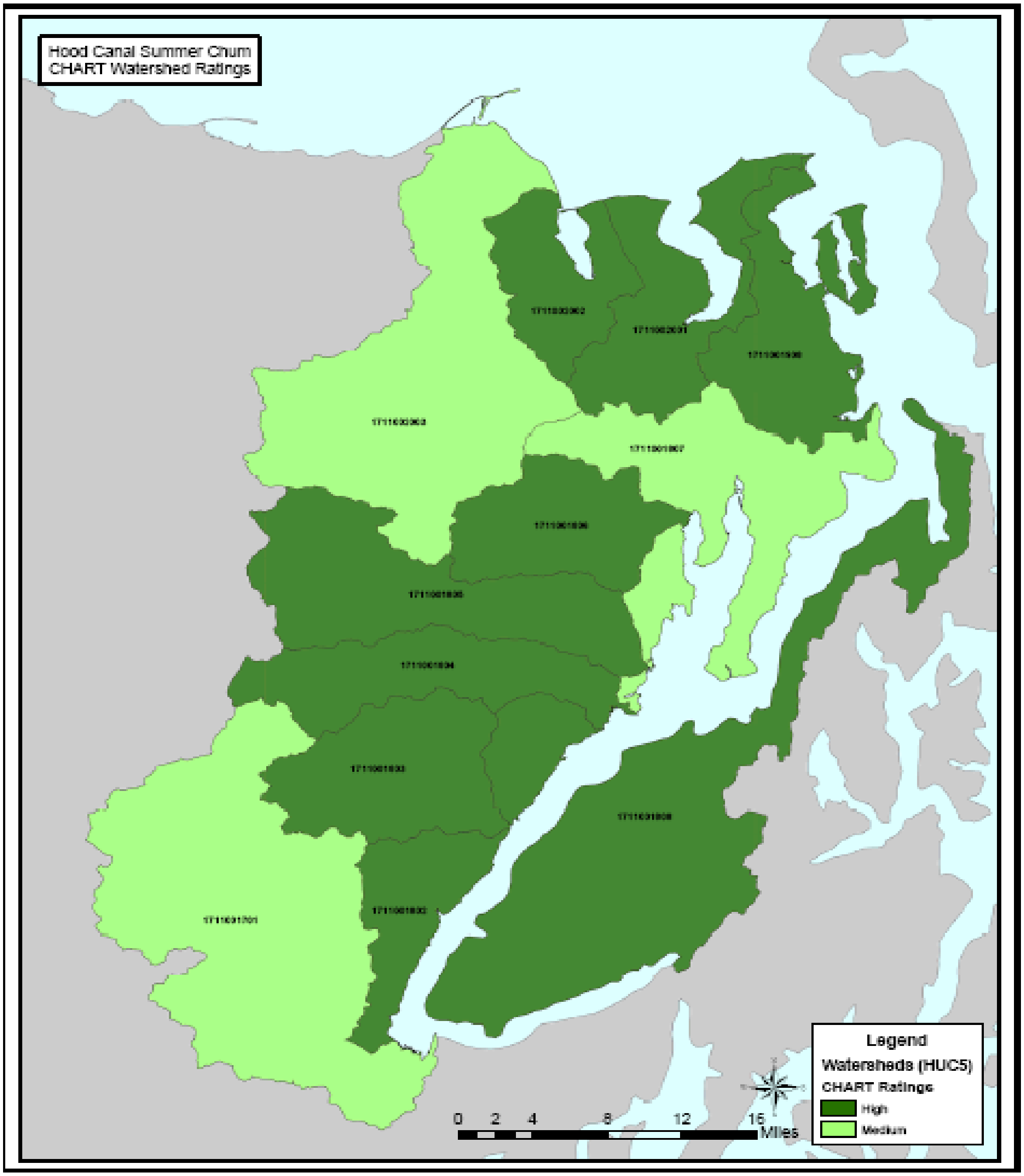


Figure 6. CHART ratings for Hood Canal 5th Field Watersheds

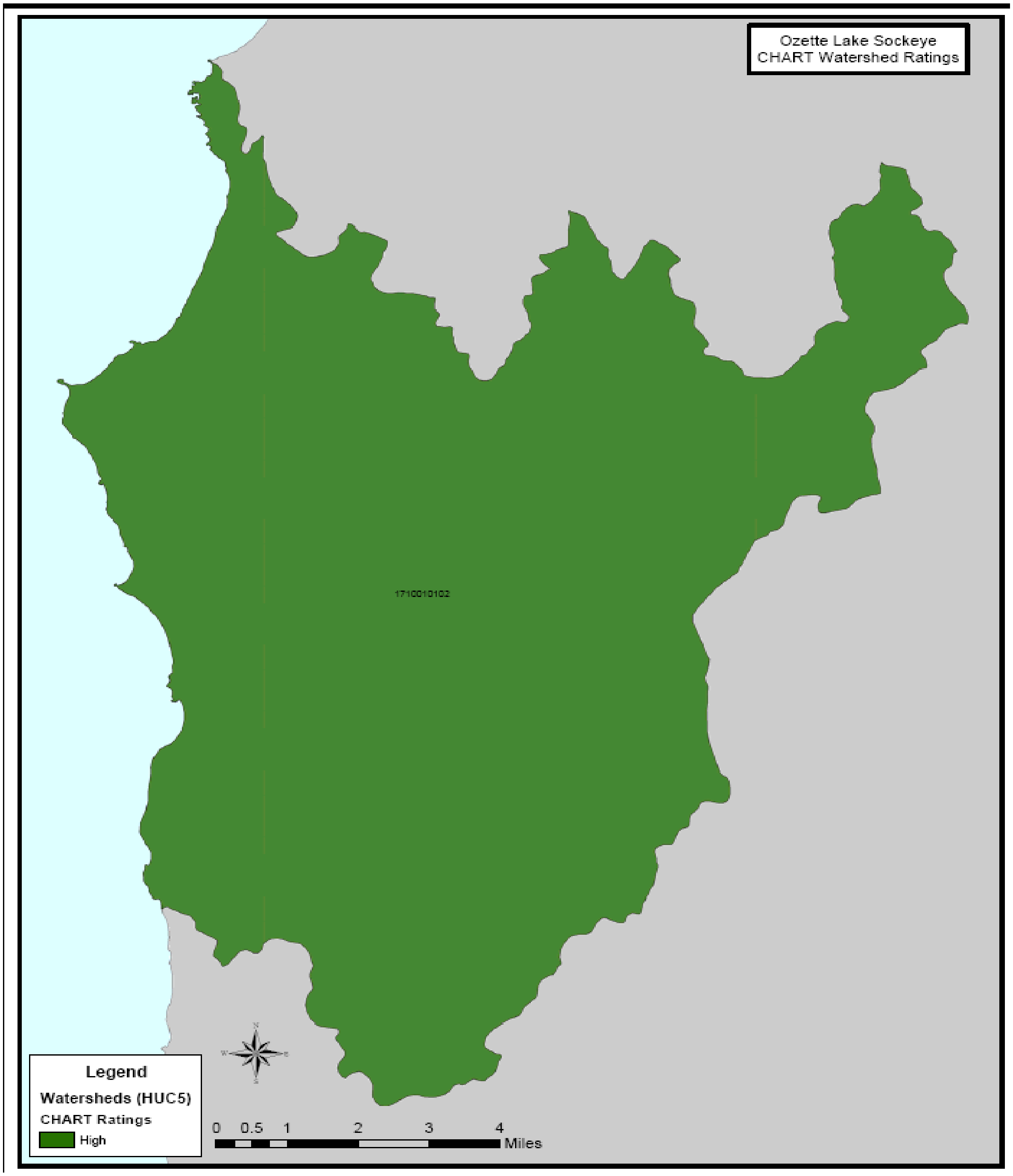


Figure 7. CHART rating for Lake Ozette Watershed.

Condition of Primary Constituent Elements of Puget Sound Chinook Salmon Critical Habitat. Puget Sound Chinook salmon Critical Habitat Conditions: All salmonid PCEs of freshwater (spawning, rearing, and migratory lifestages), estuarine and near shore marine (juvenile development and growth) critical habitat have been degraded, throughout the Puget Sound region, some PCEs more severely impaired than others:

Shoreline habitat - At least 33 percent of Puget Sound Shorelines have been modified with bulkheads or other armoring. The number of piers and docks in Puget Sound is 3,500; the number of small boat slips 29,000; and the number of large ship slips is 700, each a source of structure and shade which can support predator fish, interfere with juvenile salmonid migration, diminish aquatic food supply, and is a potential source of water pollution from boating uses.

Floodplain and off-channel habitat - Most devastating to the long term viability of salmon has been the modification of the fundamental natural processes which allowed habitat to form, and recover from disturbances such as floods, landslides, and droughts. Vegetation removal has also altered the hydrologic system in many watersheds, affecting the watershed's retention of moisture and increasing the magnitude and frequency of peak and low flows. Wetlands play an important role in hydrologic processes, as they store water which ameliorates high and low flows. Roughly 73 percent of the wetlands in major deltas of Puget Sound rivers have been lost in the last 100 years.

Estuarine habitat - Before 1900, 4,000 acres of tidal marshes and mudflats once existed where Harbor Island and the East and West Waterways now stand in Elliott Bay, Seattle. Throughout Puget Sound, 290 "pocket estuaries" formed by small independent streams and drainages have been identified; of these 75 are stressed by urbanization.

Appropriate biotic interaction - More than 40 aquatic nuisance species currently infest Puget Sound. In 2003, Spartina species infested 770 acres of Puget Sound.

Water Quality - There are 972 municipal and industrial wastewater dischargers into the Puget Sound Basin, permitted by the Washington Department of Ecology. Of these, 180 permit holders had specific permission to discharge metals, including mercury and copper, which affect olfaction in a manner that interferes with critical behaviors, such as predator avoidance, homing to natal streams, and spawning, as well as impacting fish health at sub-lethal degrees. Over 1 million pounds of chemicals were discharged to Puget Sound in 2000 by the 20 industrial facilities that reported their releases to the Environmental Protection Agency (EPA). An estimated 500,000 on-site sewage systems are estimated to occur in the Puget Sound basin. Sixteen major (greater than 10,000 gallons) spills of oil and hazardous materials occurred in Puget Sound between 1985 and 2001, plus 191 smaller spills occurred from 1993 to 2001, releasing a total of more than 70,000 gallons. More than 2,800 acres of Puget Sound's bottom sediments are contaminated to the extent that cleanup is warranted.

Condition of Primary Constituent Elements of Hood Canal Summer Run Chum Critical Habitat: In freshwater and estuarine areas numerous PCEs are degraded. In spawning areas, the largest concern is that amount of near-adjacent floodplain (off channel, and backchannel and oxbow type habitat) is limited in availability and quality, and natural cover provided by riparian vegetation is diminished throughout freshwater habitat. In the estuarine areas both migration and rearing PCEs of juveniles are impaired by loss of functional floodplain areas necessary for growth and development of juvenile chum salmon.

Condition of Primary Constituent Elements of Lake Ozette Sockeye Salmon Critical Habitat: Limiting factors hypothesized as having high impact particularly on beach spawners: poor quality spawning habitat that decreases survival in the incubation-to-emergence life stage, and predation on adults, eggs, and newly emerged fry. Moderate impact: seasonal lake level changes, water quality issues, including turbidity and fine sediment, and competition for the good quality spawning habitat, which can result in redd superimposition and decreased egg-to-fry survival. Limiting factors hypothesized as having high impact particularly on tributary spawners: fine sediments, unstable channel, and other water quality issues that reduce spawning habitat quality and result in decreased egg-to-fry survival.

Further and more site specific details about the condition salmonid habitat, including designated critical habitat, appear in the Environmental Baseline section of this Opinion.

Puget Sound steelhead do not have critical habitat designated at this time.

Critical Habitat Designated for Southern Resident Killer Whales

The final designation of critical habitat for the SRKW DPS was published on November 29, 2006 (71 FR 69054). Critical habitat consists of three specific areas: (1) the Summer Core Area in Haro Strait and waters around the San Juan Islands; (2) Puget Sound; and (3) the Strait of Juan de Fuca. These areas comprise approximately 2,560 square miles of marine habitat. Based on the natural history of the Southern Residents and their habitat needs, NMFS identified the following physical or biological features essential to conservation: (1) Water quality to support growth and development; (2) Prey species of sufficient quantity, quality and availability to support individual growth, reproduction and development, as well as overall population growth; and (3) Passage conditions to allow for migration, resting, and foraging.

This discussion and the Environmental Baseline section provide the context for our analysis of the likely effects of the proposed action on SRKWs' critical habitat. In addition, this section discusses the threats presently affecting the habitat features, which inform our determination of whether any additional risk will "adversely modify" SRKW critical habitat. The effects of the proposed action on PCE-2 (prey) would be expected in all three specific areas of designated critical habitat.

Water Quality Primary Constituent Element. Water quality in Puget Sound in general is degraded as described in salmonid sections of the Opinion, and in the Puget Sound Partnership Recommendations (Puget Sound Partnership 2006). For example, toxins in Puget Sound persist and build up in marine organisms including Southern Residents and their prey resources, despite bans in the 1970s of some harmful substances and cleanup efforts since.

The primary concern for direct effects on water quality is from oil spills (although oil spills can also have long-lasting impacts on other habitat features). The EPA and U.S. Coast Guard oversee the Oil Pollution Prevention regulations promulgated under the authority of the Federal Water Pollution Control Act. There is a Northwest Area Contingency Plan, developed by the Northwest Area Committee, which serves as the primary guidance document for oil spill response in Washington and Oregon. In 2007 the Washington State Department of Ecology published a new Spill Prevention, Preparedness, and Response Program Annual Report describing recent accomplishments and declining trends in spill incidents per transit (WDOE 2007).

Prey Quantity, Quality, and Availability Primary Constituent Element. As discussed above under human impacts, most salmon stocks throughout the Northwest are at fractions of their historic levels. Beginning in the early 1990s, 30 ESUs of salmon and steelhead in Washington, Oregon, Idaho, and California were listed as threatened or endangered under the ESA. Historically, overfishing was a major cause of decline. More recently, the major cause is loss of freshwater habitat. Poor ocean conditions over the past two decades have reduced populations already weakened by the degradation and loss of freshwater and estuary habitat, fishing, hydropower system management, and hatchery practices.

Contaminants and pollution in Puget Sound also affect the quality of SRKW prey. Contaminants enter marine waters and sediment from numerous sources, but are typically concentrated near areas of high human population and industrialization. Once in the environment these substances proceed up the food chain, accumulating in long-lived top predators like SRKWs. Chemical contamination of prey is a potential threat to SRKW critical habitat, despite the enactment of modern pollution controls in recent decades, which were successful in reducing, but not eliminating, the presence of many contaminants in the environment. In addition, vessels and sound may reduce the effective zone of echolocation and reduce availability of fish for the whales in their critical habitat (Holt 2008).

Passage Primary Constituent Element. Southern Residents are highly mobile and use a variety of areas for foraging and other activities, as well as for traveling between these areas. Human activities can interfere with movements of the whales and impact their passage. In particular, vessels may present obstacles to whale passage, causing the whales to swim further and change direction more often, which potentially increases energy expenditure for whales and impacts foraging behavior.

Environmental Baseline

The "environmental baseline" reflects the effects of past and ongoing human and natural factors in the action area and allows a comparison between the future status of the species with and without the proposed action. 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). This section describes the baseline conditions and the effect of these conditions on listed species.

Human activities have degraded extensive areas of Chinook salmon and steelhead spawning and rearing habitat in Puget Sound. Development activities have limited access to historical spawning grounds and altered downstream flow and thermal conditions. Urbanization effects many parts of the aquatic environment. It has caused direct loss of riparian vegetation and soils, significantly altered hydrologic and erosional rates and processes by creating impermeable surfaces (roads, buildings, parking lots, sidewalks etc.), and polluting waterways. Watershed development and associated urbanization throughout the Puget Sound, Hood Canal, and Strait of Juan de Fuca regions have increased sedimentation, raised water temperatures, decreased LWD recruitment, decreased gravel recruitment, reduced river pools and spawning areas, and dredged and filled estuarine rearing areas (Bishop and Morgan 1996). Large areas of lower river meanders (formerly mixing zones between fresh and salt water) have been channelized and diked for flood control and to protect agricultural, industrial and residential development. Habitat degradation in upstream areas has exacerbated flood events in these areas with adverse effects on Chinook salmon populations (Shared Strategy 2005).

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. 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. There are substantial habitat blockages by dams in the Skagit and Elwha River basins, and minor blockages, including impassable culverts, throughout the region. The Washington State Salmon and Steelhead Stock Inventory (SASSI) (WDF and WWTIT 1993) identified habitat problems, including flooding, unstable soils, and poor land management practices, for most stocks in this region. In general, habitat has been degraded from its pristine condition, and this trend is expected to continue with further population growth and resultant urbanization in the Puget Sound region.

Most devastating to the long term viability of salmon has been the modification of the fundamental natural processes that allow habitat to form, and recover from disturbances such as floods, landslides, and droughts. So critical are these driving processes that Spence et al. (1996) state that " ...salmonid conservation can be achieved only by maintaining and restoring these processes and their natural rates." Among the physical and chemical processes basic to habitat formation and salmon persistence are floods and droughts, sediment transport, heat and light, nutrient cycling, water chemistry, woody debris recruitment and floodplain structure (Shared Strategy 2005). The development of land for agricultural purposes has resulted in reductions in river braiding, sinuosity, and side channels through the construction of dikes, hardening of banks with riprap, and channelization. Constriction of the rivers, increases the likelihood of gravel scour during high flow events and the dislocation of rearing juvenile steelhead. Much of the steelhead habitat has been lost, including overwintering habitat and side channel areas that existed before European immigration (Beechie et al. 2001, Collins and Montgomery 2002, Pess et al. 2002).

Floodplains are relatively flat areas adjacent to larger streams and rivers that are periodically inundated during high flows. In a natural state, they allow for the lateral movement of the main channel and provide storage for floodwaters, sediment, macroinvertebrate production (food), and LWD. Floodplains generally contain numerous sloughs, side-channels, and other features that provide important spawning habitat, rearing habitat, and refugia during high flows (Benda et al., 2001), and may be used by rearing salmonids for long periods of time depending upon the species. 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 1998). 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).

Functional floodplains also moderate high flows by substantially increasing the area available for water storage (Ziemer and Lisle 2001). Water seeps into the groundwater table during floods, recharging wetlands, off-channel areas, shallow aquifers, and the hyphorheic zone. Wetlands, aquifers, and the hyphorheic zone in turn release water to the stream during the summer months through a process called hydraulic continuity (Water Facts Group 1997). This process ensures adequate flows for salmonids during the summer months, and reduces the possibility of high-energy flood events that can destroy salmonid redds (nests) during the winter months. (Smith 2005).

Human influence has degraded watersheds and wetlands, diminished the amount of available floodplain, and degraded remaining intact floodplains throughout Puget Sound. Floodplain impacts include the direct loss of aquatic habitat from human activities (filling), disconnection of main channels from floodplains with dikes, levees, revetments, and roads, and reduction of lateral movement of flood flows with dikes, roads, levees, and revetments. For example, King County is responsible for maintaining 119 miles of levees that line six river systems. In many stretches the levees are a mosaic of bushes and shrubs, including invasive plant species, that have low ecological value for salmon habitat. Removing vegetation from levees decreases riparian functions that enhance salmonid habitat.

The FEMA's NFIP is not the only regulatory program that affects floodplain development. The COE 404 program regulates fill in wetlands within the 100 year floodplain. However, the COE recently removed a previous restriction on using NWPs for permanent placement of fill in the 100 year floodplain. This action was taken to "harmonize" with NFIP regulatory standards to allow such fill.

The State of Washington also has regulatory authority to influence Federal actions that occur in floodplain wetlands throughout the state via section 401 of the Federal CWA, and to regulate activities that could impair fish life through the State's Hydraulic Code. However, the Washington State Department of Ecology, which has regulatory authority under the Shoreline Management Act, the state's CWA, floodplain management regulatory authority, and houses the NFIP State coordinator, is not authorized to adopt any statewide regulation more strict than the minimum criteria of the NFIP. Under RCW 86.16.031, the Department of

Ecology shall "…(6) Establish minimum state requirements that equal minimum Federal criteria for the national flood insurance program."

Local governments also have regulatory control over use of 100-year floodplains,[14] through Shoreline Management Master Programs, GMA critical areas ordinances, grade and fill permits, and other land use or zoning criteria. Of the local governments in Washington State that have floodplain lands in their jurisdiction, a majority (90 percent) have adopted only the minimum standards of the NFIP as their regulatory requirement for floodplain construction. Within the Puget Sound region, the following are NFIP participating communities, and those relying exclusively on the NFIP minimum criteria are noted in italics:

[14] RCW 86.16.020 Flood plain management regulation: Statewide flood plain management regulation shall be exercised through: (1) Local governments' administration of the national flood insurance program regulation requirements, (2) the establishment of minimum state requirements for flood plain management that equal the minimum federal requirements for the national flood insurance program, and (3) the issuance of regulatory orders.

List of Floodplain Communities by County

Clallam County - Forks, Lower Elwha Tribe, *Port Angeles, Quilueute Tribe, Sequim*

Island County - Coupeville, Langley, Oak Harbor

Jefferson County - Port Townsend, *Hoh Tribe*

King County - Algona, *Auburn, Bellevue*, Black Diamond, *Bothell, Burien*, Carnation, *Covington, Des Moines*, *Duvall*, Enumclaw, Federal Way, *Issaquah, Kenmore, Kent, Kirkland*, Lake Forest Park, *Medina, Mercer Island*, Milton, Normandy Park, *North Bend*, Pacific, *Redmond, Renton, Sammamish, Seattle, Shoreline*, Skykomish, *Snoqualmie*, Tukwila, *Woodinville*

Kitsap County - Bainbridge Island, Bremerton, Port Orchard, Poulsbo

Mason County - *Shelton, Skokomish Tribe*

Pierce County - *Bonney Lake*, Buckley, *Edgewood, Fife*, Fircrest, Gig Harbor, *Lakewood,* Orting, Puyallup, Roy, South Prairie, Steilacoom, Sumner, Tacoma, University Place, Wilkeson

San Juan County - None

Skagit County - Anacortes, *Burlington,* Concrete, Hamilton, *LaConner,* Lyman, *Mount Vernon*, Sedro Woolley

in Snohomish County - *Arlington*, Brier, *Darrington, Edmonds*, Everett, *Gold Bar*, Granite Falls, Index, Lake Stevens, *Lynnwood*, Marysville, *Monroe, Mountlake Terrace*, Mukilteo, Snohomish, *Stanwood, Sultan*

Thurston County - *Bucoda*, Lacey, *Olympia*, Rainier, *Tenino,* Tumwater, Yelm

Whatcom County - Bellingham, Blaine, *Everson*, Ferndale, Lummi Tribe, Lynden, Nooksack, *Sumas*

(Pers. Comm. Dan Sokol, Washington State NFIP Coordinator, 6/9/2006)

Although multiple levels of regulatory authorities affect floodplain function and development, the analysis of effects that will be presented at the effects section, below, is limited to the direct and indirect effect of FEMA's implementation of the NFIPs' minimum criteria, CRS, Mapping Program, and any activities interrelated and interdependent with these components.

Out of 41 WRIAs with overall floodplain ratings in Washington State (Smith 2005), 71 percent had generally poor floodplain conditions. Fair-poor conditions accounted for 10 percent of the rated WRIAs, while fair conditions comprised only 5 percent. Good and good-fair conditions were 12 and 2 percent of the WRIAs, respectively (Figure 8). Smith (2005) also compared data for floodplain condition on Type 1 streams (the largest streams in the basin, defined as the shorelines of the state) only within a WRIA. Overall, this analysis slightly downgraded the results with fewer good ratings and more fair or fair-poor ratings (Figure 9). Comparing overall results to just Type 1 streams indicates whether degraded floodplain conditions are present in all types of streams, mostly the larger streams, or mostly the smaller streams. Floodplain problems in the larger streams will impact all species, while impacts in small streams will have greater effects on coho, chum, and steelhead.

Figure 8. Floodplain ratings by WRIA across Washington State.

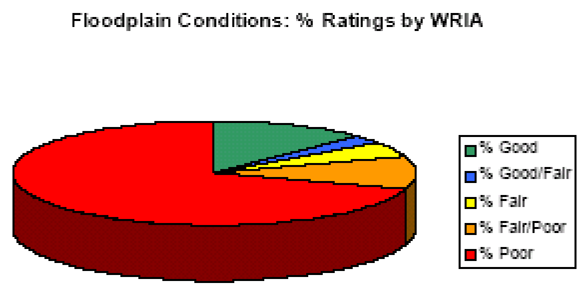
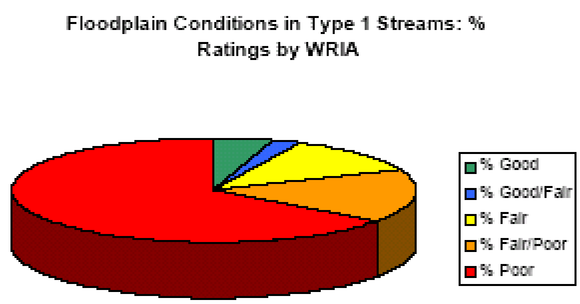


Figure 9. Floodplain conditions in Type 1 streams by WRIA.



Floodplain Conditions and Land Use. All of the basins that rated fair or good for floodplain conditions consisted of 65 percent or more forestland. In contrast, agriculture-dominated WRIAs (25 percent or greater) were all rated either poor or poor-fair for overall floodplain conditions. Urban lands also had floodplains with poor ratings, as basins with 15 percent or greater urban lands only had poor or poor-fair floodplains. All of the fair or good-rated WRIAs were associated with a low human population density of less than 1 person per acre.

However, some basins with low human population densities also had poor floodplain conditions.

Besides floodplain conditions, other habitat factors limit salmon productivity as summarized in .34 below. Historic river simplification has been a significant factor over time, creating systemic habitat loss and degradation to river valleys in the last 200 years (Beechie et al., 2001; Pess et al., 2003). In addition to the immense reduction in land area once linked to fluvial processes, river ecosystems underwent a massive simplification in their physical complexity (Abbe et al., 2003; Collins et al., 2003). Less than ten percent of the wetlands and floodplains once associated with lowland alluvial rivers of the Puget Sound basin remain intact (Collins and Montgomery 2002). Channel simplification resulted from aggressive efforts to improve navigation, flood control, "fish passage," agricultural and industrial development of floodplain lands, and the development of hydroelectric and water supply projects. Historic channel alterations included clearing channels of thousands of snags and logjams, construction of levees, revetments and dams. Ditching, diking, and dredging activities in floodplains, primarily found in urban and agricultural regions, were associated with 73 percent of the coho salmon rearing habitat losses in the Skagit River system (Beechie et al., 1994). Another widespread activity that had a significant impact on Pacific Northwest rivers was the clearing of snags and logjams (Collins et al., 2002, Abbe, et al 2003).

WRIA number and names	**Floodplain Condition**	**Streambank and bed condition**	**Riparian condition**	**Impervious Surface**	**Hydrology High flows / low flows**
1 Nooksack	poor	poor	poor	good	Poor / poor below falls
2 San Juan	Na	Data gap	poor	Data gap	data gap / poor
3 L. Skagit/ Samish	poor	Data gap	poor	good	Poor / data gap
4 Upper Skagit	good	Data gap	good	good	Good / data gap
5 Stillaguamish	Poor	Data gap	Poor	Data gap	Poor / poor
6 Island	Poor	Data gap	Poor	Data gap	data gap / data gap
7Snohomish	Poor	Data gap	poor	fair	fair / poor
8 Cedar/ Sammamish	Poor	Fair	Poor	poor	Poor / poor
9 Duwamish/ Green	Poor	Poor	Poor	Poor in lower river	Poor / poor
10 Puyallup/ White	Good (poor in Lower Puyallup)	Poor	Poor/fair	Poor in lower Puyallup	Poor / poor lower
11Nisqually	Good to	Fair to good	Fair	Data gap	Good / good

	fair				
12 Chambers/ Clover	Poor	Data gap	Poor	poor	Poor / poor
13 Deschutes	Data gap	Poor	Poor	Data gap	Poor / data gap
14 Kennedy/ Goldsborough	Poor	Poor	poor	Data gap	data gap / data gap
15 Kitsap	Good to poor	Fair to good	Fair overall	Data gap	Poor / data gap
16 Skokomish/ Dosewallips	Poor	Good to poor	Good to poor	good	Good / data gap
17 Quilcene/ Snow	Poor	Good	poor	good	Poor / poor
18 Elwha/ Dungeness	Poor	Poor	Good overall	Data gap	Good / poor
20 Soleduck/Hoh	Poor	Poor	poor	Likely good	fair / data gap

Table 3. Habitat Limiting Factors, Puget Sound Region (Washington Conservation Commission 2005)

Another factor contributing to the environmental baseline is climate variability. Salmon populations, particularly early life history stages, are affected by climate variability in marine and freshwater environments (NMFS 2008c). These climate variations include effects from El Niño and La Niña, the Pacific Decadal Oscillation (Mantua et al. 1997), and past and on-going climate change. Climate change, and the related warming of global climate, has been well documented in the scientific literature (IPCC 2007; ISAB 2007). Evidence includes increases in average air and ocean temperatures, widespread melting of snow and glaciers, and rising sea level. Observations consistent with a changing global climate have already been documented in changes of species ranges and in a wide array of environmental trends (ISAB 2007; Hari et al. 2006; Rieman et al. 2007). In the northern hemisphere, ice cover durations over lakes and rivers have decreased by almost 20 days since the mid-1800's. These changes in snow pack decrease ocean productivity in the marine environment and streamflows in the freshwater environment, decreasing survival of salmon early life stages (Scheurell and Williams 2005, ISAB 2007). For many species, their ranges have shifted pole-ward and upward in elevation. For cold-water associated salmonids in mountainous regions, where upper distribution is often limited by impassable barriers, an upward thermal shift in suitable habitat can result in a reduction in range, which in turn can lead to a population decline (Hari et al. 2006).

Temperatures in most major rivers in Western Washington have markedly increased over the past 5 to 25 years. Pacific salmon rely on colder water for spawning and incubation, and increasing temperatures are likely to adversely affect the availability of suitable cold water habitat. Ground water temperature has been shown to strongly influence the distribution of Pacific salmon species. Ground water temperature can also be linked to selection of spawning sites and has been shown to influence the survival of embryos and early juvenile rearing (Spence et al. 1996, McCullough 1999).

Climate change is already affecting the frequency and magnitude of fires, especially in the warmer, drier regions of the west. To further complicate our understanding of these effects, the forest type that naturally occurs in a particular region may or may not be the forest that will be responding to the fire regimes of an altered climate (Bisson et al. in press). In several studies related to the effect of large fires on fish populations, Pacific salmon and steelhead appear to have adapted to past fire disturbances through mechanisms such as spatial dispersal and genetic plasticity. However extreme fire events may have substantially changed watershed conditions for salmon and steelhead and other aquatic species, e.g., habitat loss, simplification and fragmentation of aquatic systems, and the introduction and expansion of exotic species (Bisson et al. in press).

Also included in the baseline for salmonids statewide are Federal activities that have proceeded since ESA listings, with the benefit of consultation with NMFS. Since the listing of salmonids in Washington State, NMFS Habitat Conservation Division has formally consulted on approximately 213 Federal actions affecting listed fish species in the Puget Sound region. All of these consultations were triggered because of likely adverse effects to listed salmonids. All formal consultations concluded with an exemption of incidental take.

Environmental Condition at the Site Analysis Scale

For the purposes of accurately evaluating habitat changes and species effects of NFIP implementation, NMFS will focus its analysis to specific geographic areas associated with several specific populations that help comprise the larger ESUs and DPSs. Appendix 1 summarizes the baseline conditions at the location of 10 salmon populations selected to represent the PS ESU and DPS. The ten salmon populations were chosen as representative of the multiple populations that make up the PS Chinook salmon and Steelhead (their range is shown in Figure 10 below), and Hood Canal summer run chum populations. Populations were chosen in order to represent the range of variability across these watersheds in the following factors: 1) human population growth rates in NFIP communities adjacent to waterbodies where the listed species resides, 2) viability parameters for salmon populations (including differences in abundance, productivity, spatial structure, and diversity), and 3) high priority salmonids populations for recovery. However, given limited population specific information on PS steelhead, populations were chosen where information was most abundant. The effects at the ESU/DPS scale are ultimately the basis for the Jeopardy and Critical Habitat analyses. For these purposes, then, NMFS examines the baseline condition at these smaller scales in order to aggregate the effects of the action with the effect of the baseline condition, and then extrapolates the small-scale effects to determine the influence on survival, recovery, and critical habitat conservation value, at the larger scale.

ESA-Listed Puget Sound Steelhead & Chinook

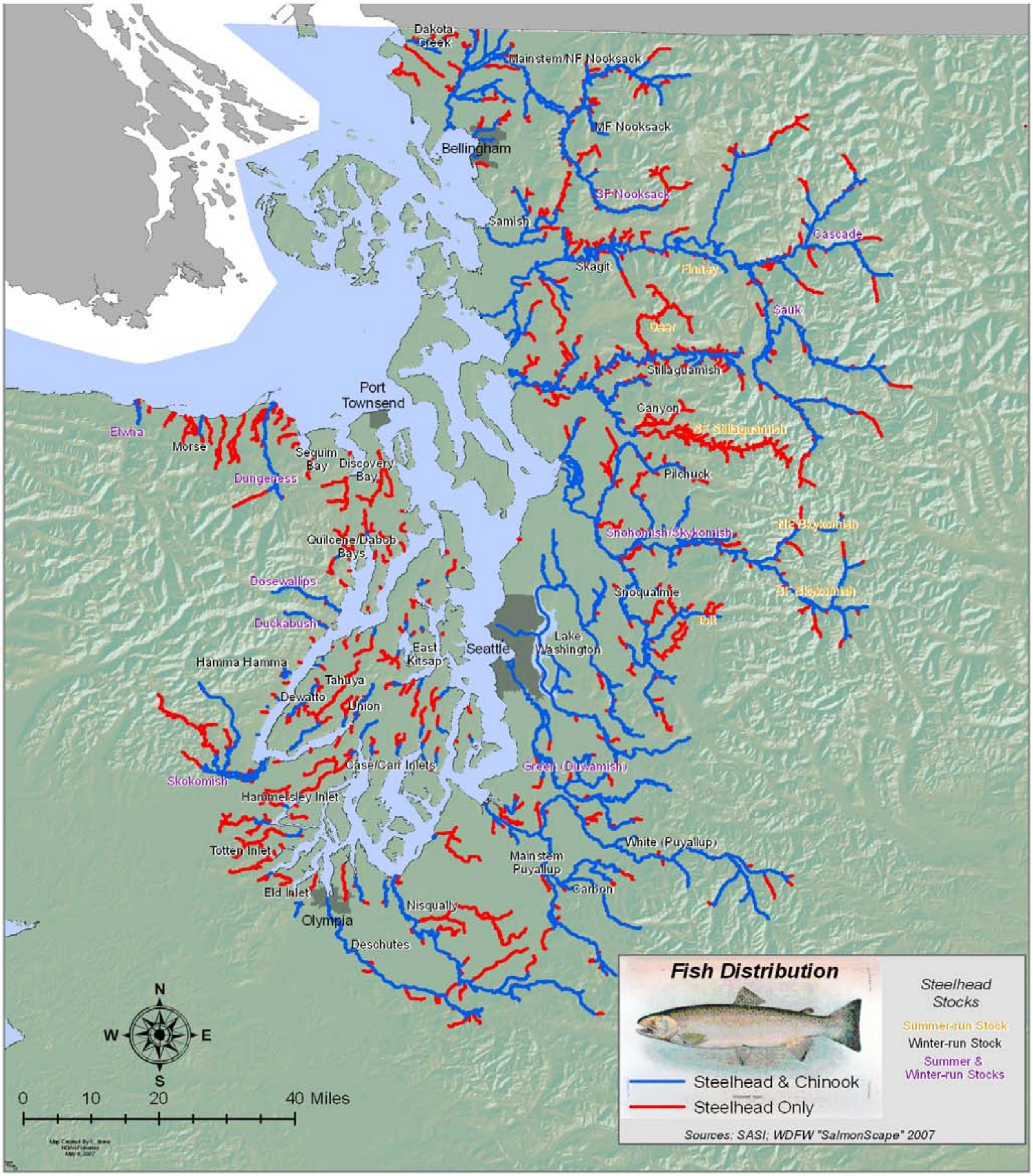


Figure 10. Presence of Chinook Salmon and Steelhead in Puget Sound .

Conditions in the White River/Lower Puyallup. Fish Access: Chinook salmon access to spawning and rearing habitat is limited by hydroelectric power projects as well as numerous flood control diversions, dikes, and stream channelization projects through the Puyallup, White and Carbon River systems and many of the tributaries. The Mud Mountain Dam and White River Hydroelectric Project eliminated 9.6 miles of mainstem spawning and rearing habitat. Returning adult salmon are trapped at the diversion dam and trucked upstream of the Mud Mountain Dam impoundment where they are released back into the White River at RM 33.9. About 70 percent of the known culverts within the Puyallup river watershed in 1999 acted as partial barriers to salmon migration upstream and downstream; about 40 percent were determined to be complete barriers. EDT modeling is being used to analyze effects of removing some of the culverts.

Sediment transport: Mud Mountain Dam disrupts the natural delivery of sediments by impounding fine sediments during high flow and/or high load periods and discharging them for prolonged periods during lower flow periods. This causes increased localized deposition and results in the reduction of spawning area and destruction of redds. Sediment deposition in Dumas Bay, a 253 acre intertidal sandflat habitat integral to the nearshore ecosystem slightly north of Federal Way, is occurring at an accelerated rate due to increases in peak flows of Lakota and Joes Creeks, shoreline armoring, clearing of vegetation on slopes, and wastewater treatment plant discharges.

Lack of estuarine and nearshore habitat: Out of more than 5,900 acres of estuary habitats that historically existed at the head of Commencement Bay, only about 200 acres remain due to dredging, filling and activities associated with development. The substantial loss of estuary habitat support for the Chinook populations has reduced capacity, productivity, and diversity. Contaminated sediments which have further limited the nearshore/estuarine habitat have resulted in additional reductions in Chinook productivity.

Flows: Diversion of flows from the 24 mile bypass reach of the lower White River has reduced spawning and rearing habitat and has disrupted the use of the river as a migratory corridor. Diversion of flows from the ten mile reach of the Puyallup River between the Electron Powerhouse and the dam has also reduced spawning and rearing habitat and disrupted the migration corridor. Periodic manipulations of flows associated with operations of both facilities are believed to result in recurrent fish strandings and kills. Numerous kills have been documented in the White River bypass reach during these flow manipulations. A lack of adequate screening in the diversion dams also impacts salmon. Screens were installed in the White River Diversion and appear to have largely corrected this issue--the effectiveness of the guidance system at Electron is being studied.

Water Quality: Point and non-point source pollution due to industrial and commercial activities, residential development and agriculture adversely impacts water quality. Water quality parameters are exceeded in the vicinity of the White River due to sanitary sewage effluent from the cities of Buckley and Enumclaw. Many of the streams in the basins suffer from combinations of high fecal coliform levels, low dissolved oxygen levels, and other water quality impacts.

Impaired riparian functions and condition: The lack of LWD in the upper Puyallup due to logging and associated road construction and other activities reduces pool quantity and quality, elevates water temperatures, and increases the vulnerability of the stream channels to instability. Habitat in the lower reaches of the mainstem Puyallup River is fragmented and disconnected. Only about 5 percent of the riparian habitat is rated as high quality. Large woody debris from Mount Rainier is typically broken into smaller pieces by the high energy stream and boulder resulting in inadequate in-stream structures that provide resting and feeding areas.

Floodplain processes and off-channel habitat: The loss of floodplain processes and off-channel habitat along the Puyallup, White and Carbon Rivers limits spawning and rearing habitat in the Puyallup. Levees along the Carbon River and Puyallup mainstems have been constructed to protect residential, agricultural and industrial lands from flooding. Downstream of the confluence with the White River, the Puyallup has been described not as a river, but as “a single purpose conveyance system.

Conditions in South Fork Nooksack. Despite the relatively low percentage of land that has been urbanized, there have been significant changes. During the early decades of Euro-American settlement, the lowland forests were logged, and wetlands drained for conversion to agriculture. Subsequently, the river and streams were cleared of logs, first for navigation, then to transport wood, and as a result, there is much less wood today. The river was straightened and its banks armored with rock to more efficiently convey floods and control flood damage to property in the floodplain. The diversion dam was built on the Middle Fork to provide water to the City of Bellingham. The Lummi distributary was cut off over a century ago, and the Nooksack delta grew rapidly into northern Bellingham Bay while eastern Bellingham Bay was filled for industrial development. These changes to the land and water processes have significantly diminished the capacity of the watershed to support salmon including Chinook and bull trout in their historic numbers.

The decline of Chinook salmon in the Nooksack watershed may also have been affected by past harvest and hatchery practices. Harvest, hatchery and habitat factors all are possibly contributing to current low abundances of Chinook salmon. All of these factors are being addressed to recover the salmon. Habitat degradation from human actions is considered the leading cause for the decline of North and South Fork Chinook salmon. Both early Chinook salmon populations have similar rearing and spawning habits. Before going out to sea, two-thirds of the early Chinook salmon move downstream as sub-yearlings to the estuary and marine environments while the other one-third rear in the river or streams and migrate to sea as yearlings. Their migration patterns make them susceptible to ocean harvest. Upon returning from the ocean, the fish can spend as many as 2-4 months holding in freshwater during the summer months before spawning.

Scientists are concerned about negative impacts on fish holding in freshwater prior to spawning because of high water temperatures particularly in the South Fork. Hardening of the riverbanks and the loss of trees along the river edges and on mid-channel islands has caused the channel to change the way it responds to flood events. In some reaches, changes in the channel are thought to increase channel migration rates and bed scour. This disrupts the ability of eggs into the gravel to survive. Stable wood that historically would have been in the river to provide stable islands, maintain deep pools, and protect eggs during flood events is greatly diminished. Recovery is hampered by the limited availability of high quality habitat in the mainstem and forks to support the various salmon life-history stages. There are seven significant habitat factors limiting the Chinook salmon:

1. Instability of channel in the upper and middle portions the Forks,
2. Increased sediment coming from natural and human causes, and changes in how that sediment is transported through the system,
3. Loss of logs and other structures in the Forks and their tributaries that create pools and rearing places for the fish,
4. Levees and dikes mostly in the South Fork and mainstem that constrain the river and eliminate side channels where fish rear and could seek refuge during floods,
5. Obstructions that block fish from key habitats,
6. Changes in the river flow and temperature. The temperature and low summer/fall flows in the South Fork are viewed as a significant challenge to the long term survival of that population.
7. Changes along marine shorelines in Bellingham Bay and in nearshore areas have affected Nooksack and other Puget Sound populations that use these waters.

The low productivity of the freshwater and estuarine habitats created by these factors makes the fish susceptible to changes in ocean conditions, and the populations more vulnerable to harvest and hatchery practices. The very small South Fork population size and hatchery strays to that fork pose additional threat to the wild run. Also, fishing has the potential to significantly impact, if not wipe out the run if extreme care is not taken.

Conditions in the Dungeness. The Dungeness River Area Watershed is located in the northeastern corner of the Olympic Peninsula. The watershed drains 172,517 acres. Mount Constance is the highest point in the watershed (7,743 feet) and forms the southern boundary. Adjacent watersheds are Maiden Creek and the Elwha River on the west, Sequim Bay on the east, and the Dosewallips River on the south. The western portion of the City of Sequim is the only incorporated area in the watershed, however unincorporated areas are located at Carlsborg, Oldtown, Agnew, Sequim Valley and Dungeness. The human population of the watershed is over 13,600. The Dungeness River Area Watershed contains a diverse array of land uses and cover types. Land uses includes pasture, hayland and cropland on both commercial and small farms, residential development scattered throughout the lower watershed, private and public forestland in the upper watershed, as well as a large portion of the Olympic National Park. Current Chinook salmon populations in the Dungeness are a small fraction of what they are estimated to have been in the past. Historically, 11 populations or population components existed in the Dungeness. Additionally, side channel habitat in the lower river, once available for spawning and rearing, has been lost due to diking and other channel changes. Major dikes are located on the east bank from RM 0 -2.6 (the "Corps" dike) as well as RM 7.6 - 8.4 (the Dungeness Meadows dike). Smaller dikes and embankments constructed by property owners are located throughout the lower ten miles of the river. With the increasing human population, the demand for water for irrigation, domestic, and business use has markedly increased. The source for this water is both the Dungeness River and groundwater. Most of the water is diverted from mid-April through September, the same time that Chinook salmon return to the river and begin to spawn. In addition to the increasing demand for fresh water, development is also adding contaminated run-off from lawns, driveways, parking lots, and other urban landscape features, and from farm animals, decaying irrigation ditches, leaky septic systems and other sources. The floodplain of the Dungeness River is severely altered from natural condition from the mouth to the WDFW Hatchery at RM 10.8. Alterations are from diking, floodplain constrictions at bridge sites, and from unnatural rates of channel downcutting or sediment accretion as shown in Figure 11 below. Road crossings at Highway101, Anderson Road, Woodcock Road, and Old Olympic Highway each constrict the channel/floodplain and affect the alignment of the channel within the floodplain upstream of the constriction. In addition, dikes preclude the ability of high flows to access the historic floodplain, utilizing the floodplain to reduce stream energy and to store and transport sediment.

Figure 11. Loss of floodplain access due to diking upstream of Ward Bridge (photo courtesy of Randy Johnson)

Conditions in the Skagit River. At 1,433,205 acres, the Skagit River Watershed is the largest within the ESU, and contributes roughly one-third of all freshwater inflow to Puget Sound. In general, its headwaters, small tributaries, and major tributaries (such as the upper Sauk River) feature intact and functioning habitat. The Skagit River system still retains a significant amount of ecological and biological function. Due to the significant amount of remaining habitat complexity, intact process function and high quality habitat the Skagit has the most robust populations in Puget Sound. Nevertheless, the populations are at less than fifty percent of their historic abundance.

The Skagit River, between RM 23 and 25, and RM 36.5 and 39.5 lies within a landscape dominated by agricultural land use with some urbanized centers such as the City of Sedro Woolley and the Town of Hamilton. Management of agricultural and urban lands has degraded salmonid habitat in many areas of the watershed. For the most part, this rearing range is characterized by a relatively wide floodplain and a high level of floodplain disturbance in the section between Sedro Woolley and Hamilton. The Skagit Recovery Plan (Beamer et al. 2005a) identified Cockreham Island (where the site at RM 38.5) as an isolated floodplain. Floodplain disturbances 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.

Habitat within the lower Skagit River offers a fraction of its historic habitat conditions. The loss and simplification of floodplain, off channel, and edge and riparian habitat in the mainstem (above the estuary delta) contributes to a reduction of freshwater rearing capacity for each population (Beamer et al., 2005b). Of the historic mainstem floodplain, 31 percent is lost or inhibited from river access and processes, there has been a 98 percent loss of habitat area (wetland and floodplain forest) in the non-tidal delta, and 85 percent of the remaining non-tidal delta edge habitat has been hydro-modified. The most prominent example of this hydro-modification is the placement of rock riprap, often from the bottom of the stream channel margin to the upper extent of the bank. Upstream of the town of Sedro-Wooley, which is located at river mile 23, 15 percent of mainstem edge habitat has been hydro-modified[15] (Beamer et. al., 2005).

Hydro-modification has eliminated edge habitat complexity and riparian functions in most areas of the lower Skagit. Absent intervention, river and riparian habitat can recover from disturbance events that temporarily compromise or eliminate functions. For instance, riparian vegetation grows back after landslides or fires that destroy vegetation. In the case of the lower Skagit, bank stabilization activities and riparian land use arrest the re-establishment of shrubs and most trees along the river bank, and in turn the formation of edge habitat that provides necessary functions for rearing juvenile Chinook and steelhead. Functioning edge habitat features reduced velocities, refuge from predation, and enhanced feeding opportunities relative to other portions of the channel. Streambank conditions and floodplain connectivity in the action area are degraded by bank armoring, levees, channelization, and other flood control measures. Colonizing riparian vegetation is often cut down in order to reduce perceived flood and bank stabilization risks, as well as to comply with COE policies and remain eligible for some Federal levee protection programs. As such, the natural regeneration and recovery of beneficial habitat conditions along the mainstem is arrested. As a result, buffer widths are narrow and vegetation is mostly immature. Bank armoring has hindered large wood recruitment in the action area, and woody debris generally does not collect or persist along armored banks.

[15] Hydro-modification or hydro-modified is the technical terminology used by Eric Beamer and the Skagit River System Cooperative to describe bank stabilization, namely riprap, bulkhead, and other physically hardening of banks. It is descriptive in the hydrological sense, that it modifies the hydrology of the site, reach, and system.

The Skagit recovery plan thus lists a number of factors limiting Chinook salmon production (no recovery plan currently exists for steelhead). Factors identified as limiting Chinook salmon recovery are (1) seeding levels (density of spawners and juveniles), (2) degraded riparian zones, (3) poaching, (4) current hydroelectric operations, (5) sedimentation and mass wasting, (6) flooding, (7) high water temperatures, (8) hydromodification, (9) water withdrawals, (10) loss of delta habitat and connectivity, (11) loss of pocket estuaries and connectivity, and (12) illegal habitat degradation. These factors largely affect juvenile and adult steelhead viability in the same way.

Conditions in the Snohomish River. Formed by the confluence of the Skykomish and Snoqualmie Rivers, the mainstem Snohomish River flows through a broad valley and multi-threaded delta for 21 miles. Portions of the Snohomish have been straightened and the banks have been armored, particularly in the lower river. The upper end of the Snohomish River provides important spawning habitat and holding and rearing habitat for many species of salmon. As with many large rivers in the Puget Sound, urbanization has caused a loss of off-channel habitat such as oxbows (important salmon rearing habitat and fish shelter from major flood events). In the estuary, approximately 85 percent of the historic marsh downstream of Ebey Slough has been disconnected by tidegates and dikes. In the mainstem 82 percent of off-channel sloughs and ponds (994 acres) are disconnected. Rural residential areas make up a large percentage of the land base. Lands zoned for rural residential development are typically found near the major rivers and their tributaries.

Conditions in the Elwha River. The aging Elwha and Glines Canyon dams currently completely block access to 95 percent of the high quality spawning and rearing habitat for salmonids in the watershed, and interrupt the natural functions of the river ecosystem. Nearly 18 million cubic yards of sediment have been captured in the two reservoirs, affecting not only the lower river system but also the estuarine and nearshore environment both east and west of the river mouth. Recruitment of LWD has also been halted by the dams' restricting normal channel processes that create salmon habitat. While the Elwha River is classified as "extraordinary" quality water by the Washington State Department of Ecology, it is on the Clean Water Act 303(d) List of impaired water bodies for temperature. Summer temperatures appear to be three to six degrees higher than normal, as the reservoirs act as a solar "heat sink", warming the river during the summer, dramatically increasing water temperature downstream of the two hydroelectric projects. Channel conditions in the lower river are adverse for salmon and steelhead. Levees and dikes constrain the channel at seven sites and reduce the river's access to the floodplain. Loss of seasonal floodplain fish habitats, and the inability of the river to form alternate channels, has further degraded habitat complexity leading to reduced rearing opportunity for juvenile salmon as they move into the estuary and marine environment. Within the leveed channel, the river repeatedly experiences scouring and filling with sediment on the scale of hours and days, creating unproductive conditions for both spawning, incubation and rearing of PS Chinook salmon and steelhead. The few sites of good quality side-channel habitat that occur in the lower river are used by both adult and juvenile salmonids. Consequently, the effects of the two dams have left the remaining accessible downstream habitat severely degraded.

Their removal, which is considered part of the baseline due to having been consulted on by NMFS, expected to begin in 2010, and will make available 70 miles of prime mainstem and tributary habitat, most of it in pristine condition. Negative effects on PS steelhead will accrue during removal because of sediment loading in the river, and these effects will be persistent and affect multiple age classes of steelhead, since steelhead occupy the river year round; pausing dam demolition during fish migration windows will not have significant beneficial effect for steelhead. NMFS expects sediment loads to have a serious short-term adverse effect on both winter and summer steelhead populations. Indirect, and mostly beneficial effects to PS steelhead will result as dam removal restores natural hydrograph, sediment flow, reduces thermal impacts of the reservoirs. In addition, prey for PS steelhead will improve, as other populations of salmon and trout respond to the positive long-term effects from this Elwha River ecosystem restoration action. Overall, the serious short-term effects to steelhead abundance, productivity, and spatial distribution will be outweighed by the substantial long-term improvements to all population parameters. The long-term improvements in environmental conditions are reasonably certain to occur, and will substantially reduce the risks to the PS steelhead in the Elwha River.

Conditions in Hood Canal. Several key habitat factors were identified as degraded in nearly all watersheds: 1. Forest conditions along streams used by summer chum: these stands are now dominated by small trees and deciduous species and are frequently too narrow to provide quality habitat for summer chum. 2. Instream habitat: in most watersheds stream-side development, water withdrawal, and channel manipulations (removal of large wood, dredging, bank armoring) have severely damaged salmon habitat. 3. Floodplains diked for residences and businesses and converted to agriculture: this has reduced the storage area of floodwaters. Habitat is degraded in the diked portions of the channel that is not allowed to meander naturally across the floodplain. 4. Most sub-estuaries developed for human use: this has resulted in loss or degradation of summer chum rearing habitat. Road and dike construction, ditching, dredging, filling, and other modifications have all taken their toll. In spite of their importance to salmon, these habitats have received only limited conservation attention to date. (Hood Canal Recovery Plan Executive Summary). To provide site specific information upon which to base an aggregate analysis for Hood Canal summer run chum salmon, NMFS has chosen three watersheds representing both of the Major Population Groups (MPGs) and distinctive geographic areas, as well as areas of varying human population growth.

> ***Conditions in Union Creek*** - The Union River watershed covers an area of almost 24 square miles with 10 miles of mainstem length. The town of Belfair is located near the mouth of the Union River. Other human developments of significance in this conservation unit continue along the south and north shores of southern Hood Canal. The Union River enters Lynch Cove at the far end of the hook in south Hood Canal and is relatively far removed from the other known populations of summer chum. The dominant land use in the upper portions of the Union River, and its tributaries, is residential development, small farms, industrial forestry and water storage/diversion. The middle and lower reaches have moderately heavy residential development, as well as numerous small hobby farms and minor forestry operations. Belfair is located directly east of the river mouth and subestuary. Three County owned bridge crossings, and several privately owned bridges, exist. These prevent the river from migrating throughout its floodplain (WDFW and PNPTT 2000). The overall freshwater habitat is in fair condition, with the majority of the negative impacts occurring from encroachment by homes and farms in the floodplain. In addition, dikes and agricultural activities and

modifications in the subestuary and intertidal areas are problems. The potential for further habitat degradation remains high due to the trends in growth, urban land use designations, and inadequate stream, riparian and shoreline protections. Loss of channel complexity; riparian degradation; estuarine habitat loss and degradation are the primary factors for decline. Floodplain connectivity is ranked fair to good, bed and bank conditions are ranked at good to poor, riparian conditions are at fair to poor. May and Peterson (2002) rated floodplain conditions for the lower mile of the Union River as "fair" (25 to 50 percent lost connectivity and habitat) and "good" (≤ 25 percent lost connectivity and habitat) on the remainder of the mainstem. Fine sediment was rated "good" with a measure of 10 percent to 15 percent fines in the lower mainstem (May and Peterson 2002). Although summer chum salmon habitats in the Union River watershed have undergone changes from historic conditions, Lestelle, et. al. (2005) believe they still provide relatively good nursery conditions for chum salmon fry. Extensive mudflat and wetlands exist at the mouth of the river. For its comparatively small size of 344.6 acres (6.1 miles perimeter), the estuarine delta of the Union River has been extensively diked and the tidal floodplain constrained as a result. Seven diked areas occupy 78.6 acres or 22.8 percent of the original summer chum rearing and migration habitat area.

Conditions in Salmon and Snow Creeks – The Salmon Creek watershed is 19 square miles and flows for 9 miles into Discovery Bay. Snow Creek is approximately 10 miles long and also flows into Discovery Bay near the mouth of Salmon Creek. These are part of the Eastern Strait of Juan de Fuca Conservation Unit. The Salmon/Snow summer chum population aggregation currently exceeds the escapement threshold but this is likely a combination of both hatchery and natural-origin recruits and the target applies only to natural origin recruits. The Salmon-Snow population shows a severe loss in performance, particularly in productivity.

Salmon Creek: Loss of channel complexity (LWD, channel condition, loss of side channel, channel instability) reducing spawning and incubation. Reduction of riparian buffers, LWD, side channels and associated wetlands, increase in peak flows impairing incubation; reduction in LWD bank hardening exacerbated scour events during peak flows, confinement of channel, reduced side channels and wetlands Degraded riparian condition limiting spawning and incubation; Degradation and loss of riparian habitat, from mature forested area, to a present day riparian mixture of young forest (32 percent), agriculture (43 percent), low number of pools, forested buffer in lower reach less than 66 feet in width, estuarine habitat loss and degradation (diking and road causeways) all diminishing juvenile rearing and migration; Delta area impacted by diking and intertidal fills associated with the Highway 101 corridor and railroad grade, ten roads or causeways cross or encompass the delta, increased sedimentation (fines, aggradation) impairing spawning and incubation.

Snow Creek: Loss of channel complexity (LWD, channel condition, loss of side channel, channel instability) negatively impact spawning and incubation. Reduction of riparian buffers, LWD, side channels and associated wetlands, scarcity of pool habitat, increased peak flow and low summer flows also negatively affect spawning and incubation. Extensive re-routing of Snow Creek out of Salmon Creek and Andrews

Creek into Snow Creek, and channelization have contributed to excessive sediment aggradation, increased peak flows contribute to bed and redd scour. Degraded riparian condition impair spawning and incubation. Degradation and loss of riparian habitat, from mature forested area, to a present day riparian mixture of young forest (64 percent), agriculture (43 percent), low number of pools, 76 percent of forested buffer in lower reach is less than 66 feet in width with 56 percent of that either absent or small immature trees. Estuarine habitat loss and degradation (diking and road causeways) impair juvenile rearing and migration; Delta area impacted by diking and intertidal fills associated with the Highway 101 corridor and railroad grade, two roads or causeways cross or encompass the delta, railroad grade located in center of emergent marsh rearing habitat, railroad grade mutes tidal circulation, and increased sedimentation (fines, aggradation) all impair spawning and incubation; Re-routing of channel and loss of instream complexity have decreased channel's ability to route sediment through the system, increased aggradation which has increased scour, low flows as a result of aggradation may be impacting access to spawning areas.

Conditions in Hamma Hamma - Loss of channel complexity (large woody debris, channel condition, loss of side channel, channel instability) negatively impact spawning and incubation In lower mainstem. Dredging and bank hardening along with removal of LWD has reduced overall channel complexity. Large woody debris is completely lacking in specifically identified areas. Altered sediment dynamics also impact spawning and incubation, as extensive sediment aggradation in lower John Creek has impeded spawning access in recent years. Subsurface flows can occur in summer during spawning migration periods, which robs spawners of needed flow. Riparian degradation contributes to depressed spawning and incubation - 48 percent of the forested buffer area consists of small trees (<12 in dbh). In the lower 1.8 miles of John Creek, pools composed 51 percent of the total habitat area (rated fair), but LWD loading was extremely poor (0.06 LWD pieces/m). Most notably, large-sized LWD pieces, which are important habitat forming and stabilizing features of larger rivers, were completely absent from the Hama Hama mainstem, suggesting that streambed instability that may result in redd scour during peak flow events. Estuarine habitat loss and degradation (diking, filling, log storage, road causeways) negatively affect juvenile rearing and migration. Over 13 percent of the estimated 368.5 acre historic delta is diked in three areas, accounting for a loss of summer chum rearing habitat. One filled area in the outer, southern corner of the delta accounts for a loss of 3.2 acres (one percent of historic delta habitat). An estimated 2.4 acres (0.6 percent of historic delta area) of the mainstem distributary channel, where it crosses the outer intertidal area, has been dredged. At least seven areas of aquaculture or other modifications of the delta surface are apparent from contemporary aerial photographs that total 2.2 acres (0.6 percent of historic delta area).

Generally, among chum salmon, steelhead, and Chinook salmon, the effect of these baseline conditions is an overall reduction of suitable spawning and rearing habitat, and a conversion of these habitats to conditions that largely support only migration. As rearing and spawning habitat is limited, productivity, abundance and spatial structure of populations are impaired. Also, the loss of channel complexity together with the reduction of off-channel and floodplain habitat sites, and the preclusion of habitat forming processes, narrows the range of habitat conditions available over time, which reduces the variety of genotypic, phenotypic, and life-history diversity of salmonids that utilize can the remaining, largely homogeneous habitat.

Conditions in Lake Ozette. Limiting factors hypothesized as having high impact particularly on beach spawners: poor quality spawning habitat that decreases survival in the incubation-to-emergence life stage, and predation on adults, eggs, and newly emerged fry. Moderate impact: seasonal lake level changes, water quality issues, including turbidity and fine sediment, and competition for the good quality spawning habitat, which can result in redd superimposition and decreased egg-to-fry survival. Limiting factors hypothesized as having high impact particularly on tributary spawners: fine sediments, unstable channel, and other water quality issues that reduce spawning habitat quality and result in decreased egg-to-fry survival.

(http://www.noplegroup.org/NOPLE/pages/watersheds/OzetteLakeWatershedPage.htm)

Conditions Affecting Southern Resident Killer Whales.

Most of the human activities contributing to the current status of SRKWs occur within the action area. The following discussion summarizes the principal human and natural factors within the action area (other than the proposed action) that are known to affect the likelihood that SRKWs will survive and recovery in the wild, and the likelihood that their critical habitat will function to support their recovery.

Natural mortality. Seasonal mortality rates among Southern and Northern Resident whales are believed to be highest during the winter and early spring, based on the numbers of animals missing from pods returning to inland waters each spring. Olesiuk et al. (2005) identified high neonate mortality that occurred outside of the summer field research seasons. At least 12 newborn calves (9 in southern community and 3 in northern community) were seen outside the summer field season and disappeared by the next field season. Additionally, stranding rates are higher in winter and spring for all killer whale forms in Washington and Oregon (Norman et al. 2004). Southern Resident strandings in coastal waters offshore include three separate events (1995 and 1996 off of Northern Vancouver Island and the Queen Charlotte Islands, and 2002 offshore of Long Beach, Washington State), and the causes of death are unknown (NMFS 2008a).

In recent years, sighting reports indicate anecdotal evidence of thin killer whales returning to inland waters in the spring. For example in March 2006, a thin female from the Southern Resident population (L54) with a nursing calf was sighted off Westport, WA. The sighting report indicated she had lost so much blubber that her ribs were showing under the skin (Cascadia Research unpubl. data.).

Human-related Sources of Mortality.

Prey Availability. Chinook salmon are preferred prey of SRKWs in inland waters of Washington State during spring, summer and early fall. Chum salmon are also identified as an important source of prey, at least during fall months inside Puget Sound. Chemical analyses support the importance of salmon in the year round diet of Southern Residents. Based on the best available information, Southern Residents may also prefer Chinook salmon when available in coastal waters. This analysis focuses on effects of the action on Chinook salmon. Focusing on Chinook salmon provides a conservative estimate of potential effects of the action on Southern Residents. The total abundance of all salmon and other potential prey species id difficult to quantify, but is orders of magnitude larger than the total abundance of Chinook salmon.

As described previously (Status of the Species), the size of individual salmon likely affects Southern Residents' prey needs compared to prey availability. In general, the literature indicates a historical decrease in salmon age, size, or size at a given age. Hypotheses advanced to explain declining body size are density-dependent growth and selection of larger, older fish by selective fisheries (review in NMFS 2008d). Fish size is influenced by factors such as environmental conditions, selectivity in fishing effort through gear type, fishing season or regulations, and hatchery practices. The available information on size is also confounded by factors including inter-population difference, when the size was recorded, and differing data sources and sampling methods (review in Quinn 2005). As a result, a comparative measure of prey biomass for individual salmon stocks affected by the action is not available. Therefore, this opinion relies on abundance estimates as a proxy measure (as in past consultation, i.e., NMFS 2008d, NMFS 2008e, NMFS 2008f, NMFS 2008g).

When prey abundance is low, killer whales may spend more time and energy foraging than times when prey abundance is high, with potential for fitness consequences including reduced reproductive rates and higher mortality rates. Ford and Ellis (2006) correlated coastwide reduction in Chinook salmon abundance (Alaska, British Columbia, and Washington) with decreased survival of resident whales (Northern and Southern Residents), but changes in killer whale abundance have not been definitively linked to local areas or changes in salmon stock groups. No recent changes in salmon populations are obviously apparent that may be responsible for the recent decline in the Southern Resident population between 1996 and 2001 (review in NMFS 2008h). However, potential prey limitation is an area of ongoing research, and new information will be considered as it becomes available.

The availability of prey to SRKWs is affected by a number of natural and human actions. The health and abundance of wild salmon stocks have been negatively affected by altered or degraded freshwater and estuarine habitat (i.e., hydro-power systems, urbanization, forestry and agriculture), harmful artificial propagation practices, and overfishing. Details regarding baseline conditions of salmon are described in salmonid sections of the NFIP Opinion. Predation in the ocean also contributes to natural mortality of salmon. Salmonids are prey for pelagic fishes, birds, and marine mammals.

Salmon abundance is also substantially affected by climate variability in freshwater and marine environments, particularly by conditions during early life-history stages of salmon (review in, NMFS 2008c). Sources of variability include inter-annual climatic variations (e.g., El Niño and La Niña), longer term cycles in ocean conditions (e.g., Pacific Decadal Oscillation, Mantua et al. 1997), and ongoing global climate change. For example, climate variability can affect ocean productivity in the marine environment and water storage (e.g. snow pack) and in-stream flow in the freshwater environment. Early life-stage growth and survival of salmon can be negatively affected when climate variability results in conditions that hinder ocean productivity (e.g., Scheurell and Williams 2005) and/or water storage (e.g., ISAB 2007) in marine and freshwater systems, respectively. However, severe flooding in freshwater systems may constrain salmon populations (NMFS 2008c). The availability of adult salmon – prey of Southern Residents – may be reduced in years following unfavorable conditions to the early life-stage growth and survival of salmon.

Historically, the abundance of Chinook salmon stocks returning to the action area was greater than present. The historical abundance of Puget Sound origin Chinook salmon is estimated to have been 690,000, while recent abundance averages 240,000, most of which are hatchery fish (Myers et al. 1988). While wild salmon stocks have declined in many areas, hatchery production has been generally strong. Hatchery production contributes a significant component of the salmon prey base returning to the Puget Sound region (i.e., 74 percent of the total Chinook salmon return to Puget Sound from 2000-2004 originated from hatcheries, data from WDFW Stock Strength Summaries in NMFS 2008h). Recently, wild Chinook salmon escapement has been relatively stable in the Georgia Basin (2000-2005, NMFS 2008h,), as is also true of Chinook salmon runs in Puget Sound (1999-2005, T. Tynan, pers. comm., March 19, 2008).

Although hatchery production in the action area has off-set some of the historical declines in the abundance of PS wild salmon, hatcheries also pose risks to wild salmon populations (review in NMFS 2008b). Since the 1990s, managers have taken steps to reduce risks identified for Puget Sound hatchery programs as programs have received reviews (e.g., HSRG 2000, 2002), and through region-wide recovery planning efforts (Shared Strategy 2005). Hatchery programs in the region will be further reviewed for consistency with ESA standards as part of section 7 consultations. Past and current adjustments to hatchery operations in the action area are likely to benefit the abundance and productivity of co-occurring wild salmon populations.

The NMFS estimated Chinook salmon available to Southern Residents when they occur in inland waters (Table 4). This estimate reflects best available information by relying on current data and where available 5+ year averages to incorporate some level of variability, as Chinook salmon productivity, escapement, and ocean exploitation fluctuates over time.

Table 4. An estimate of adult Chinook abundance in inland waters of the action area across summer and fall months.

Chinook Stocks[1]	Abundance
Puget Sound Chinook Stocks	**205,968**
Puget Sound Chinook ESU	132,724
Listed-Natural Origin Return[2]	54,494
North Fork Nooksack	397
South Fork Nooksack	206
Lower Skagit	3,719
Upper Skagit	10,831
Upper Cascade	749
Lower Sauk	1,354
Upper Sauk	1,315
Suiattle	1,041
North Fork Stillaguamish	913

South Fork Stillaguamish		239
Skykomish		3,180
Snoqualmie		2,355
Sammamish		73
Cedar		410
Green River		18,822
White River		1,482
Puyallup		1,041
Nisqually		2,564
Skokomish		1,053
Mid Hood Canal		181
Dungeness		110
Elwha		2,461
Listed-Artificial Propagation Programs[3]		**78,230**
Hatchery Program	Release Watershed	
Kendall Creek subyearling onstation	NF Nooksack	691
Kendall Creek subyearling offstation	NF Nooksack	2,766
Skookum Creek subyearling	SF Nooksack	0
Marblemount Fall subyearling	Baker River	28
Marblemount Spring subyearling	Cascade R	199
Marblemount Spring yearling	Cascade R	912
Marblemount Summer subyearling	Skagit	898
Tulailip Summer subyearling	Tulalip Bay	5,731
Wallace River subyearling	Skykomish	1,995
Wallace River yearling	Skykomish	1,634
Harvey Creek/Whitehorse subyearling	NF Stillaguamish	954
Issaquah subyearling	Sammamish	6,880
Icy Creek yearling	Green	2,270
Keta Creek subyearling	Green	248
Soos Creek subyearling	Green	9,907
Clear Creek subyearling	Dyes Inlet	172
Dogfish Creek subyearling	Liberty Bay	516
White River subyearling	White	394
White River yearling	White	446
White River Acclim. Subyearling	White	902
Clarks Creek subyearling	Puyallup	468
Voights Creek subyearling	Puyallup	5,834
Puyallup Fall Acclim. Subyearling	Puyallup	206
Hupp Springs subyearling	Minter Creek	550
Hupp Springs yearling	Minter Creek	53
Clear Creek subyearling	Nisqually	18,480
Kalama Creek subyearling	Nisqually	3,344
George Adams subyearling	Skokomish	8,628
Ricks Pond yearling	Skokomish	256
Hamma Hamma subyearling	Hamma Hamma	482
Dungeness subyearling onstation	Dungeness	12
Dungeness subyearling offstation	Dungeness	12
Elwha subyearling	Elwha	1,949
Elwha yearling	Elwha	413
Non-Listed Puget Sound Chinook (Artificial Propagation Programs)[3]		**73,244**
Hatchery Program	Release Watershed	
Lummi Bay subyearling	Lower Nooksack R	2,587
Lummi Bay subyearling	Lummi Sea Ponds	2,587
Glenwood Springs subyearling	Orcas Island	1,011

Glenwood Springs yearling	Orcas Island	1,944
Samish subyearling	Samish	13,485
Samish yearling	Samish	28
Tulalip Fall subyearling	Tulalip Bay	0
Tulalip Spring yearling	Tulalip Bay	0
Portage Bay subyearling	Lake Washington	768
Gorst Creek subyearling	Sinclair Inlet	6,880
Gorst Creek yearling	Sinclair Inlet	1,135
Grovers Creek subyearling	East Kitsap	3,440
Minter Creek subyearling	Minter	5,573
Chambers subyearling	Chambers Creek	303
Chambers yearling	Chambers Creek	1,514
Garrison subyearling offstation	Stellacoom Lake	454
Garrison subyearling onstation	Chambers Creek	1,287
Capitol Lake subyearling	Deschutes	23,791
Capitol Lake yearling	Deschutes	523
Hoodsport subyearling	Hoodsport	5,587
Hoodsport yearling	Hoodsport	347
Canadian Chinook Stocks[4]		**286,810**
Upper Fraser		157,506
L. Fraser late (Harrison, Chilliwae)		111,674
Georgia Strait		17,630
Total Combined Chinook Stocks		**492,778**

[1]Chinook stocks identified are representative of adult (mostly age 4) Chinook. Immature (mostly age 2 to 3) Chinook may be additional prey resources for Southern Residents; however, the best available information indicates that Southern Residents prefer adult-sized Chinook (Ford and Ellis 2006). Stocks other than those identified (i.e., some Columbia River Chinook stocks caught in small percent and with low CWT recovery in inland waters) likely contribute little additional abundance to the total available prey in inland waters.
[2] Natural origin return estimates represent the average (2000 to 2004) terminal recruits (escapement + terminal catch) for all listed-populations of the Puget Sound Chinook ESU (Source: N. Sands, NMFS, - NWFSC unpubl. data).
[3] Listed and non-listed artificial propagation program estimates are derived by adjusting current annual juvenile fish production by program survival rates (based on coded-wire tag or other mark recovery, determined by estimating contribution of released juvenile fish to fisheries and escapement) and estimated recent year (1999-2004) average ocean exploitation rate of 31.2% (based on south Puget Sound fall Chinook fingerlings; PSC CTC Report 2007) (Source: T. Tynan, NMFS, Propagation and Tributary Fisheries Branch, unpubl. data).
[4] Sources: NMFS 2007b and NMFS 2007c.

Fisheries that occur in the action area and overlap with the occurrence of Southern Residents reduce the availability of prey, and are included in the baseline (Table 5). Fisheries that occur outside the action area are indirectly considered in the baseline by methods used to estimate abundance, and as necessary will be the subject of future consultation.

For example, U.S. Fraser Panel fisheries catch Chinook salmon and overlap with the occurrence of Southern Residents in inland waters. Past consultations on the US Fraser Panel fisheries have concluded that implementing the regulations for the inland waters salmon fishery was not likely to jeopardize the continued existence of SRKWs based on the small seasonal reduction in prey available to the whales when they occur in inland waters (i.e., NMFS 2008e -Fraser BO; Table 5). The U.S. Fraser Panel fisheries target sockeye salmon and pink salmon and are managed to monitor and limit impacts to listed Chinook salmon stocks.

Additionally, Puget Sound commercial and recreational salmon fisheries are included within the Puget Sound Harvest Management Plan, which is covered under an ESA Section 4(d) approval through April 30, 2010 (70 FR 12194, March 11, 2005). The harvest plan prescribes escapement goals and exploitation rate objectives for PS Chinook salmon that NMFS has determined will not appreciably reduce the likelihood of survival and recovery of the PS Chinook salmon ESU. This management plan includes seasonal catch of Chinook salmon in marine fisheries that overlap in space and time with the whales' occurrence within inland waters, based on available sighting data (Table 5). Terminal fisheries within the inland range of Southern Residents, including some Canadian First Nation (Canada), U.S. subsistence, and other fisheries were not evaluated as seasonal reductions in available prey. Terminal fisheries occur after Southern Residents have access to the fish.

Coastal fisheries also catch Chinook salmon bound for Puget Sound, reducing the amount of prey available to the whales in inland waters (i.e., PFMC fisheries). The PFMC fisheries catch Chinook salmon that would have returned to inland waters. Past consultations have concluded that PFMC salmon fisheries were not likely to jeopardize the continued existence of SRKWs based on the small reduction in prey resources with minimal change in the ratio of prey availability to needs for Southern Residents within their inland range (i.e, NMFS 2008d). Additional reductions would also occur from Canadian fisheries in the coastal area considered (i.e., West Coast of Vancouver Island). The NMFS estimated the loss of prey resources from the ocean to inland waters for hatchery stocks by applying an average ocean exploitation rate for South PS Chinook salmon provided by NMFS fisheries biologist, T. Tynan (31.2 percent; source: Appendix E, Table E.35 PSC Joint Technical Committee Report 2007) as a surrogate for exploitation of ocean rearing Chinook salmon in general (Table 4). The natural origin return component of PS Chinook salmon was estimated with different methodology, which indirectly accounted for ocean exploitation by only estimating abundance from adult escapement plus terminal catch (N. Sands, NMFS, NWFSC, Chinook Technical Recovery Team, pers. comm., March 20, 2008).

Considering the above harvest actions included in the baseline, the remaining Chinook salmon abundance available to Southern Residents in inland waters is 447,421Chinook (Table 5). The effective baseline is an estimate that incorporates best available information from recent estimates for harvest and ocean exploitation for fisheries that are managed on an annual basis and harvest levels changes from year to year.

As discussed in the Status of the Species section, very little is known about the temporal and spatial distribution of Southern Residents within their known coastal range (central California to Queen Charlotte Islands), and the area within this range where they overlap with the PS Chinook salmon ESU affected by this action is relatively small. Thus, while NMFS recognizes that some reductions from active fisheries in the coastal area are part of the environmental baseline, NMFS cannot quantify them at this time.

Table56. Effective baseline of Chinook prey seasonally available to Southern Residents after seasonal reduction from harvest in inland waters of the action area.

Chinook Stocks	Abundance
Baseline: Combined Stocks Available[1]	492,778
Estimate of inland fisheries seasonal harvest	45,357
U.S. Fraser Panel fisheries[2]	8,109
WDFW and PSTIT fisheries[3]	37,248
Effective Baseline: baseline minus harvest	**447,421**

[1] Total combined Chinook Stocks reported in Table 1.
[2] 2006/2007 and 2008/2009 average; sources: NMFS 2007b, NMFS 2008d.
[3] Pre-terminal fisheries in inland waters that overlap with the occurrence of Southern Residents in inland waters characterized by average recent year actual Chinook catch for Puget Sound marine sport fishery (2001 to 2005 average; 24,976 Chinook,; source: L. Lavoy, WDFW, unpubl. data), plus average recent year actual catch for Puget Sound pre-terminal net and troll fishery (2003 to 2005 average; 12,272 Chinook,; source: L. Lavoy, WDFW, unpubl. data).

Environmental Contaminants. Contaminants enter marine waters and sediments from numerous sources, but are typically concentrated near populated areas of high human activity and industrialization. Freshwater contamination is also a concern because it may contaminate salmon that are later consumed by the whales in marine habitats. As discussed in the Status of the Species section, recent studies have documented high concentrations of PCBs, DDTs, and PBDEs in killer whales (Ross et al. 2000, Ylitalo et al. 2001, Reijnders and Aguilar 2002, Krahn et al. 2004). Harmful contaminants are stored in blubber; however, organochlorines can be released from the blubber and become redistributed to other tissues increasing risk of immune or reproductive effects during weight loss from reductions in prey (Krahn et al. 2002).

As top predators, when killer whales consume contaminated prey the accumulate the contaminants in their blubber. When prey is scarce, killer whales metabolize their blubber and the contaminants are mobilized. In addition, nursing females transmit large quantities of contaminants to their offspring. Chinook salmon contain higher levels of some contaminants (i.e., PCBs) than other salmon species (O'Neil et al. 2005). Only limited information is available for contaminant levels of Chinook salmon along the west coast (i.e., higher PCB and PBDE levels may distinguish Puget Sound-origin stocks, whereas higher DDT-signature may distinguish California origin stocks; Krahn et al. 2007).

Vessel Activities and Sound. Commercial shipping, military vessels and recreational vessels occur in the coastal range of Southern Residents and additional whale watching, ferry operations and recreational traffic in their inland range. The density of traffic is lower in the coastal compared to inland waters of Washington State and British Columbia. Several studies in inland waters of Washington State and British Columbia have linked interactions of vessels and Northern and SRKWs with short-term behavioral changes (Kruse 1991; Williams et al. 2002a; 2002b; Foote et al. 2004, Bain et al. 2006). Although the potential impacts from vessels and the sounds they generate are poorly understood, these activities may affect foraging efficiency, communication, and/or energy expenditure through their physical presence, increased underwater sound level, or both. Collisions of killer whales with vessels are rare, but remain a potential source of serious injury and mortality.

Vessel sounds in coastal waters are most likely from large ships, tankers and tugs, whereas vessel sounds in inland waters also come from whale watch platforms, ferry operations and smaller recreational vessels. Sound generated by large vessels is a source of low frequency (5 to 500 Hz) human-generated sound in the world's oceans (NRC2003). While larger ships generate some broadband noise in the hearing range of whales, the majority of energy is below their peak hearing sensitivity. Such vessels do not target whales, move at relatively slow speed and are likely detected and avoided by Southern Residents. In inland waters, the majority of vessels in close proximity to the whales are commercial and recreational whale watching vessels and the average number of boats accompanying whales can be great during the summer months (i.e., from 1998 to 2002 an average of 18 to 22 boats were within ½ mile in inland waters from May to September; Koski 2007). Sound generated from whale watch vessels varies by vessel size, engine type, and operating speed (Holt 2008).

Although investigators have documented numerous short-term behavioral responses to whale watch vessels, studies have not demonstrated the consequences of these effects on the health of the population. There is ongoing research to evaluate changes in energy expenditure from behavioral responses and effects of sound on echolocation and foraging efficiency, which may translate to fitness effects. To date, research suggests that Southern Residents may expend 10 to 15 percent more energy when vessels are present than they would without vessels present (Bain et al. 2006, Williams et al. 2002a). Currently, NMFS is considering vessel management regulations to protect Southern Residents from vessel effects (72 FR 13464; March 22, 2007).

Other Sound. Anthropogenic (human-generated) sound in the range of Southern Residents is generated by other sources besides vessels, including oil and gas exploration, construction activities, and military operations. Natural sounds in the marine environment include wind, waves, surf noise, precipitation, thunder, and biological noise from other marine species. The intensity and persistence of certain sounds (both natural and anthropogenic) in the vicinity of marine mammals vary by time and location and have the potential to interfere with important biological functions (e.g., hearing, echolocation, communication).

In-water construction activities are permitted by the COE under section 404 of the Clean Water Act and section 10 of the Rivers and Harbors Act of 1899 and by the State of Washington under its Hydraulic Project Approval program. Consultations on these permits have been conducted and conservation measures have been included to minimize or eliminate potential effects of in-water activities, such as pile driving, to marine mammals. Sound, such as sonar generated by military vessels also has the potential to disturb killer whales in inland and coastal waters within their range.

Oil spills. Oil spills have occurred in the range of Southern Residents in the past, and there is potential for spills in the future. Oil can be discharged into the marine environment in any number of ways, including shipping accidents, refineries and associated production facilities, and pipelines. Despite many improvements in spill prevention since the late 1980s, much of the region inhabited by Southern Residents remains at risk from serious spills because of the heavy volume of shipping traffic and proximity to petroleum refining centers in inland waters. Numerous oil tankers transit through the range of Southern Residents throughout the year. The magnitude of the risks posed by oil discharges in this area is difficult to precisely quantify or estimate, but may be decreasing because of new oil spill prevention procedures in the state of Washington (WDOE 2007).

The long-term effects of repeated ingestion of sub-lethal quantities of petroleum hydrocarbons on killer whales are not well understood. In marine mammals, acute exposure to petroleum products can cause changes in behavior and reduced activity, inflammation of the mucous membranes, lung congestion, pneumonia, liver disorders, and neurological damage (Geraci and St. Aubin 1990). In addition, oil spills have the potential to adversely impact habitat and prey populations, and, therefore, may adversely affect Southern Residents by reducing food availability.

Scientific Research. Most of the scientific research conducted on SRKWs occurs in inland waters of Washington state and British Columbia. In general, the primary objective of this research is population monitoring or data gathering for behavioral and ecological studies. In 2006, NMFS issued scientific research permits to seven investigators who intend to study SRKWs. The majority of research activities are conducted between May and October in inland waters; however, some permits include authorization to conduct research in coastal waters.

In the Opinion NMFS prepared to assess the impact of issuing the permits, and determined that the effects of these disturbances on Southern Residents were likely to adversely affect, but not jeopardize the continued existence of, the SRKWs (NMFS 2006). Most of the authorized takes would occur in inland waters, with a small portion in the coastal range of Southern Residents. In light of the number of permits, associated takes, and research vessels and personnel present in the environment, repeated disturbance of individual killer whales is likely to occur in some instances. In recognition of the potential for disturbance and takes, we took steps to limit repeated harassment and avoid unnecessary duplication of effort through conditions included in the permits requiring coordination among permit holders.

Activities Outside of U.S. Jurisdiction. The SRKWs are highly mobile and may transit in and out of the waters of the United States and the high seas. The NMFS does not presently have information to assess the impact on Southern Residents of scientific research or boating activities within Canadian jurisdictional waters.

Summary of Environmental Baseline for Southern Resident Killer Whales. Southern Resident killer whales are exposed to a wide variety of past and present state, Federal or private actions and other human activities in the coastal and inland waters area considered, as well as Federal projects in this area that have already undergone formal section 7 consultation, and state or private actions that are contemporaneous with this consultation. All of the activities discussed in the above section are likely to have some level of impact on Southern Residents when they are in inland and coastal waters of their range.

Prey availability, environmental contaminants, and vessel effects and sound have all been identified as threats to killer whales in Washington and British Columbia (Ford and Ellis 1999, Ford et al. 2000, 2005, Baird 2001, Krahn et al. 2002, 2004, Taylor 2004, Wiles 2004). Researchers are unsure about which threats are most significant to the Southern Resident population. None of the primary threats have been directly linked to or identified as the cause of the recent decline of the SRKWs (Krahn et al. 2002). There is limited information on how these factors or additional unknown factors may be affecting SRKWs when in coastal waters in winter. For reasons discussed earlier, it is possible that two or more of these factors may act together to harm the whales. The small size of the population increases the level of concern about all of these risks (NMFS 2008a).

Effects of the Action

Effects of the action include the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02).

Approach to the Analysis

The NMFS' fundamental determination in conducting ESA section 7(a)(2) formal consultation it to determine whether a proposed action will or will not jeopardize listed species, or destroy or adversely modify designated critical habitat. To make those determinations, NMFS assesses the status of the species and critical habitat, the environmental baseline in the action area, and the cumulative effects. The status information provides an overall assessment of the risk listed species presently face for their long term survival and conservation. The environmental baseline provides a more acutely focused look at factors in the action area that bear on that risk. The cumulative effects provide a forward looking assessment of certain reasonably likely future actions that will eventually bear on that risk.

In contrast to status, baseline, and cumulative effects information, the effects of the action are the environmental changes caused specifically by the proposed action. In the context established by status, environmental baseline, and cumulative effects assessments, the effects analysis examines how environmental changes caused by the proposed action bear on, and exacerbate existing risk to the species and their critical habitat. The jeopardy analysis turns on whether and to what extent the effects of the proposed action on fish in the action area influence the existing prospects for species conservation. Similarly, but distinctly, the adverse modification analysis turns on whether and to what extent the effects of the proposed action on PCEs of critical habitat in the action area influence the conservation role or value of the entire designated critical habitat.

For the first step of the analysis, NMFS established causation between NFIP program activities and environmental changes. The NMFS identified the program activities that cause floodplain development that is likely to be indicative of effects on the habitat of listed salmon and steelhead. The analysis focuses on habitat change. Using a habitat-based analysis enables NMFS to assess the NFIP's effects on both listed fish and their critical habitat. For the species analysis, NMFS assesses how habitat change bears on individual fish in the action area. For the critical habitat analysis, NMFS assesses how habitat effects bear on the functional condition of the PCEs of critical habitat.

After establishing causation and describing the habitat effects of NFIP program activities, NMFS assessed the extent to which habitat change affects individual fish in the action area and critical habitat PCEs in the action area. To conduct the jeopardy analysis, NMFS analyzed whether and to what extent effects on fish affect the viability of the populations to which those fish belong. To make a jeopardy determination, NMFS finally assessed whether changes in population viability, if any, undermine the conservation prospects of the ESUs or DPSs comprised of those populations.

The critical habitat analysis begins with the same assessment of habitat change in the action area. But in contrast to the species analysis, the critical habitat analysis focuses exclusively on the action's effects on the functional condition of PCEs in the action area, rather than on fish. After analyzing action area effects, NMFS assessed the conservation role of the affected PCEs in the watersheds in which the action area lies, and in turn the conservation role of the watershed relative to the entire geographic designation of critical habitat. To make the adverse modification determination, NMFS finally assessed whether changes in PCE function at the local scale would undermine the conservation role of critical habitat or diminish the conservation value of critical habitat. Since the regulatory definition of adverse modification was invalidated in *Gifford Pinchot Task Force v. USFWS,* 378 F. 3d 1059 (9^{th} Cir. 2004), NMFS focused on the effects of the action on the conservation value of critical habitat and did not rely on the invalidated standard.

How National Flood Insurance Program Leads to Environmental Change in the Floodplain

There is a wide range of aquatic habitats in the floodplain that contain a diversity of habitat characteristics (e.g. water permanence, vegetation, and river connectivity). Modification of those characteristics can change the results of fish and amphibian presence. For example, dissolved oxygen is an important driver for fish use in floodplain wetlands, and is an important limiting factor for year round fish rearing (Henning 2004). A recent Washington state study suggests high fish utilization of floodplain wetlands, and that floodplain wetlands function differently and provide a diversity of biological responses such as fish rearing and amphibian breeding. The combination of off-channels, oxbows, beaver ponds, seasonal wetlands, and restored habitats are support a diversity of fish and wildlife species.

Floodplain management should focus on maintaining this habitat complexity, and the WDFW recommends that the riparian buffer widths should extend to the outer edge of the 100-year floodplain. Intact riparian habitat performs many functions essential to fish survival and productivity, and it is critical in supporting suitable instream conditions necessary for the recovery of imperiled native salmon stocks. Vegetation in riparian areas shades streams maintaining cool temperatures needed by most fish. Plant roots stabilize stream banks and control erosion and sedimentation, and vegetation creates overhanging cover for fish. Riparian habitat contributes leaves, twigs, and insects to streams, thereby providing basic food and nutrients that support fish and aquatic wildlife. Large trees that fall into streams create pools, riffles, backwater, small dams, and off-channel habitat that are necessary to fish for cover, spawning, rearing, and protection from predators. Pools help maintain riffles where gravel essential for spawning accumulates. Riparian vegetation, litter layers, and soils filter incoming sediments and pollutants thereby assisting in the maintenance of high water quality needed for healthy fish populations. Riparian habitat moderates stream volumes by reducing peak flows during flooding periods (WDFW, undated). Floods are a natural process that is important for maintaining stream function. Flood flows flush fine sediment from spawning gravel, create pools and riffles by reshaping the streambed, deposit fine sediment on the floodplain, and move LWD from the floodplain to the stream channel (Benda et al*.*, 2001, as cited in Smith 2005).

Three elements of the NFIP (floodplain mapping, minimum floodplain management criteria, and the CRS) directly and indirectly lead to changes in floodplain environments and eventually to floodplain development. These changes in the floodplain environment adversely affect the habitat and habitat forming processes for listed species in the Puget Sound region. Current implementation of the mapping and the minimum criteria elements of the NFIP contributes to: 1) the placement of fill in the floodplain (EDAW 2006, Task Force on the Natural and Beneficial Functions of the Floodplain 2002, FEMA 2001, Pinter 2005), and 2) construction and maintenance of levees according to certain standards that reduce or eliminate their ecological function as riparian habitat and constrain natural channel dynamics. The following sections describes how these NFIP programs lead to the environmental outcomes that adversely affect listed species and their critical habitat in the Puget Sound region.

Flood Mapping Program. The FEMA has promulgated regulations governing the production and revision of flood maps. These regulations permit the boundaries of SFHAs on a flood map to be revised following human alterations to the floodplain such as such as construction, operation and maintenance of levees and placement of fill to elevate a property above the base flood level. Building and maintaining levees, and placing fill to elevate a property triggers the map revision process, removing land behind the levee (or the elevated property) from the mapped floodplain (informally referred to as having been "mapped out" of the floodplain). Once property is removed from the floodplain it is no longer necessary for the property owner to comply with the community's floodplain regulations or purchase flood insurance, and once out of the floodplain, these properties become available for land use development and construction that might have otherwise been prohibited or constrained by community floodplain regulations. Therefore, the NFIP mapping process, especially the map revising activities, contribute to human alteration of the floodplain, adversely affecting the habitat and habitat forming processes that occur there. Simultaneously, FEMA's recategorization of certain land or parcels from floodplain to non-floodplain creates a false sense of security that results in more floodplain development (Task Force on the Natural and Beneficial Functions of the Floodplain 2002).

The FEMA's mapping protocols separate a river and adjacent areas into two components, the floodway and the floodplain (also known as the flood fringe). The floodway is the active portion of the river channel and adjacent areas, presumably the area with the greatest water velocities and highest depths, which must be reserved to convey the base flood without cumulatively increasing the water surface elevation by more than a designated height. When establishing a floodway line, hydraulic engineers consider continuous floodplain encroachments until, on average, the flood levels increase 1 foot. The flood fringe comprises the rest of the floodplain area on both sides of the floodway, and generally stores water, at shallower depths and lower velocities, during a flood.

The NFIP limits development only in the floodway, if one is designated, however, development in a floodway can occur, so long as the floodway map is revised in anticipation of development. Once a floodway is designated, the NFIP allows unlimited development across the rest of the floodplain so long as developed areas are either raised above the level of the 100-year flood (the event with a one-percent-chance of occurring in any year) or protected by levees with at least 100-year protection (Pinter 2005)
The presence of a 100-year levee, when certified under the NFIP procedures, eliminates the NFIP requirement to comply with construction standards, such as elevation of any new or substantially improved buildings in that area, and also removes the flood insurance purchase requirement. Increased development in these flood risk areas provides a short-term economic benefit with potentially long-term adverse consequences, particularly from the perspective of floodplain and channel function for salmonid habitat.

The FEMA acknowledges fill placed in the floodplain and the removes the property from a mapped flood area through a LOMR-F. Because property within the floodplain can be "mapped out" of the floodplain, and thereby removed from the jurisdiction of the NFIP's insurance requirements, there is an inherent incentive for property owners to place sufficient fill to elevate their buildings above the BFE. By allowing individuals to remove their property from regulation by artificially filling it, FEMA is in effect encouraging filling (Rosenbaum 2005, EDAW 2006), even though their primary action is accurately depicting fill on FIRMs.

Placing fill to elevate properties and building levees to trigger floodplain map revisions are detrimental to floodplain and channel function. Lands that are periodically flooded provide safe off-channel refugia, with abundant food items, for rearing juvenile salmonids during periods of high flow when mainstem channels cannot be occupied, functions essential to decrease mortality in juvenile salmonids. Filling in floodplains to remove them from the mapped floodplain decreases the extent of off channel habitat and impairs the natural processes that create and maintain these habitats, removing these functions. Fill in floodplains also reduces flood water storage. This causes higher water levels downstream, greater water velocity during high flow events, and increased erosion, which have adverse effects on salmon. Channels that are unconfined by floodplain fill have more diverse habitat complexity that supports salmon survival. Both natural floodplains and unaltered stream channels support listed species by providing increased juvenile to adult survival, which is essential for recovery of listed species.

The FEMA's mapping program fails to identify and protect the channel migration zone (CMZ) which provides important functions for salmonids. A confined river can no longer move across the floodplain and support natural processes of channel migration that create the side channels and off-channel areas that shelter juvenile salmon (Montgomery, 2003). In contrast, functioning CMZs are capable of meandering and braiding, leading to increased side and off channel habitat which supports rearing juvenile salmonids as mentioned above

The FEMA's decision-making process related to mapping includes approving map revisions. The FEMA requires the applicant to provide project location information and adequate flow modeling information to determine whether the fill or map change is in compliance with their mapping regulations. For a map revision with fill, information is required on the extent of fill (length and width) in the floodplain, but not on the amount of floodplain fill (height), and the floodplain habitat and storage functions that are lost or displaced, or the effects on listed salmon. The FEMA verifies by a surveyor that the fill is placed so that the final elevation is at or above BFE. The FEMA can also monitor enforcement through the LOMC process (requests to make map changes) which may indicate that floodplain areas have been improperly filled.

Effects of Levee Vegetation Maintenance Standards

Indirect effects are those effects that are caused by or will result from the proposed action and are later in time, but are reasonably certain to occur (50 CFR 402.02).

The effectiveness of COE vegetation standards as they apply to maintaining levee integrity, are debated at local, regional and national levels (Sacramento Area Flood Control Agency and US Army Corp of Engineers 2007) in part due to their adverse effects to listed salmon. In addition, an increasing amount of scientific information demonstrates that root structure and brushy vegetation protect levee stability and decrease levee failures (Dwyer et al., 1997, COE 2001a, Gray et al. 1991, Geyer et al., 2003, Hollis and Leech 1997, Abernethy and Rutherfurd 2000a). Some of the literature establishing the stabilization benefits of vegetation to river banks have been generated by the COE's own research center based in Vicksburg, Mississippi.[16]

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[17] "The minimum NFIP standards do not contain measures to protect existing development. New construction causing increased runoff and higher BFEs is a common culprit in exacerbating the hazard for existing construction,

In the case of non-RIP levees, the COE's vegetation management requirements and the adverse effects that result from those requirements are an indirect and/or interrelated effect of the NFIP, based on FEMA's practice of relying on the COE's vegetation standards to determine NFIP compliance. An example of this is the North Creek levee in the City of Bothell, where FEMA notified the City that it would initiate a map revision to re-designate formerly protected areas as flood-prone, unless the City took certain remedial actions. The FEMA identified concerns over the integrity of the levee related to its original construction materials, height, and presence of mature vegetation (FEMA 2007). To gain re-certification, an original proposal was made to remove over 850 trees on the levee, all plant species with potential to grow larger than four inches in diameter out to 15 feet from the toe of the levee, and all shrubs and smaller vegetation that obscure visibility of the levee face. These measures were proposed to comply with COE regional standards. However, since this levee isn't certified by the COE, compliance with COE standards to gain certification was not required. The project proponents are now working on a design that maintains riparian vegetation to provide habitat function for salmon, and ensures the stability of the levee.

In the case of RIP levees, the causal link between the COE vegetation standards and the NFIP is more attenuated, because the vegetation standards serve the dual purposes of determining both NFIP and RIP eligibility. Many sponsors of levees active in the RIP cut vegetation in order to remain eligible for RIP funds, even if FEMA does not require the tree removal as a precondition for NFIP recognition. Nevertheless, if FEMA were to cease relying on COE's vegetation standards and instead adopt its own more "fish-friendly" vegetation standards, it is likely that at least some levee sponsors would opt to retain riparian vegetation to protect fish habitat. King County, for example, has recently indicated that it will withdraw five out of thirteen levees on the Green and Snoqualmie Rivers from the RIP in order to avoid removing vegetation that provides important habitat functions for salmon. This decision was in response to a request from the COE that the County remove 477 trees in order to retain RIP eligibility. By withdrawing the five levees from the RIP, King County estimates that it will reduce the number of trees cut to 98 (Steve Bleifuhs, pers. comm. 7/8/08). As these examples show, FEMA's reliance on the COE's vegetation standards leads to the removal of at least some riparian vegetation that would remain in place if allowed by the NFIP, therefore the adverse effects of removing such vegetation may be attributed to the NFIP.

Levees cause additional adverse effects to salmon due to bank stabilization methods and channel confinement. Riprap displaces vegetation and decreases survival and growth as soil is not available for root establishment. In addition, riprap is generally uniform and lacks bank irregularities needed to provide velocity refuge for fish and their prey (COE 2003). Levees also confine rivers, limiting the potential for creating or re-establishing complex and diverse habitats that are important for juvenile salmon rearing and refuge, such as side channels, oxbows, and floodplain wetlands.

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but can most effectively be dealt with through stormwater management regulations. However, increases in hydrology do occur with filling in the flood fringes, a practice that is allowed by the minimum NFIP regulations. It is recommended that this be addressed by instituting regulations that either prohibit fill in the fringes or require compensatory cut and fill provisions." Statement of Charles Steele, Floodplain Management Specialist, Washington State Department of Ecology, July 3, 2003.

In contrast, levees that are not certified by the COE can be designed and built to include features that increase salmon habitat value. For example, a levee on the South Fork Skykomish River that protects portions of the Town of Skykomish was recently constructed to replace approximately 600 feet of an existing levee as part of a site clean-up and remediation project. The levee is not eligible for FEMA levee accreditation (it does not provide protection from the 100-year base flood), and thus avoided the need for COE certification (Bean, electronic comm. 7/7/08).

The new levee features five large woody debris clusters, each consisting of six pieces of wood. Large wood was keyed approximately 15 feet into the levee material, with log and rootwad protruding out five to 10 feet. The levee face has armored rock that was covered with soil, and planted with six species of native trees, and five species of native shrubs. A total of 161 trees and 403 shrubs were planted, and are being actively monitored with a goal of 100 percent survival at three years, and 80 percent survival at five years. The reconstructed levee has improved riparian habitat functions that facilitate more complex edge habitat and cover that are beneficial for juvenile fish while still protecting vital infrastructure. Riparian functions will increase over time as the levees' trees and shrubs mature. The project design was reviewed and approved by registered professional engineers employed by King County. The NMFS determined that the project was "not likely to adversely affect" PS Chinook salmon or critical habitat of PS Chinook salmon.

While FEMA and the COE describe participation in the NFIP and maintenance of levees as strictly voluntary, fiscal ramifications to local communities if such voluntary measures are ignored can have severe economic consequences. Flood prone communities that do not participate in the NFIP cannot avail themselves of Federal guarantees in property financing, and are not eligible for disaster relief for flood damage (FEMA 2002b). The COE will not authorize emergency funds to be expended for flood emergency preparation, flood fighting and rescue operations, or repair or restoration of flood control works if levees do not comply with vegetation management standards and are therefore are not eligible for the PL 84-99 program (33 CFR Part 203). In addition, if levees are certified by the COE, funding for the certification process if often available from the COE, whereas, levee certification performed by private registered engineers must be paid for the levee owner/operator. Therefore the combined fiscal incentive is for local jurisdictions to request COE certification and remove vegetation, thus aquatic species and rivers bear the costs of levee maintenance in these reaches.

Minimum Floodplain Management Criteria. As explained in the Proposed Action section of this document, the NFIA provides strong incentive for communities to participate in the NFIP, so that property owners may obtain financing and other benefits. To participate in the NFIP, a community must adopt minimum floodplain management criteria established by FEMA. The U.S. District Court recognized that there is economic incentive for communities to participating in the NFIP, finding that the FEIS for FEMA's NFIA regulations states that if a community chooses not to participate in the NFIP, economic development in the flood hazard area may be severely restricted (*National Wildlife Federation v. Federal Emergency Management Agency*, 345 F. Supp. 2d 1151 (W.D. WA. 2004)).

While the minimum criteria promulgated by FEMA are intended to constrain development in flood-prone areas, some criteria encourage activities that are ecologically harmful, and result in conditions that adversely affect salmon and steelhead and their habitat. For example, as mentioned under Flood Mapping Program, the NFIP allows unlimited development across the floodplain, except in the floodway if one has been designated, so long as the developed areas are either at or above the level of the 100-year flood, or protected by levees with at least 100-year protection. This requirement to raise developed areas above the level of the 100-year flood is one of the minimum criteria of the NFIP. The lowest habitable floor of a structure must be placed at or above the level of the BFE. The FEMA provides technical guidance on fill placement in floodplains, and building structures on fill, to reduce risk of damage from flooding (FEMA Technical Bulletin 10-01; see Figure 1 above, page 14). This guidance leads to placing fill in the floodplain as a part of NFIP participation.

Recognizing some of the environmental shortcomings of the minimum criteria led to the development of the *Higher Regulatory Standards* (FEMA 2002a). In the *Higher Regulatory Standards*, FEMA states, “With the recent listing of several salmonid species as threatened or endangered under the Endangered Species Act in large areas of the Northwest, the need to protect and restore aquatic habitat has taken on a new urgency. Unfortunately, many communities continue to rely on the minimum requirements of the NFIP to regulate activities in the floodplain. Others, however, have realized that the purely economic flood loss reduction objectives of the NFIP may not provide an adequate level of stream habitat protection.” In Washington state, none of the communities have as yet adopted the Higher Regulatory Standards. The effects of management according to the minimum criteria alone are discussed below.

The FEMA’s decision-making process related to minimum criteria includes approving the floodplain ordinances of local communities, monitoring communities to ensure that they have adopted an ordinance that meets or exceeds the minimum criteria, and ensuring that they are effectively enforcing their ordinance. If the community is out of compliance, FEMA can initiate a formal enforcement action, or if the community does not make adequate progress, formal probation can be initiated. If a community doesn’t address FEMA’s concerns within the probation period, the community may be suspended from the program. Although there are financial disincentives for communities to be on probation and suspended, FEMA frequently doesn’t use these approaches, preferring instead to work with the communities to achieve compliance (pers. comm. Mark Eberlein 6/7/06).

To summarize, the primary element of FEMA’s minimum criteria that affects listed salmonids and their habitats is the requirement to elevate structures so that the lowest floor of construction is at or above the BFE (the discussion in this paper focuses on riverine examples, but there are similar standards for coastal areas). The placement of fill in the floodplain displaces salmonid habitat, and the associated development results in the placement of additional fill to support infrastructure and in increased pollution, stormwater runoff, vegetation removal, and other adverse effects. Other elements of the NFIP as it is currently administered contribute to exacerbate the potential scope of habitat loss. For example, when establishing BFEs, FEMA’s current methodology generally does not account for waves or to future increases in the level of the 1-percent-chance flood. The increased future flood level is usually the result of increased runoff from developing watersheds, floodplain encroachment that occurs under the current regulations, and climate change that is not accounted for by the models currently in use. The FEMA has recently issued guidance allowing future built-out conditions to be mapped on FIRMs.[17]

Community Rating System. The major goal of the CRS is to encourage communities to adopt standards more stringent than the NFIP, and one of the express statutory purposes of the CRS program is to encourage the adoption of measures that protect natural and beneficial floodplain functions (see list of credit points awarded for CRS activities in Appendix 2). However, 227 of the 252 communities participating in the NFIP in Washington (90 percent) have the lowest community rating (EDAW 2006), meaning they use only the minimum standards of the NFIP. For these areas particularly, as well as for many areas that have higher ratings, measures to guard against loss of ecological function do not appear to be in place.

The influence of the CRS on the character of development in floodplains is unclear although some evidence suggests that the impact of the CRS may be confined largely to minimizing flood damage, reducing repetitive claims, and increasing awareness of flood risk and strategies for structural mitigation (FEMA 2002b). In addition, participation in the CRS may significantly inhibit floodplain development if communities adopt ordinances that require more than the NFIP mandates (Rosenbaum 2005). Some CRS elements can be beneficial to salmon, while other elements do have deleterious effects to salmon habitat as described below.

Activity 420 (preservation of open space). Credit is given for areas that are permanently preserved as open space. Additional credit is given for parcels of open space that are protected by deed restrictions or that have been preserved in or restored to their natural state. Under this activity, several different methods of preserving floodplain lands as open space are recognized. To be termed "open space," the land must be free from buildings, filling, or other encroachment to flood flows. The objective is to prevent or minimize development that obstructs floodwaters, exposes insurable buildings to damage, or adversely affects water quality or quantity or other floodplain functions. This activity recognizes programs that have preserved wetlands, beaches, and other critical areas from development, even though they may not have been intended as floodplain regulatory activities. If an open space parcel has a deed restriction or other permanent legal attachment that prohibits buildings or fill from ever being placed on the land, it is given the designation "DR" and additional credit. If it has been preserved in or restored to its natural state, it is designated Natural and Beneficial Functions "NB" and given additional credit. This CRS activity is entirely beneficial to listed salmonids.

Activity 520 (acquisition and relocation). Credit is provided for acquiring, relocating, or otherwise clearing buildings out of the flood hazard area. This CRS activity has long term

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benefits to listed salmonids, and short term impacts associated with demolition and clearing of existing buildings.

Activity 530 (flood protection). Credit is based on the number of insurable buildings in the area of regulated floodplain that have been retrofitted since the date of the community's original FIRM. For the purposes of this activity, an accessory structure such as a garage or shed is not counted as an insurable building. Extra credit is given for protecting buildings on FEMA's repetitive loss list.

Flood protection techniques that are recognized by this activity include structural flood control projects such as:

- Barriers, including levees, berms, and floodwalls
- Channel modifications, including enlarging bridges and culverts
- Diversions
- Storm sewer improvements, including enclosing open channels
- Small reservoirs, including retention and detention basins

Structural flood control project such as those listed above restrict floodwaters from dispersing in floodplains, and therefore restrict the movement of juvenile salmonids that are present during the flood conditions. Constrained floodwaters generally move through the floodway and floodplain with higher volume and velocity, conditions that significantly stress juvenile fish, and which they cannot escape since the slow velocity areas to refuge in have been eliminated via the structures.

Activity 540 (drainage system maintenance). Credit requires removal of “debris” from streams and rivers. In natural stream systems, this LWD creates roughness, delaying downstream conveyance of floodwater and creating pooling or backwater impoundment of floodwater. This activity was recently modified in a manner that can be interpreted to mean LWD can be left "in some areas with natural streams, some woody debris may remain as long as it doesn't increase the flooding problem". However, this activity does not recognize local Best Management Practices that "re-introduce" LWD into a system as part of stream restoration actions (pers. comm. Robert Flaner 11/22/06). Large wood placement in riverine systems to replenish materials systematically removed over time is currently practiced throughout the State of Washington in order to benefit fish by providing habitat complexity. Multiple local jurisdictions have been unable to receive CRS points given the conflict between the NFIP’s emphasis on floodwater conveyance and state and Federal requirements to preserve or mitigate aquatic habitat conditions for fish.

Activity 450 (Stormwater Management). The City of Portland recently completed "Actions for Watershed Health, 2005 Portland Watershed Management Plan (PWMP)" which established goals and objectives to move towards "normative" stream flow conditions. The CRS did not recognize this multi-objective management approach as a means of achieving the same [flood risk reduction] results as the single objective approach promoted by the CRS. Since Portland’s normative flow approach to stormwater does not fit the CRS prescribed method of managing watersheds, the City was not be allowed to achieve a CRS class 4 rating for which they have met the credit criteria. The NMFS correspondence on this issue states:

> "Normative flows are flows that mimic pre-development flows in the magnitude, frequency, duration, and timing of both peak and low flows. Normative flows help support salmonids through the formation and maintenance of aquatic habitat. Within the PWMP, the City uses the concept of normative flows in two places: (1) The watershed health goal for hydrology is to move toward normative stream flow conditions for the Willamette River tributaries within the City of Portland; and (2) because of the uncertainty in what normative flows are for tributaries to the Willamette River, the City commits to identifying design storm standards that support normative flows. Managing stormwater within a watershed by striving to achieve normative stream flow conditions is a multi-objective methodology that NMFS supports and encourages at the local government level in lieu of traditional methodologies that focus on only one objective.
>
> The normative flow approach is an alternative approach to traditional stormwater management that can achieve the same net result of the traditional approaches, while at the same time provide multiple program benefits such as improved water quality, habitat restoration and the attenuation of the increase in runoff generated from new development that can cause habitat degradation.
>
> The NMFS is aware that the City is currently being reviewed by FEMA under the CRS which designates the flood insurance discount based on review of a comprehensive floodplain management plan. The NMFS encourages FEMA to recognize the normative flow approach to watershed management as an alternative approach under its CRS program. Normative flows can protect floodplain functions, with appropriate watershed management, while supporting the habitat requirements for salmonids in streams" (NMFS 2006 letter to FEMA, (June 19, 2006)).

Relationship Between Floodplain Changes and Salmonid Habitat

As described above, the NFIP, through the three described programs, leads to development in the floodplain environment. Development within the floodplain results in stream channelization, habitat instability, vegetation removal, and point and nonpoint source pollution (NMFS 1996) all of which contribute to degraded salmon habitat (Botkin et al. 1995). The distribution of large floods over time reflects the precipitation and runoff within a watershed, and large floods are natural and necessary for the drainage of the watershed and maintenance of the river channel. In urbanized watersheds problems may result simply because placement of structures disrupts natural processes, or because the urbanization itself has induced changes in the hydrologic regime that cause more intense flooding. Structures (such as levees and homes) act to constrict the stream channel, degrading instream and floodplain habitat. Impervious surfaces (e.g., pavement) reduce water infiltration and increase runoff, thus creating greater flood hazard (Leopold 1968). Flood control and land drainage schemes may increase the flood risk downstream by concentrating runoff. A flashy discharge pattern results in increased bank erosion with subsequent loss of riparian vegetation, undercut banks and stream channel widening. Point source and non-point source pollution occurs at almost every point where urbanization activity influences the watershed. Sediments washed from the urban areas and deposited in river waters include trace metals such as copper, cadmium, zinc, and lead. These, together with pesticides, herbicides, fertilizers, gasoline, and other petroleum products, contaminate drainage waters and destroy aquatic life necessary for salmon survival.

The following section describes the relevance of environmental changes in the floodplain to salmon and steelhead and their habitat. Thereafter, the section relates the program's effects on salmonids to SRKW. Finally, the section describes the relevance of these effects to designated critical habitat.

Placing Fill. Through both the mapping and minimum criteria elements of the NFIP, the program leads to placing fill in floodplains which has environmental ramifications that bear on the ability of floodplain habitat to meet the ecological needs of listed salmon and other animals in the Puget Sound region (Cross 1989, Rosenbaum 2005, Muckelston 1983, EDAW 2006, *National Wildlife Federation v. Federal Emergency Management Agency*, 345 F. Supp. 2d 1151 (W.D. Wa. 2004)).

Placing fill in the floodplain diminishes the functional condition of floodplain processes that create and maintain salmonid habitat. Fill eliminates wetlands, wetland and riparian vegetation, and limits channel dynamics. Fill constrains floodwater flow into smaller spaces, increasing flood flow velocity and concomitant erosive damage and scour. The FEMA itself acknowledges that filling in the floodplain is highly likely to have adverse effects on habitat of listed and endangered species (FEMA 2002a, 2002b).

Fill directly affects salmon by converting aquatic areas to uplands. The corollary argument that floodplains are not lost with filling, because floodwaters are merely displaced to different locations along the river system, fails to recognize that rather than inundating high quality riparian areas, wetlands, oxbows, and other off-channel habitats, floodwaters are increasingly displaced to areas that include infrastructure such as roads, homes, and businesses, as shown in Figure 12 below. Floodwater contact in these locations creates secondary issues for species, such as exposure to contamination from industrial pollutants and/or household hazardous materials including insecticides, herbicides and fertilizers.

Figure 12. Right behind the truck there is a two foot long salmon swimming across the street. The banks of the creek they are spawning in overflowed in the 2007 floods, and a few had to dodge traffic to continue along their way.

The importance of river-floodplains to fish populations has been shown by Lambou (1959), Holcik and Bastl (1976, 1977), Bryan and Sabins (1979), Welcomme (1979, 1985, 1989), Bayley (1980, 1981a, 1983), Junk (1980, 1984), Littlejohn et al., (1985), Amoros et al. (1986) and Bravard et al. (1986). The life histories of major plant and animal groups, in particular fish, in a large river-floodplain system is in many ways analogous to a highway network with the vehicles corresponding to the fish. Detritivores, herbivores, and/or omnivores support large fisheries in the main channel (Petrere 1978, 1982; Welcomme 1979; Quiros and Baigun 1985), but the highest yields are associated with adjoining floodplains (Richardson 1921; Lowe-McConnell 1964; Petrere 1983) and most of their production is derived from floodplain habitats (Welcomme 1979: Bayley 1983). Fisheries biologists tend to consider main channels and their floodplains as a single unit, because both are essential for the survival of fish stocks (Holcik and Bastle 1976; Welcomme 1979; Bayley 1980, 1981a, 1983). When a regularly inundated floodplain is present, most of the vertebrates found in the main channel depend to a great extent directly or indirectly on primary production in the laterally linked floodplain habitats. The importance of lateral migration of animals between the floodplain and the main channel of a large river system has been underestimated because modern civilization has substantially modified the hydrograph and separated floodplains from main channels. These modifications dominate in large temperate river systems. The biologist’s typical view of fish in temperate rivers has been that they complete their life cycles within the river channel. Indeed, fish have no alternative in sections of some highly altered systems (Junk et al. 1989).

Floodplain inundation substantially increases the total habitat availability, particularly shallow water area. For example, Sommer et al. (2001b) calculated that complete inundation of Yolo

Bypass creates a wetted area approximately 10 times larger than the adjacent Sacramento River channel. Unlike the steep trapezoidal river channel of the Sacramento River and other Sacramento– San Joaquin Delta tributaries, the flooded Yolo Bypass contains large areas of shallow (typically <2 m), inundated vegetation, a habitat type preferred by salmon (Moyle 2002). In addition to increased habitat area, inundated floodplain provides an enhanced food supply. Sommer et al. (2001a) reported that multiple trophic levels are stimulated by floodplain inundation, increasing the availability of invertebrates to young fish (Sommer 2004).

The NFIP as currently administered causes harm to salmon and their habitat by providing incentive, technical guidance and recognition for placing fill in floodplains. Placing fill in floodplains reduces floodwater storage, alters hydrology and channel morphology, increases water velocity at high flows, and eliminates juvenile rearing habitat vitally important to survival. These hydologic and channel morphology changes cause take by significantly imparing spawning and rearing habitats.

Channel Morphology and Function. Placing fill and levee construction under the NFIP confines rivers in a process called channelization. Confinement of the channel eliminates off-channel flood storage and off channel habitat relied on by juvenile salmonids for refuge from high flows. Confinement disconnects the side channels, oxbows, and off-channel areas that store floodwaters and provide refuge for juvenile salmon during floods. Reducing floodplain flood-storage capacity increases flood velocities and peak flows in the stream channel and exacerbates downstream erosion and scour (Task Force on the Natural and Beneficial Functions of the Floodplain 2002). Shallow floodplains displaced by fill cause channels to convey greater volumes of runoff at higher velocities.

Channel dredging, lining, straightening, large-scale removal of riparian vegetation, and adding embankments and levees are common responses to flooding that lead to adverse effects on salmon and their habitat. The goal of all these approaches is to move water through a channel faster and more efficiently (Mount 1995). However, changing channels and filling in floodplains are destabilizing. During periods of high water, the water confined to main channels has greater erosive force.

In addition to exacerbating erosive issues, channel confinement affects sediment distribution in channels. One effect is scouring spawning gravel. In addition, channelization converts a river into a homogeneous system characterized by laminar flow in a smooth uniform channel. Lack of spatial and textural diversity eliminates numerous species dependent on a physically diverse substrate for shelter, reproduction or food. This affects all trophic levels (Mount 1995). Straight channels are less biologically diverse than meandering or braided channels (Beechie et al. 2006).

These sedimentary and fluvial processes and effects are not often considered when levees are constructed or rehabilitated (Mount 1995, Bolton and Shellburg 2001). River systems are dynamic and without constraints of levees or other flood control structures, they reach a dynamic equilibrium in which channels move in response to sediment and water volume transport (Bolton and Shellburg 2001).

As rivers become progressively more confined, water moves through the channel at a faster rate, which translates into sharp increases in peak flows and a decrease in the lag time. Flood structures prevent site level habitat formation needed to maintain PCEs of Critical Habitat designated in the Federal Register (September 2, 2005 70 FR 52630). They affect bank erosion, lateral migration and riparian succession. They preclude floodplain connectivity, forage and natural cover that are derived by undercut banks and backwaters. Floodplain connectivity, forage and natural cover in the form of undercut banks and backwaters are important for the long term productivity of aquatic habitats (COE 2003). In addition, levee systems create drier conditions on the protected floodplain and contribute to the loss of wetlands (Task Force on the Natural and Beneficial Functions of the Floodplain 2002), thus causing indirect effects.

The COE recently modified its nationwide program for permitting fill in waters and wetland of the United States to include permanent placement of above grade fill within the 100 year floodplain (March 12, 2007, 72 FR 11092). It reduced the level of regulatory oversight for fills in this category from individual 404 permitting to general permitting under the Nationwide Permit Program, and limited its authority in floodplains to wetland fills. The COE's stated purpose in reducing its permitting function for placement of permanent above grade fill in 100 year floodplains is to harmonize with the regulatory program of the NFIP.

Impacts of even small scale developments in floodplains have cumulative effects. Imprecision in modeling supports assertions that each incremental increase in flood levels will be negligible. Thus, project permits are being issued on an individual basis, resulting in incremental loss of floodplain land to development (Pinter 2005). However, the cumulative loss of floodwater storage and channel confinement destabilizes hydrology. Hydrologic instability is linked to biological losses. Confined channel reaches are velocity barriers for salmon. Food energy is less available. At the same time, there are higher bioenergetic requirements for salmon to survive conditions with faster currents.

Measures used to stabilize banks in channelized reaches and along levees also have adverse effects. For example, projects that rely solely on riprap can cause damage to riparian and instream habitats (COE 2003, Schmetterling et al. 2001, Beamer and Henderson. 1998). When river banks are covered by riprap and the top of the bank supports only grass species, several important functions of riparian areas are virtually eliminated. Native tree and shrubs have difficulty growing among and through rock, likely due to limited soils available for root establishment. Riparian banks are devoid of trees and shrubs, and are actively maintained to preclude most trees from colonizing. In turn, functions from riparian shrubs and trees that are important for aquatic habitat quality, such as shade, eventual delivery of large wood, production of insects that serve as food, and delivery of organic matter and other nutrients to the river, are all greatly diminished or lost. Riprap is generally uniform and lacks bank irregularities needed to provide velocity refuge for fish and their prey (COE 2003).

Channelization affects salmon because river ecosystems supporting salmon have interacting hydrology, sediment and biota (Beechie et al 2001, Benda et al. 2001, Buffington et al. 2003, Fox et al. 2003, Mount 1995, Montgomery et al. 1999). Channel processes are linked to fish use and abundance in channel reaches. Dramatic decreases in salmon abundance follow increased channelization (Montgomery et al 1999). Channelization causes loss and degrades the quality of freshwater rearing habitat for juvenile salmonids. Loss of velocity and predator refuge, food supply, and access to feeding areas, as well as increased water temperature, all are caused by displacing floodwaters and channelization (Bolton and Shellburg 2001). As well, confining floodwaters to channels reduces the beneficial ecological interactions that occur between salmon and riparian vegetation.

Riparian Function. The existence and persistence of vegetation in proximity to streams and rivers is essential to the development and maintenance of functioning riparian habitats. Riparian functions that depend on vegetation include maintaining instream water temperatures (through shade), bank stability (through vegetative root structure), primary food production (organic inputs through leaf litter and insects falling from trees over streams), recruitment of large woody debris, and sediment trapping. Each of these functions supports the ability of any reach to contribute to the salmonid life histories expressed in those reaches. Actions taken under, or to avoid participation in, the NFIP that cause removal of vegetation undermine the ability of those reaches to support those salmonid life histories.

The effects of floodplain fill on channel dynamics can lead to erosion of streambanks, which leads to lost riparian vegetation. Increasing high flows and velocities, resulting from channel confinement due to fill, can remove riparian vegetation outright, or cause vegetation removal as a result of bank erosion. Furthermore, riparian vegetation is generally removed for the placement of fill to enable construction. Riparian vegetation is generally not replaced as part of such development. Instead, street trees, non-native landscaping and impervious surface most often replace the previously existing native vegetation. Maintenance of certified levees often requires removal of riparian vegetation. In these ways, channelization and fill in floodplains degrades riparian functions (Bolton and Shellberg 2001).

Riparian zones with functioning vegetation contribute to the processes that supply food, habitat structure and cover, channel form, and water quality (especially temperature). When mature riparian vegetation and wood cover occurs along channel margins and the wetted perimeter of the channel, it offers critical habitat conditions that: (1) provide holding habitat for juveniles next to faster currents that can bring steady supplies of food from upstream, (2) retain organic matter and wood from upstream sources to increase surface areas for primary and secondary production, (3) reduce current velocities along channel margins that are preferred by newly emerged fry and yearling Chinook salmon, (4) provide overhead cover and refuge for juvenile salmonids by enhancing structure to avoid predation from birds and other fish, (5) retain organic matter and wood from upstream sources to increase habitat complexity, and (6) maintain cool stream water temperatures and adequate dissolved oxygen levels. These functions contribute to the function of forage, natural cover, channel habitat, and water quality of salmon habitat.

When rivers are connected to floodplains, floodwaters and channel migration are able to disperse and develop channels away from the mainstem. Side channels and backwaters in turn provide forage, natural cover, rearing and refuge for sub yearling Chinook salmon. These areas feature reduced river velocities, particularly during flood events that enable juvenile Chinook salmon to reside and grow prior to movement downstream. Flooding is needed to maintain riparian ecosystems (Richter and Richter 2000). Sub-yearling Chinook salmon occur in higher densities in side channel and backwater habitats than in mainstem habitat in the Skagit (Beamer and Henderson 1998; Beechie et al. 2005).

Floodplain and streamside vegetation is an important source of energy for the maintenance of invertebrates and fish. Instream communities are highly dependent on leaf litter from streamside forests for maintaining metabolism and ecosystem structure. Robust vegetation along the water's edge dramatically increases the input of terrestrial invertebrates into aquatic systems (COE 2001b). Roots uptake elements from the soil and bedrock, then deliver them to the stream through the process of decay (COE 2001a).

Roots, stems, logs and organic debris such as leaves provide colonization sites through increased surface area, and velocity refuge for algae and macro invertebrates (COE 2001b). Organic matter delivered from site level riparian areas, or accumulated within edge habitat from upstream sources, is a food source for macro invertebrates (COE 2001b). Riparian vegetation is a vital source of energy for invertebrates and fish (COE 2001b). The opportunity for juvenile forage which includes aquatic invertebrate species that support salmonid growth and maturation, are reduced by placing fill in floodplains and confining channels.

In particular, undercut banks and bank irregularity can provide reduced velocities and micro-habitat structure for aquatic species (COE 2001b), including juvenile Chinook salmon and their prey. Channelized reaches do not feature nor will they develop overhanging vegetation. Neither will channelized reaches be able to maintain exposed roots, undercut banks or complex bank structure, due to the the increased high volumes and velocities that occur in channelized reaches. In combination with complex bank margins, riparian vegetation provides refuge from predation, and allows fish to hold in lower velocity areas, thus expending more energy to forage, rather than to simply hold position within the water column.

A diverse assemblage of native riparian vegetation can appreciably increase instream habitat conditions, and enhance bank integrity (Shields 1991). Riparian vegetation has a profound effect on the stability of both cohesive and non-cohesive soils. Wynn et al. (2004) found that at sites where banks are nearly vertical, woody vegetation may provide better protection against scour of the bank toe. Woody vegetation also appears to provide greater geotechnical reinforcement of stream banks by serving as an effective buffer between the water and the underlying soil. It increases flow resistance, which reduces flow velocity, thereby greatly reducing erosion (COE 2001b). On levees, root structure enhances soil cohesion, and levee failures occur more frequently where trees are absent than where present (Dwyer et al. 1997, Fischenich and Copeland 2001, Gray et al. 1991, Geyer et al. 2003, Hollis and Leech 1997, Abernethy and Rutherfurd 2000).

In Puget Sound lowlands, wood jams were integral to maintaining an anastomosing channel pattern and a dynamic channel-floodplain connection. They also created deep pools. These jams illustrate the dynamic between riparian forests, wood recruitment and wood jams (Collins and Montgomery 2002).

Salmon depend on cold, oxygenated water (September 2, 2005 70 FR 52662) but removing vegetation increases stream water temperatures and decreases dissolved oxygen.

Water Quality. Water quality is affected by the implementation of the NFIP; as development displaces natural habitat point source and nonpoint source pollution occurs throughout the watershed. Proximity of the floodplain to systems supporting listed salmon heightens the effects of degraded water quality on fish and fish habitat. Impervious surfaces (i.e. pavement) reduce water infiltration and increase runoff, thus creating greater flood hazard (Leopold 1968, Booth et al. 2002). Sediments washed from the urban areas and deposited in river waters include trace metals such as copper, cadmium, zinc, and lead (California State Lands Commission 1993).

Pollutant loading in surface water is widely attributable to urban stormwater runoff. EPA (2002) identified a wide range of pollutants associated with urbanization which contribute to the degradation of receiving waters. These include nutrients; sediment; metals; hydrocarbons from gasoline, oil and vehicle exhaust; pathogens; and pesticides. Water temperature, turbidity, dissolved oxygen, pH, nutrients, and toxic chemicals/metals also affect water quality and the ability of surface waters to sustain listed salmonids. These factors naturally fluctuate daily or seasonally in magnitude or concentration. However, when exacerbated by stormwater runoff, the acceptable range of these factors can be exceeded, altering or impairing biological processes and adversely impacting salmonids (Spence et al. 1996).

In addition to listed species, recent occurrences of pre-spawn mortality (PSM) in coho salmon have heightened our concern with stormwater quality. Beginning in the late 1990s, agencies in the greater Seattle area began conducting fall spawner surveys to evaluate the effectiveness of local stream restoration efforts. These surveys detected a surprisingly high rate of PSM among migratory coho females. In recent years, PSM has been observed in various lowland urban streams in the Pacific Northwest. Although the precise cause of PSM in urban streams is unknown, results from the first three years of an ongoing effort (2002-2004) suggest conventional water quality parameters (i.e. temperature and dissolved oxygen) and disease are not causal. Rather, the weight of evidence suggests that adult coho salmon, which enter small urban streams following fall storm events, are acutely sensitive to non-point source stormwater runoff containing pollutants that typically originate from urban and residential land use activities. Coho salmon maybe more sensitive to and react more acutely to water quality degradation than other salmonids. However, a growing body of science (discussed further below) suggests it is likely that other salmonids, including listed salmonids, experience sub-lethal impacts from pollutants found in stormwater.

Pollutants in stormwater not only result in water quality degradation, but many adsorb to particulates and are sequestered in sediments where they enter the food chain via the benthic community (benthic invertebrates are a prey species for listed salmonids). Sediment contamination from stormwater has also been identified in recent work by the Puget Sound Ambient Monitoring Program on changes and trends in Puget Sound sediments (Dutch et al. 2005). These authors noted an increase in PAHs since the 1980s, attributable to stormwater conveyance from increasing urbanization and vehicle traffic. When benthic invertebrates are exposed to and assimilate many of these pollutants, they can become sources of contamination for listed salmonids that prey on them. Perhaps more importantly, declining numbers and diversity of invertebrates provide less food for listed salmonids at critical times in their lives.

Listed salmonids will be exposed, directly and indirectly, to stormwater runoff discharging from parts of the floodplain that are filled or diked for development and are likely to be detrimentally affected. Impacts related to selected individual chemicals or classes of chemicals are readily available in the scientific literature (for example Baldwin et al 2003). As a result of NFIP implementation, floodwaters are increasingly displaced to areas that include infrastructure such as roads, homes, and businesses, increasing pollutant loading in salmonids streams, and yielding as yet undetermined synergistic effects among juvenile and adult salmonids.

A variety of water quality changes are associated with channelization. Channelization that occurs as a result of the channel being confined by fill placed in the floodplain as part of the NFIP will result in increased erosion of stream channels and banks. The eroded sediment particles will cause turbidity in the stream that impacts salmon prey species and the ability of salmon to detect predators. Dredging to enlarge the channel and enable flood flows to more quickly travel downstream will also cause channelization. This dredging and earth-moving suspends large amounts of silt and clay within the river, increasing turbidity downstream. In addition, dredging often suspends abundant nutrients and organics formerly buried within the sediment. Since most of this material resides in a highly reduced state while in the sediment, it can produce exceptionally high biological and chemical oxygen demands when mixed with river water. Materials that are often toxic, such as hydrogen sulfide, methane, and heavy metals, will also be suspended by dredging, greatly reducing water quality (Mount 1995). Sediment particles, along with pesticides, herbicides, fertilizers, and petroleum products, contaminate drainage waters and destroy aquatic life necessary for salmon survival. The California State Water Resources Control Board (1991) reported that non-point source pollution is the cause of 50 to 80 percent of impairment to water bodies in California.

Effects on Listed Salmonids

The effects of the NFIP on fish habitat are discussed in detail above. As described earlier in the *Approach to the Analysis*, NMFS conducted a habitat-based analysis of the effects of the action. The species-based analysis is based on examining how fish exposed to habitat change will respond to that habitat change. After assessing how individual fish will respond to the effects of the action, NMFS can assess whether those responses will lead to an appreciable reduction in 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 (the jeopardy determination).

To make the jeopardy determination, NMFS again takes an intermediate step to assess whether the effects of the action adversely alter any of the characteristics of VSPs (McElhany et al. 2000). The four characteristics of VSPs are abundance, productivity (population growth rate, spatial structure, and diversity. Abundance is the number of individuals in the population at a given life stage or time; productivity or growth rate is the actual or expected ratio of abundance in the next generation to current abundance; spatial structure refers to how the abundance at any life stage is distributed among available or potentially available habitats; and diversity is the variety of life histories, sizes, and other characteristics expressed by individuals within a population (McElhany et al. 2000). So NMFS examines how effects on individual fish that are part of populations, that make up an ESU or DPS, affect the viability of those populations to form an opinion on whether any changes in population viability reduce the likelihood of survival and recovery of those ESUs or DPSs in the wild.

As described above, the primary habitat effects of the proposed action are changes in floodplain extent and functional condition, and the corresponding changes in channel condition. Floodplains provide higher biotic diversity (Junk et al., 1989) and increased production of fish (Bayley 1991; Halyk and Balon 1983) and invertebrates (Gladden and Smock 1990) than the mainstem alone. Potential mechanisms for floodplain effects include increased habitat diversity and area (Junk et al., 1989), large inputs of terrestrial material into the aquatic food web (Winemiller and Jepsen 1998), and decreased predation or competition due to intermediate levels of disturbance (Corti et al., 1997). The degree to which floodplains support riverine ecosystems was studied by examining the relative importance of floodplain and riverine habitat to juvenile Chinook salmon in the Sacramento River (California, U.S.A.), a large regulated river. The system is particularly well suited to a comparative study, because young salmon migrating down the lower Sacramento River to the San Francisco Estuary in wet years have two alternative paths: they may continue down the heavily channelized main river or they may pass through the Yolo Bypass, an agricultural floodplain bordered by levees. Two reasons that the floodplain might be important habitat for young salmon are based on the observation that, years of high flow 1) enhance populations of a variety of species in the San Francisco Estuary (Jassby et al., 1995) and 2) increase the survival of Chinook salmon (Kjelson et al., 1982). Possible reasons for the positive effects of flow on fish include increased habitat availability, migration cues, food supply, larval transport, and reduced predation rates (Bennett and Moyle 1996).

Floodplain inundation is one of the unique characteristics of wet years, during which the Yolo Bypass is likely to be a significant migration corridor for young Chinook salmon in the Sacramento Valley. During high-flow events, the Yolo Bypass can convey greater than75 percent of the total flow from the Sacramento River basin, the major producer of salmon among tributaries of the San Francisco Estuary. Floodplains are known to be among the most important fish-rearing areas in a variety of river systems, yet in developed regions, the availability of this habitat has been greatly reduced by channelization and levee and dam construction (Rasmussen 1996). A high degree of habitat loss may greatly enhance the biological significance of remnant floodplains in heavily modified systems. (Sommer et al 2001a).

The results from this study suggest that hydrology may affect salmon feeding success, migration, and survival in both floodplain and river habitat. The coded wire tag results indicate that salmon grew faster, migrated faster, and may have had better survival rates in 1998 than in 1999. One clear difference between the years is that the flow pulses were higher and of longer duration in 1998 than in 1999. Higher flow could directly increase migration rates through higher water velocities and have multiple indirect effects on growth through factors such as food supply or water temperature. The abundance of Diptera (juvenile salmon prey item) in drift samples was substantially higher in 1998 than in 1999 in both locations. The significant interaction between location and year for both prey weights and the wet weight ration index indicates that the combined effects of diet and water temperature under 1998 hydrology should have resulted in higher growth rates. Higher growth rates and faster migration times in 1998 may, in turn, have improved survival by reducing predation risk. Higher-flow conditions in 1998 increased the quantity and duration of floodplain rearing area, perhaps reducing resource competition and predator encounter rates. Increased flow duration and magnitude in 1998 could also have improved survival on the floodplain by reducing stranding risks.

These results highlight the significance of seasonal floodplain habitat for salmon rearing, which has been studied primarily in perennial waterways such as estuaries and rivers (Healey 1991; Kjelson et al., 1982). This study demonstrates that off-channel floodplain provides major habitat for Chinook salmon. Sommer et al (2001a) do not believe that the benefits of the floodplain to Chinook salmon are unique to Yolo Bypass. Initial results from the Cosumnes River, an undammed watershed in the delta, show similar growth enhancements for juvenile Chinook salmon that rear on the floodplain rather than in adjacent river channels. Salmon reared in seasonally inundated habitats with annual terrestrial vegetation showed higher growth rates than those reared in a perennial pond on the floodplain. Growth of fish in the river upstream of the floodplain varied with flow and turbidity in the river. When flows and turbidity were high, there was little growth and high mortality (Jeffres, 2006). Moreover, the benefits of the floodplain to salmon are consistent with findings for other fish species (Sommer et al., 2001a).

Among other fish species that require functional floodplains and floodplain connectivity to provide important habitat are steelhead. 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. For 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).

Many authors document coho reliance on floodplain habitat as being greater than all other salmon species. Juvenile coho salmon far outnumbered all other fishes in the majority of side channels in the both the summer and winter on the Skykomish River (Drucker 2006). Similar results were found on the Skagit (Beechie et al. 2005) and Elwha. Juvenile coho salmon show strong preference for pools and woody debris cover in the summer and for side-channel and pond habitats in the winter (Pess et al. 2002).

Chum salmon rely primarily on near floodplain areas above the ordinary high water mark that are inundated during the wet season as spawning areas (Drucker 2006). Spawning success can be impaired when landscape conditions further up in the floodplain (decreasing natural vegetation and increasing impervious surface) increase volume and velocity that will scour out redds or suitable spawning gravels. Additionally, mortality in eggs and alevin can increase when floodplain development becomes a source of pollutants in stormwater. Chum salmon also rely heavily on estuarine floodplain areas for rearing. Access to shallow water estuarine areas where food and cover are plentiful are necessary to ensure successful outmigration to deeper estuarine waters and the ocean. Growth and survival can be impaired when access to estuarine floodplains is blocked by dikes and levees, or these areas are filled for development.

Many of the lower reaches of rivers and their tributaries in Puget Sound have been dramatically altered by urban development. Urbanization and suburbanization have resulted in the loss of historical land cover in exchange for large areas of impervious surface (buildings, roads, parking lots, etc.). The loss of wetland and riparian habitat has dramatically changed the hydrology of many urban streams, with increases in flood frequency and peak flow during storm events and decreases in groundwater driven summer flows (Moscrip and Montgomery 1997, Booth et al. 2002, May et al. 2003). Flood events result in gravel scour, bank erosion, and sediment deposition. Land development for agricultural purposes has also altered the historical land cover; however, because much of this development took place in river floodplains, there has been a direct impact on river morphology. River braiding and sinuosity have been reduced through the construction of dikes, hardening of banks with riprap, and channelization of the mainstem. Constriction of the river, especially during high flow events increases likelihood of gravel scour and the dislocation of rearing juveniles. Side channels are spawning habitat for steelhead and other salmonids. Additionally, side channel areas provide juvenile rearing habitat, especially overwintering habitat (Beechie et al. 2001, Collins and Montgomery 2002, Pess et al. 2002). From: NMFS' Status Review Update for Puget Sound Steelhead 26 July 2005.

The life histories of major plant and animal groups, in particular fish, in a large river-floodplain system is in many ways analogous to a highway network with the vehicles corresponding to the fish. Detritivores, herbivores, and/or omnivores support large fisheries in the main channel (Welcomme 1979; Quiros and Baigun 1985), but the highest yields are associated with adjoining floodplains (Richardson, 1921; Lowe-McConnell 1964; Petrere 1983) and most of their production is derived from floodplain habitats (Welcomme 1979: Bayley 1983). Fisheries biologists tend to consider main channels and their floodplains as a single unit, because both are essential for the survival of fish stocks (Holcik and Bastle 1976; Welcomme 1979; Bayley 1980 1981a 1983). When a regularly inundated floodplain is present, most of the vertebrates found in the main channel depend to a great extent directly or indirectly on primary production in the laterally linked floodplain habitats. The importance of lateral migration of animals between the floodplain and the main channel of a large river system has been underestimated because modern civilization has substantially modified the hydrograph and separated floodplains from main channels. These modifications dominate in large temperate river systems.

Floodplains are typically inundated in winter and early spring, when many native fishes spawn and rear (Sommer et al., 2001a). The timing of this inundation excludes non-native fish, keeping populations of alien fishes from increasing and dominating the floodplain fish assemblage (Moyle 2002). Moreover, floodplain inundation substantially increases the total habitat availability, particularly shallow water area. For example, Sommer et al., (2001b) calculated that complete inundation of Yolo Bypass creates a wetted area approximately 10 times larger than the adjacent Sacramento River channel. Unlike the steep trapezoidal river channel of the Sacramento River and other Sacramento– San Joaquin Delta tributaries, the flooded Yolo Bypass contains large areas of shallow (typically less two meters), inundated vegetation, a habitat type preferred by native fishes such as young Sacramento splittail and Chinook salmon (Moyle 2002). In addition to increased habitat area, inundated floodplain provides an enhanced food supply. Sommer et al., (2001a) reported that multiple trophic levels are stimulated by floodplain inundation, increasing the availability of invertebrates to young fish. (Sommer et al 2004).

As floodplains are filled and modified with the structural features benefiting human existence, the features that support salmonids are lost. These features include: prey availability (food), protection from predation by larger and/or non-native fish, increased habitat area, shallow habitat areas with inundated and overhanging vegetation, better water temperature range and water quality for metabolism and growth, and refugia from extreme volume and velocity. As juvenile salmonids increasingly experience the loss of these features, listed fish will have a reduced growth rate from lack of food abundance, higher rates of mortality due to predation, and higher mortality due to inability to find areas to avoid extremes in water conditions including temperature, velocity, and pollutants. Those juveniles surviving these conditions will typically smolt at smaller sizes, making them more vulnerable to predation and relatively less fit as they reach the estuarine and marine environments.

Relevance of Effects on Individual Fish to Salmonid Population Viability. The NMFS assesses the importance of habitat effects on individual fish to their ESUs or DPSs by examining the relevance of those effects to the characteristics of VSPs. The characteristics of VSPs are abundance, population growth rate (productivity), spatial structure, and diversity. Abundance is the number of individuals in the population at a given life stage or time; productivity or growth rate is the actual or expected ratio of abundance in the next generation to current abundance; spatial structure refers to how the abundance at any life stage is distributed among available or potentially available habitats; and diversity is the variety of life histories, sizes, and other characteristics expressed by individuals within a population (McElhany et al. 2000). While these characteristics are described as unique components of population dynamics, each characteristic exerts significant influence on the others. For example, declining abundance can reduce spatial structure of a population, and when habitats are less varied, then diversity among the population declines.

The NMFS analyzes the NFIP effects on characteristics of VSPs to determine whether and to what degree the effects of the proposed action influence the existing risk to the ESUs and DPSs of salmon and steelhead those populations comprise. At the population scale, the driving factors in determining extinction risks are population abundance and productivity. A population at low abundance is at greater risk of extinction caused by demographic or environmental stochasticity. If a population does not have the ability to replace itself, it "will deterministically go extinct, even if current abundance levels are relatively high" (ICTRT 2005). Thus, to determine if effects to individual fish are meaningful at the population scale, the risk factors of the population must first be identified, then the project effects among individuals of that population must be anticipated.

Abundance. Many PS salmon populations are limited in abundance by the loss of floodplain habitat. For example, Beamer et al (2005) found that Skagit delta and pocket estuary habitats are much smaller and more fragmented than historically, greatly reducing rearing opportunity for estuarine rearing Chinook salmon.

Channel confinement or channelization also has profound and adverse consequences on salmon. As juvenile Chinook salmon move downstream, they use complex edge habitat, sloughs and backwaters. Habitat conditions that provide optimum refuge from predation, velocity refuge and feeding in turn support higher densities of juvenile salmon (Beamer and Henderson 1998; Beechie et al. 2005).

Juvenile Chinook salmon densities along stabilized and natural banks have been positively correlated with increased surface area of large wood within the bank, and overhead cover from riparian vegetation (Peters et al., 1998). Many studies have documented that juvenile salmon abundance is lower at riprap banks than at natural banks (Hayman et al. 1996, Peters et al. 1998; Beamer and Henderson 1998), and in areas with no overhead cover compared to undercut banks (Brusven et al. 1986). Juvenile Chinook salmon not only have been found in greater densities within complex edge habitats, one study found them to be consistently larger in areas with overhead cover than fish in areas with no cover (Brusven et al. 1986).

Beechie et al. (2005) found densities of juvenile Chinook salmon and coho salmon were highest in bank and backwater units in winter, and in summer, only coho salmon densities were significantly different among edge unit types, densities being highest in banks and backwaters. Among ocean-type salmon, Chinook salmon and chum salmon fry were captured in large numbers in all edge units and exhibited only slightly higher densities in low-velocity areas.

Juvenile Chinook salmon often use stream margin habitats, where water velocity is typically slower than other micro-habitats (Lister and Genoe 1970; Bjorn and Reiser 1991). Studies indicate that increases in stream discharges displace juvenile salmonids with limited swimming ability (Tchaplinski and Hartman 1983; Heggenes and Traan 1988), such as newly emerged and rearing Chinook salmon fry and parr. Local velocity of edge habitat generally increases for smooth surfaces and decreases for rough surfaces, such as shrubs and trees (COE 2001a). Increases of localized stream velocity in urbanized parts of Puget Sound contribute to downstream displacement of juvenile Chinook salmon, and contribute to a decrease in habitat with water velocities within the tolerance of juvenile Chinook salmon. In a survey of juvenile Chinook salmon density related to velocities by natural bank habitats in the Skagit, Beechie et al. (2005) found an inverse relationship between velocity and fish abundance.

Flow changes affect fish in a number of ways. Changes in flow affect habitat availability, migration cues, food supply, larval transport, and predation rates (Bennett and Moyle 1996). Floodplain inundation is one of the unique characteristics of wet years, providing additional habitat for fish rearing and foraging. In developed regions, the availability of this habitat has been greatly reduced by channelization and levee and dam construction (Rasmussen 1996). A high degree of habitat loss may greatly enhance the biological significance of remnant floodplains in heavily modified systems, such as in the Puget Sound Region.

All of the populations in the PS salmon ESUs and DPSs (considered in this analysis) are highly variable and some are quite small. Some of the smallest populations are also at the greatest risk from the effects of global warming (addressed in the cumulative effects section, later in this document). As the frequency and magnitude of flood events increases, and channel and floodplain habitat is limited, juvenile salmon will be affected by the lack of refuge areas with increases in mortality. Actions that further reduce abundance of these populations are harmful.

Productivity. Fill in floodplains adversely affects salmon by reducing food and shelter for juvenile fish and thus reducing survival (Bayley, 1991, Junk et al. 1989, Sommer et al. 2001a). This results from the conversion of floodplains to uplands and also from reducing riparian functions. Reducing the amount of habitat used by juvenile salmon in parts of river systems (often the lower and estuarine reaches) also reduces spatial distribution. Diversity is also thought to be reduced by shifting conditions so they are less favorable for stream-type versus ocean-type Chinook salmon for example.

Fish yield and production are strongly related to the extent of accessible floodplain, whereas the main river is used as a migration route by most fishes (Junk et al. 1989). Most of the salmon habitat in the Skagit and Stilliguamish River watersheds were located in the floodplains and deltas (Beechie et al. 2001). These two watersheds support important populations in the PS Chinook salmon ESU and steelhead DPS. There is broad consensus that anthropogenic effects at the habitat and watershed scales cause changes in salmon abundance and distribution at a regional scale (Pess et al. 2003). The loss of floodplain habitat and function is clearly a leading factor in the decline of Chinook salmon abundance and productivity.

Growth rates of juvenile salmon are higher in floodplains (Jeffres 2006, Sommer et al. 2001a). Salmon reared in seasonally inundated habitats with annual terrestrial vegetation showed higher growth rates than those reared in a perennial pond on the floodplain (Jeffres 2006). Jeffres found that overall, ephemeral floodplain habitats supported higher growth rates for juvenile Chinook salmon that more permanent habitats in either the floodplain or river.

Skagit data illustrate the strong likelihood of density dependent movement from freshwater to estuarine and nearshore areas. As juvenile Chinook salmon move downstream, they prefer habitat with low velocities and wood cover. These habitat types are relatively scarce in the lower mainstem reaches, and juvenile Chinook salmon encounter greater numbers of other fish at his habitat types than at other bank types. Competition forces some fish to continue to move downstream in an effort to occupy beneficial rearing conditions. Chinook salmon fry that arrive within stream (and estuarine) habitats that already host larger, older Chinook salmon must either compete with these fish for food, or emigrate in search of other habitat. In these instances, interaction occurs that forces smaller, less developed Chinook salmon to move to the estuary and higher saline waters.

The greater the proportion of juvenile Chinook salmon that emigrate as fry, rather than parr and yearlings, reduces optimum life-history diversity and has population-level consequences (Reimers 1973). Because of similar habitat limitations in the Skagit estuary, many fry move into Skagit Bay (Beamer et al. 2005). As juvenile Chinook salmon move out of the estuary, they face a changing gradient of environmental conditions and biotic communities, such as increasing salinities and depths, different food sources, and types and abundances of predators. These changing conditions are particularly challenging for these young fish, and result in large rates of mortality, thus the vast majority do not return as adults (Quinn 2005). Those Chinook salmon that do return as adults have successfully avoided many predators, such as other fish, birds, and marine mammals. Among the many factors that contribute to the return rates of adult Chinook salmon, the timing of juvenile entry to the sea, smoltification status, and their size influence the probability of fish to survive and grow. Data on timing of arrival and growth within Skagit Bay show that habitat and growth constraints in the estuary lead to the movement of Chinook salmon fry that enter Skagit Bay earlier, at smaller sizes, and exhibit minimal growth compared to juveniles that reside in the estuary (Beamer et al. 2005). These factors contribute to individuals that are unlikely to successfully survive and become adult Chinook salmon.

Fry migrants are less fit to survive within seawater for several reasons. In addition to (or because of) their small size and slow growth rate, they may have not initiated or finished smoltification, which places them at physical, physiological, and possibly behavioral disadvantages in saltwater. Smoltification and growth are interrelated; Chinook salmon that are rapidly growing possess an osmotic and ionic regulatory system that is more functional at higher saline waters, and may be capable of being initiated more quickly in response to changing saline gradients (Wagner et al. 1969). Studies have shown osmoregulatory dysfunction related to insufficient smoltification results in high juvenile mortality. Sufficient time is needed for transition from fresh to saline water for salmon to survive. Restricting access to the floodplain, especially in estuaries, reduces the area, food, habitat that is available for transition and these have been demonstrated to limit productivity and/or survival.

Flood management structures to keep water out of floodplains also prevent salmon from accessing floodplains. Many studies illustrate how this reduces salmon productivity. For example, floodplains can provide higher biotic diversity (Junk et al. 1989) and increased production of fish (Bayley 1991; Halyk and Balon 1983) and invertebrates (Gladden and Smock 1990) than the mainstem alone. Potential mechanisms for floodplain effects include increased habitat diversity and area (Junk et al. 1989), large inputs of terrestrial material into the aquatic food web (Winemiller and Jepsen 1998), and decreased predation or competition due to intermediate levels of disturbance (Corti et al. 1997).

Freshwater and nearshore environmental conditions strongly influence the survival of Skagit River Chinook salmon. Over 90 percent of the variation in the return rate was explained by environmental conditions relating to flooding and the amount of estuarine rearing habitat available for juvenile Chinook salmon (Greene et al 2005).

Channel confinement affects sediment distribution in channels. One effect is increasing velocities which scour spawning gravel, thus decreasing the ability of salmon eggs to successfully survive and reproduce.

Spatial Structure. Pacific salmon have disappeared from approximately 40 percent of their historical range in Washington (NRC 1996, Nehlsen et al 1991). Biomass of salmon, average weight of individuals, and the number of adults returning to spawn have all precipitously declined (Gresh et al. 2000).

Beamer et al. (2005) found that at contemporary Chinook salmon population levels, current delta habitat conditions (reduced from previous floodplain habitat) are displacing juvenile Chinook salmon from delta habitat to Skagit Bay habitat and forcing a change in their life history from delta rearing to fry migrants.

Construction of dams has reduced spatial structure by preventing migration into snow-melt dominated reaches. The few extant populations that have access to snowmelt habitat are thus a high priority for conservation. (Beechie et al. 2006).

Diversity. Salmon spawning distributions and reproductive success reflect a complicated interplay of biological and physical processes. Findings of Montgomery et al. (1999) emphasize the multi-scale influence of geomorphic processes on salmon abundance. At the scale of entire river networks, differences in bed mobility appear to influence salmon distributions and spawning timing. Channel types defined by bed morphology appear to explain broad patterns of anadromous and resident species distributions and correlate with spawning densities of different species. Variations in within-reach habitat characteristics also affect the relative abundance of salmon. There is a strong, multi-scale influence of geomorphologic processes on salmon distribution and abundance in channels (Montgomery et al. 1999).

Beechie et al. (2006) illustrate how loss of diversity in salmon ESUs has been exacerbated by activities, largely dam construction, that affect stream-type Chinook salmon more than the ocean-type. This loss of diversity is likely to be increased with additional hydrologic modifications resulting from loss of flood water storage.

There are few extant Puget Sound populations dominated by the stream-type life history, as several populations with high proportions of stream-type fish have been extirpated by loss of access to the unique habitat of snow-melt dominated streams. Stream-type Chinook salmon may be dependent on diminishing snowmelt-dominated habitat, (Beechie et al. 2006) which has been reduced through previous construction of dams for flood-control purposes, and is expected to diminish at an accelerating rate with global climate change.

Puget Sound Chinook Salmon Populations Analysis. There are 22 extant populations included in the listed PS Chinook salmon ESU (Puget Sound Technical Recovery Team (PSTRT) 2001; NMFS 2005). These 22 independent populations were grouped by the PSTRT (2001) into 5 geographic regions of diversity and risk (defined here as “MPGs”), that each contain at least two populations. Accepting ESU viability recommendations from the PSTRT, NMFS determined that recovery and delisting of the ESU will require that at least two populations in each of the five MPGs be improved to a low extinction risk status (NMFS SSP Supplement, 2005). Other key NMFS criteria deemed necessary to recover and delist the ESU require that the viability status of all populations in the ESU is improved from current conditions, and that at least one population from each major genetic and life history group historically present within each of the five biogeographical regions is viable. Tables 7 and 8 show recent levels of abundance and productivity for all populations of PS Chinook salmon.

Table 7. Abundance of natural spawners, estimates of the fraction of hatchery fish in natural escapements, and estimates of historical capacity of Puget Sound streams. Sources: For data sources, see Appendix A, Table-2.

Population	Geometric mean natural spawners (1998–2002)	Arithmetic mean natural spawners (1998–2002) (minimum, maximum)	Geometric mean natural–origin spawners (1998–2002)	Average % hatchery fish in escapement[a] 1997–2001 (min.–max. since 1992)	Chinook salmon hatcheries in basin	Hatchery fraction data? (years)	EDT estimate of historical abundance[b]
North Fork Nooksack[c]	1,538	2,275 (366–4,671)	125	91 (88–95)	Kendall (NFH; RM 45)	Yes (1995–2002)	26,000
South Fork Nooksack[c]	338	372 (157–620)	197	40 (24–55)	Kendall (NFH; RM45)	Yes (1999–2002)	13,000
Lower Skagit	2,527	2,833 (1,043–4,866)	2,519	0.2 (0–0.7)	Marblemount (mouth of Cascade)[d]	Yes (1998–2001)	22,000
Upper Skagit	9,489	10,468 (3,586–13,815)	9,281	2 (2–3)	Marblemount (mouth of Cascade)[d]	Yes (1995–2000)	35,000
Upper Cascade	274	329 (83–625)	274	0.3	Marblemount (mouth of Cascade)[d]	No (assume low)	1,700
Lower Sauk	601	669 (295–1,103)	601	0	Marblemount (mouth of Cascade)[d]	Yes (2001)	7,800
Upper Sauk	324	349 (180–543)	324	0	Marblemount (mouth of Cascade)[d]	No (assumed)	4,200
Suiattle	365	399 (208–688)	365	0	Marblemount (mouth of Cascade)[d]	No (assumed)	830
North Fork Stillaguamish	1,154	1,172 (845–1,403)	671	40 (13–52)	Tribal (NF)	Yes (1988–1999)	24,000
South Fork Stillaguamish	270	272 (243–335)	NA	NA	Tribal (NF)	None	20,000
Skykomish	4,262	4,286 (3,455–4,665)	2,392	40 (11–66)	Wallace River	Yes (1979–2001)	51,000
Snoqualmie	2,067	2,229 (1,344–3,589)	1,700	16 (5–72)	Wallace River	Yes (1979–2001)	33,000
North Lake Washington	331	351 (227–537)	NA	NA	Lake Washington, Issaquah, University of Washington	None	NA
Cedar	327	394 (120–810)	NA	NA	Lake Washington, Issaquah, University of Washington	None	NA
Green	8,884	9,286 (6,170–13,950)	1,099	83 (35–100)	Soos, Icy, Keta creeks	Yes (1989–1997)	NA
White[e]	844	1,039 (316–2,002)	NA	NA	White River (RM 23); Voights Creek (Carbon River), Diru (RM 5)	None	NA

Puyallup	1,653	1,679 (1,193–1,988)	NA	NA	Voights Creek (Carbon River), Diru (RM 5)	None	33,000
Nisqually	1,195	1,221 (834–1,542)	NA	NA	Kalama, Clear Creek	None	18,000
Skokomish	1,392	1,437 (926–1,913)	NA	NA	George Adams (Purdy Creek, lower Skok)	None	NA
Dosewallips[f]	48	50 (29–65)	NA	NA	None	None	4,700
Duckabush[f]	43	57 (20–151)	NA	NA	None	None	NA
Hamma Hamma[f]	196	278 (32–557)	NA	NA	None	None	NA
Mid Hood Canal	311	381 (95–762)	NA	NA	None	None	NA
Dungeness[e]	222	304 (75–663)	NA	NA	Dungeness (and Hurd Creek)	None	8,100
Elwha[g,h]	688	691 (633–813)	NA	NA	Tribal (RM 1) and state (RM 3.2)	None	NA

NFH = National Fish Hatchery.

[a] Estimates of the fraction of hatchery fish in natural spawning escapements are from the Puget Sound TRT database; Green River estimates are from Alexandersdottir (2001).

[b] Estimates of historical equilibrium abundance based on an EDT analysis conducted by the comanagers in Puget Sound (Puget Sound TRT 2002).

[c] North Fork Nooksack natural escapement counts include estimated numbers of spawners from the Middle Fork Nooksack River since the late 1990s and Chinook salmon returning to the North Fork hatchery that were released back into the North Fork to spawn; South Fork Nooksack natural escapement estimates contain naturally spawning hatchery fish from the early run and late-run hatchery programs in the Nooksack River basin.

[d] Previous summer-run Chinook salmon hatchery program discontinued—last returns in 1996; current summer-run program (initiated in 1994) collects hatchery broodstock from spawners in upper Skagit River.

[e] Captive broodstock program for early run Chinook salmon ended in 2000; estimates of natural spawning escapement include an unknown fraction of naturally spawning hatchery-origin fish from late- and early run hatchery programs in the White and Puyallup River basins.

[f] The Puget Sound TRT considers Chinook salmon spawning in the Dosewallips, Duckabush, and Hamma Hamma rivers to be subpopulations of the same historically independent population; annual counts in those three streams are variable due to inconsistent visibility during spawning ground surveys.

[g] Year 2002 natural escapement data are not available.

[h] Estimates of natural escapement do not include volitional returns to the hatchery or those fish gaffed or seined from spawning grounds for broodstock collection.

Table 8. Estimates of long- and short-term trends, and the short-term median population growth rate (λ), and their 95% confidence intervals (CI) for spawners in Puget Sound Chinook salmon populations.

Population	Data years	Long-term trend (CI)[a]	Short-term trend (CI) (1990–2002)[b]	ST λ (± lnSE) (1990–2002)[b]
North Fork Nooksack	1984–2001	1.16 (1.04–1.30)	1.42 (1.18–1.70)	0.75 (0.07)
South Fork Nooksack	1984–2001	1.00 (0.96–1.05)	1.07 (0.98–1.15)	0.94 (0.05)
Lower Skagit	1952–2002	0.99 (0.97–1.00)	1.06 (0.94–1.18)	1.05 (0.09)
Upper Skagit	1952–2002	1.00 (0.99–1.01)	1.06 (0.98–1.14)	1.05 (0.06)
Upper Cascade	1984–2002	1.04 (1.00–1.08)	1.05 (0.98–1.14)	1.06 (0.05)
Lower Sauk	1952–2002	0.99 (0.98–1.00)	1.03 (0.91–1.17)	1.01 (0.12)
Upper Sauk	1952–2002	0.97 (0.96–0.99)	0.97 (0.89–1.06)	0.96 (0.06)
Suiattle	1952–2002	0.99 (0.98–0.99)	1.00 (0.92–1.08)	0.99 (0.06)
North Fork Stillaguamish	1974–2002	1.01 (0.99–1.03)	1.06 (1.01–1.11)	0.92 (0.04)
South Fork Stillaguamish[c]	1974–2002	1.02 (1.00–1.04)	1.00 (0.97–1.02)	0.99 (0.02)
Skykomish	1965–2002	0.99 (0.98–1.00)	1.07 (1.03–1.11)	0.87 (0.03)
Snoqualmie	1965–2002	1.03 (1.01–1.04)	1.10 (1.01–1.21)	1.00 (0.04)
North Lake Washington[c]	1983–2002	0.97 (0.91–1.03)	1.04 (0.91–1.19)	1.07 (0.07)
Cedar[c]	1965–2002	0.97 (0.95–0.98)	0.97 (0.89–1.07)	0.99 (0.07)
Green[c]	1968–2002	1.02 (1.01–1.04)	1.05 (0.98–1.13)	0.67 (0.06)
White[c]	1970–2002	1.05 (1.00–1.10)	1.14 (1.06–1.22)	1.16 (0.06)
Puyallup[c]	1968–2002	1.02 (1.00–1.04)	0.96 (0.91–1.02)	0.95 (0.06)
Nisqually[c]	1968–2002	1.02 (0.99–1.05)	1.06 (0.93–1.20)	1.04 (0.07)
Skokomish[c]	1987–2002	0.99 (0.93–1.05)	1.04 (0.97–1.12)	1.04 (0.04)
Combined Dosewallips[c]	1968–2002	0.96 (0.93–0.98)	1.11 (0.99–1.20)	1.17 (0.10)
Dungeness[c]	1986–2002	1.02 (0.94–1.10)	1.07 (0.94–1.20)	1.09 (0.11)
Elwha[c]	1986–2001	0.92 (0.84–1.00)	0.97 (0.86–1.10)	0.95 (0.11)

[a] Long- and short-term trends are calculated on all spawners.

[b] Short-term λ is calculated assuming the reproductive success of naturally spawning hatchery fish is equivalent to that of natural-origin fish (for those populations where information on the fraction of hatchery fish in natural spawning abundance is available).

[c] Estimate of the fraction of hatchery fish in time series is not available for use in λ calculation, so trend represents that in hatchery-origin + natural-origin spawners.

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Taking into account the above key ESU viability and delisting criteria, and considering the broad geographic scope of the FEMA's implementation of the NFIP in Washington state, NMFS' evaluation of program effects on the PS Chinook salmon ESU is focused on four indicator populations. These populations were chosen because they encompass a substantial portion of the total areal extent of the listed ESU within the program action area, representing four of the five MPGs defined for PS Chinook salmon. The indicator populations were also selected because they carry unique genetic and/or life history group traits that are important to ESU viability and delisting considerations. Finally, the watersheds inhabited by the selected indicator populations reflect varying levels of likely human population growth, allowing for appropriate scoping of the potential effects of the program across varying potential conditions in the program action area.

The White River and the Nooksack South Forks populations were selected because: (1) these represent spring Chinook salmon, the loss of which has diminished life history diversity of the ESU; and (2) these populations represent 2 major population groupings (Nooksack and South Puget Sound respectively). Skagit River Chinook salmon were selected because of the abundance and productivity they provide to the ESU, and their location in the North Puget

Sound population grouping. Dungeness Chinook salmon were selected because of their representation as one of two populations in the Dungeness/Elwha population grouping, whose abundance is considered critical and productivity is low. Moreover, these populations are from varied areas of Puget Sound that reflect a range of human growth rates (low in the Dungeness, high in the Skagit and the Nooksack), which is indicative of corollary trends in floodplain development and thus the frequency with which the NFIP would be employed in that geography.

White River Chinook Salmon. Life history differences support genetic and geographical evidence of different populations. White River Chinook salmon return earlier, beginning in late May, than Puyallup River Chinook salmon, which begin entering the river in late July (WDF et al. 1993), length at age of maturity for White River Chinook salmon is different from Puyallup River Chinook salmon, and habitat differences support genetic and geographical evidence of different populations - White River early run Chinook salmon spawn in a mixed snowmelt and rainfall-dominated river, whereas the Puyallup River is at a lower elevation and its hydrograph is mostly rainfall-dominated (Ruckelshaus et al 2006). This demonstrates the unique genetic contribution of White River Chinook to the ESU, as well as the obvious contribution to ESU spatial structure. The long term lambda (growth rate) of White River Chinook is 1.05 (replacement is a lambda of 1.0).

Extensive dredging, diking and filling for flood control and development beginning in the early 1900s eliminated and degraded miles of salmon habitat. South Puget Sound is hard hit by major floodplain modification where, "The Puyallup, White and Carbon Rivers are all contained within a revetment and levee system for their lower 26, 8 and 5 miles respectively. These channel containment structures have removed the natural sinuosity of the rivers and the spawning and rearing habitats that were once present." (South Sound Salmon Recovery Chapter). Dikes, levees, and channelization beginning in 1906 reduced the length of the Puyallup River from its mouth to the confluence with the White River by 1.84 miles, a loss of almost 15 percent of its channel length in that section alone. Levee structures eliminated connections with side-channel and off-channel habitat. Although juvenile Chinook salmon fry would once have been present in high numbers in the lower river and its distributaries, the modifications of the floodplain have increased water velocities, making it difficult for juveniles to maintain their position or defend territories. Spawning activity throughout the diked portions of the river is limited, and water velocities scour pockets of eggs. The Puyallup basin represents one of the more extreme examples of floodplain modification in the region (Shared Strategy 2005).

This geographic location has experienced a 34 percent human population growth rate (extrapolated from the State Office of Financial Management intermediate county growth projections 2000 - 2025) which is projected to continue for the next 18 years. The baseline condition shows a significant loss of historic floodplain connectivity throughout the region and additional losses of floodplain to development are expected in the future. Given Chinook salmon life history strategies that rely on functional floodplain to increase juvenile to adult survival, and the fact that this population is only fractionally above replacement, this combination of factors is expected to diminish productivity by reducing lambda to 1 (precluding recovery of the population) or below 1 (trending toward extirpation).

South Fork Nooksack Chinook Salmon. Genetic data showed strong support for independence of early returning Chinook salmon from the north and south forks. Previous analyses (Marshall et al. 1995) also considered the Chinook salmon in the two Nooksack River forks to be independent, designating them as separate genetic diversity units (GDUs), based on genetic differences, geographic distribution, and life history. The primary spawning areas of the two groups of fish are separated by at least 10 km, age distributions of spawning fish from the two forks are very different (more Chinook salmon from the south fork tend to spawn as 5-year-olds), and the north fork is predominantly dominated by snowmelt, while the south fork is dominated by mixed rain and snowmelt (Ruckelshaus et al 2006). Both populations are essential to recovery of PS Chinook salmon not only because they are the only two independent populations left in the northern sub-region of Puget Sound (spatial structure), but also because they are two of only six Chinook salmon runs left in Puget Sound that return to their rivers in the spring (genetic and life-history contribution).

The South Fork Chinook salmon population is at high risk due to low numbers and the low productivity of the freshwater habitat (long-term lambda is estimated at1). Estimates of historic Chinook salmon abundances are an average of 13,000 for the South Fork population. Chinook salmon return totals have been in the low hundreds, averaging 210 South Fork fish in recent years. However, recent genetic analyses indicate that the proportion of this total that are South Fork native stock origin is only one-quarter to one-third of this total, with the remaining fish being strays from the North Fork Nooksack or naturalized fall Chinook salmon (pers. comm. Tim Tynan 3/7/08).

One of several strategies necessary to preserve habitat essential for increased productivity of the Nooksack populations is to ensure floodplain management protects and enhances fish habitat. A high percentage of the riverbanks along the mainstem as well as the North and South forks is armored with rock to protect property or roads from erosion and flooding. These same areas are important for fish. Consequently, habitat restoration and floodplain management for property protection must be closely linked to ensure fish and people will benefit in the future (Shared Strategy 2005). If development of floodplains proceeds consistent with NFIP minimum standards and mapping protocol, NMFS expects further impairment of juvenile-to-adult survival will impair productivity and push lambda to below one. Given the very low abundance, such a loss of productivity will rapidly further impair abundance, and significantly increase the risk of extirpation of the population.

Skagit River Chinook Salmon. Skagit Chinook salmon populations have been on a long decline over the last century. This is demonstrated by the significant declines in harvest from 40,000 to 50,000 in the 1930's to only a few hundred in the 1990s. The productivity of the populations has been less than one for the last twenty years, meaning that the returning fish number less than their parents. Recently, although the number of fish spawning in the river has been relatively stable, the number of juveniles produced by these spawners has been dropping, indicating there may be a significant recent loss in the ability of the habitat to allow for egg and juvenile survival. Long term lambda in the Lower Skagit is .99, lower than replacement and trending toward extirpation.

Four different juvenile Chinook salmon life history strategies have been identified in the Skagit; yearlings, parr migrants, tidal delta rearing migrants and fry migrants. Because of differences in habitat use, yearlings and parr migrants depend more on abundant and high quality freshwater habitat while tidal delta rearing migrants and fry migrants depend more on estuarine habitats (tidal delta and pocket estuaries). This difference in habitat use by individual life history strategies helps shape the habitat recovery actions proposed in the plan. The greatest impact on egg-to-fry survival is flooding during egg incubation. Severe floods (15-20 year events) reduce survival by 75-80 percent when compared to 1 year flooding events. Ten year events reduce survival by 33 percent. In the Skagit, flood events are increasing in frequency and magnitude, which has serious impacts on survival. Flood events are especially severe in the Lower Skagit where the full brunt of a flood must be absorbed. Lower Skagit impacts are further magnified by increased impervious surfaces, land clearing and drainage networks that contribute to increased flows. Upper Cascade, Suiattle, and the Upper Sauk are all considered to be hydrologically functioning areas. Even though the Lower Skagit populations are hit hard with flood events, it is the Lower Sauk population that appears to suffer the greatest losses.

Continued conversion of floodplain to development consistent with NFIP criteria will exacerbate flood conditions in a manner that reduces juvenile Chinook salmonid survival rates, further lowering the rate of productivity which is already non-viable, hastening the trend toward extirpation of these populations.

Dungeness River Chinook. Genetically, Chinook salmon in the Dungeness and Elwha rivers are distinctive from other Puget Sound populations and from each other, providing unique genetic contribution to the ESU. The Elwha River and Dungeness River populations have some of the earliest spawn timings of PS Chinook salmon (Ruckelshaus et al 2006) providing unique life-history expression to the ESU. The Dungeness River spring/summer Chinook salmon stock is the only spring Chinook salmon stock in WRIA 18. It is classified as a distinct stock based upon geographic distribution and spawn timing. The Dungeness Chinook salmon population is comprised of a single population of native origin fish.

Biologists estimate that about 8,000 Chinook salmon entered the Dungeness River annually before the 1850s. Current fish populations in the Dungeness are a small fraction of what they are estimated to have been in the past - returning numbers are now approximately 200 spawners, and are considered to have fallen so dramatically that their low numbers “allow no room for further downward cycles” (McNulty, T. 2001). Long-term lambda for this population is 1.02.

After emerging as fry in the early spring, most Chinook salmon emigrate to rear in the estuary during their first year, while others will rear in the river for a year and emigrate as yearlings. Thus, estuarine habitat is very important for Dungeness Chinook salmon, as the majority of the fish spend most of their first year in the estuary or nearshore area, and lower river mainstem areas are important for the stream-type component of this Chinook salmon population. While run timing appears to be unchanged over time, a number of life-history pathways have been lost due to the loss of side-channel and estuarine habitat. It is estimated that only 70 percent of the historic pathways remain available. Estimates suggest that the Dungeness River currently is theoretically capable of supporting 699 spawners and that the Gray Wolf River, historically an important spawning area, is underutilized.

The lower Dungeness has considerable residential development; upstream of the highway is mainly agriculture, although there is pressure to subdivide for residential development (Dan Sokol pers. comm 3/10/08). Continued floodplain development consistent with the NFIP minimum criteria and mapping standards will further impair juvenile to adult survival, reducing already low levels of productivity back to a lambda of 1 (precluding recovery), or below 1 (setting the trend toward extirpation). Because abundance is very low, loss of productivity will also rapidly depress abundance, and significantly hasten the trend of this population to extirpation.

Puget Sound Steelhead Populations. Historically, there were 51 natural populations present within the Puget Sound ESU. 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 9 percent of these populations evaluated are considered "healthy." The status of 47 percent of the steelhead populations couldn't be rated because of the lack of a time series of escapement or other abundance data. 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 but no rivers in the DPS met adult return escapement goals in return years 2000, 2001 and 2002, and only the (wild) Skagit River winter-run steelhead exceeded its escapement goal in 2003 (Wild Steelhead Coalition 2006). 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). Because of their limited distribution in upper tributaries, summer-run steelhead may be at higher risk than winter-run steelhead from habitat degradation in larger, more complex watersheds.

Given the limited information on viability characteristics of the PS steelhead populations, NMFS has focused its analysis on Skagit River, Snohomish River, and Elwha River populations of steelhead, in part because this is where the most complete information is available. In addition, these populations were chosen to represent the geographic range of the steelhead DPS, important life history diversity (summer steelhead in the Snohomish), and areas of varying human population growth (high in the Snohomish and Skagit and low in the Elwha).

<u>Skagit River Steelhead</u>. Seven populations historically used the Skagit Basin for spawning, rearing, migrating, and holding. Of these, one (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 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. In terms of genetic diversity, allozyme analysis performed on the Skagit winter steelhead clusters those fish with Sauk summer and winter stocks, Suiattle winter, North Fork Stillaguamish steelhead, and with steelhead from Skokomish, Dosewallips, and Dungeness Rivers. This shows they are closely related to two out of the remaining five stocks within the Skagit Basin, and are distinct from the Finney Creek summer-run population and both the winter and summer stocks of the Cascade.

Spatial structure is defined by limits on potential spawning grounds such as natural and man-made obstacles, including 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 the Seattle Light. Baker River has two dams, which has already led 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, 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.

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 population productivity. 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, likely increasing their rate of survival and improving their level of fitness during flood events. 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 would decline over time as floodplains are filled to support development consistent with NFIP minimum criteria and mapping protocols.

<u>Snohomish River Steelhead</u>. Steelhead are most abundant in the DPS in northern Puget Sound, with winter-run steelhead in the Snohomish rivers supporting one of the two largest populations. There are three summer steelhead stocks and three winter steelhead stocks. In SASSI, Tolt summer steelhead is rated as depressed; the South Fork Skykomish summer steelhead, Snohomish and Skykomish winter steelhead stock, Pilchuck winter steelhead stock, and are Snoqualmie winter steelhead are all rated healthy. North Fork Skykomish summer steelhead is rated unknown.

In recent years, the Skagit and Snohomish river winter-run populations have been three to five times larger than the other populations in the DPS, and average approximately 3,000 total adult spawners in the Snohomish annually (NMFS, 2005 Steelhead Status Review). However, all

BRT members noted the declines in both natural escapement and natural run size for the Snohomish river winter-run populations, and observed that most of the other populations in the DPS are small, especially those in Hood Canal and the Strait of Juan de Fuca. These trends have occurred despite widespread reductions in direct harvest of natural steelhead in this DPS since the mid 1990s. Although steelhead populations in large systems such as the Snohomish rivers remain relatively large, these escapements are still far below those estimated as recently as the mid 1980s, when harvest rates on natural fish were higher. Furthermore, the Snohomish winter-run steelhead population has been given a lambda of .804, indicating this population is in decline.

Given that juvenile steelhead will rear in lower river systems where channel complexity and floodplain connectivity is intact, it is expected that juvenile steelhead would also access floodplains during highwater events for refugia, increasing their rate of survival and improving their level of fitness during flood events, compared to juveniles that are restricted to the mainstem during flooding (Tom Bansak Pers Comm. 2/25/08). Therefore, extrapolating the analysis of juvenile fitness and survival vis a vis productivity and abundance, NMFS believes that Snohomish River steelhead populations productivity and abundance would decline more rapidly over time as floodplains are filled to support development consistent with NFIP minimum criteria and mapping protocols, pushing lambda below its current level of .804, hastening the trend toward extirpation.

<u>Elwha River Steelhead</u>. Steelhead use the Elwha River for spawning and rearing. General information on PS steelhead ecology is available in the BRT report (Good et al., 2005) and a recent, draft assessment by WDFW. According to the WDFW assessment, and the 1992 WDFW SASSI report, the wild summer steelhead stock in the Elwha River is depressed. Steelhead populations are augmented by hatchery practices. The hatchery /wild winter-run steelhead return to the Elwha primarily from November through February and spawn in spring during times of naturally higher flows. Juveniles that emerge from the gravels in early to mid-summer spend the first few weeks rearing along shallow margins. As they grow, the juveniles gradually inhabit deeper and faster riffles and pools. Juveniles typically rear year-round in steeper headwaters and pools, before emigrating to marine waters after one to two years in freshwater, however this habitat type is currently restricted by the presence of the dams.

Effects of the NFIP are expected to negatively influence the Elwha River steelhead population until such time as the dams are removed. Since much of the 70 miles of habitat that will be accessible after dam removal will be in the national park, where both Federal ownership and topography will limit development of floodplains, once habitat is re-established, increased spawning and rearing opportunities are expected to increase productivity in a manner that mitigates losses in productivity through floodplain habitat impacts below the dams. Below the dams, trends in human development are expected to continue, degrading the function of the relatively limited amount of floodplain habitat there. The continued floodplain development consistent with the NFIP's minimum criteria and mapping protocols will diminish conditions for juvenile steelhead survival below the dams. While this initial loss may be indiscernable at a later date given expected trends in productivity after the upper 70 miles reestablishes new spawning and rearing areas, there is potential for such floodplain losses to create a new bottleneck in juvenile steelhead survival, thus impeding recovery potential gained by re-establishment of habitat above the dam locations. (Thom Hooper, pers. comm. 2/25/08).

Lake Ozette Sockeye Salmon. The single population of this ESU consists of two stocks, beach and tributary spawners, both being essential to the recovery of the ESU to a viable status. BRT expressed concern that the reduction in the number of spawning aggregations poses risks for ESU spatial structure and diversity. The BRT expressed moderately high concern for each of the VSP risk categories. The Lake Ozette sockeye salmon population viability factors are " Not Likely to be Adversely Affected" by the NFIP due to the fact that their habitat is primarily within Federal (Olympic National Park), or private forest land where floodplain development pressures in the floodplain are not currently significant. Potential conversion of flood-plain forest land presently in timber production to rural or urban development use in future years may change this finding.

Hood Canal Summer Run Chum Salmon Populations. The Hood Canal summer-run chum salmon ESU consists of two independent populations: the Strait of Juan de Fuca and the Hood Canal populations, which have been divided into six conservation units. The ESU viability criterion for the Hood Canal summer chum ESU states that in order for the ESU to have a negligible risk of extinction, both the Strait of Juan de Fuca and Hood Canal populations, including the eight stocks composing these two populations, would need to be viable. Estimates of median population growth rates, and stock abundance and escapements, are shown for summer run chum salmon populations in Table 8 and 9 below. Summer chum salmon exist today in several spawning aggregations located in at least 11 rivers and streams. The relative total abundance of spawning by the component aggregations has changed over time for both populations, with one spawning aggregation in each population now contributing most of the total abundance. Union chum is the only remaining population from the Hood Canal population, the Tahuya population (once one of the biggest contributors to the abundance of the ESU) was functionally extirpated in the early 1990s. Summer chum from Union stock were reintroduced through a hatchery fry release program in the watershed beginning in 2003. That program will continue for a maximum of 12 years (three chum generations), but could be terminated sooner based on observed adult returns. 300 summer chum adults (all three year olds) returned to the Tahuya to spawn naturally in 2006, and 675 adults spawned in 2007 (Tim Tynan, pers. comm 3/10/08).

Table 8. Estimates of long- and short-term trend, short-term median population growth rate (lambda), and their 95 percent confidence intervals for natural spawners in extant Hood Canal summer-run chum salmon populations (data are from the WDFW and PNPTC, unpublished data). Short-term lambda is calculated assuming the reproductive success of hatchery-origin spawners is equivalent to that of wild origin spawners (in cases where information on the hatchery fish is available).

Stock	1993-2004[2] Mean Abundance	Abundance Threshold	1993-2004[2] Mean Escapement	Escapement Threshold
Hood Canal				
Quilcene	9,930 (19,536)	4,570	8,066 (13,209)	2,860
Dosewallips	***2,825*** (4,746)	3,880	2,777 (4,716)	2,420
Duckabush	***1,446*** (2,629)	4,630	***1,423*** (2,617)	2,900
Hamma Hamma	***813*** (1,301)	7,690	***793*** (1,288)	4,800
Lilliwaup	***235*** (61)	1,330	***229*** (60)	830
Union	2,045 (3,497)	720	2,000 (3,467)	450
Strait				
Salmon/Snow	2,275 (3,438)	1,630	2,249 (3,422)	1,020
Jimmycomelately	***254*** (235)	530	***251*** (234)	330

[1] Twelve year mean values that are less than the recovery thresholds are indicated by italics with bold font.
[2] Four year (2001-2004) mean NOR only values are shown in parentheses.

Population	**Data years**	**LT Trend (CI)**	**ST Trend (CI) (1990-2002)**	**ST λ (± lnSE) (1990-2002)[18]**
Combined Quilcene	1974 – 2002	1.05 (0.96-1.16)	1.62 (1.31-2.01)	1.39 (0.22)
Dosewallips	1972 – 2002	0.96 (0.90-1.04)	1.25 (0.94-1.63)	1.17 (0.24)
Duckabush	1968 – 2002	0.91 (0.87-0.96)	1.14 (0.96-1.36)	1.1 (0.17)
Hamma Hamma	1968 – 2002	0.90 (0.86-0.94)	1.20 (1.04-1.40)	1.3 (0.19)
Jimmycomelately	1974 – 2002	0.88 (0.84-0.93)	0.82 (0.64-1.03)	0.85 (0.16)
Lilliwaup	1971 – 2002	0.88 (0.83-0.92)	1.00 (0.74-1.37)	1.19 (0.44)
Salmon/Snow	1974 – 2002	0.99 (0.94-1.03)	1.24 (1.12-1.37)	1.23 (0.10)
Union	1974 – 2002	1.08 (1.05-1.12)	1.10 (1.00-1.22)	1.15 (0.10)

Table 9. Mean total (combined NOR and HOR) stock abundances and escapements over most recent 12 years compared to recovery and goal thresholds[1]. Recent NOR mean abundances and escapements (available only for the last four years) are shown in parentheses

[18] Estimates of the fraction of hatchery fish are available only for the combined Quilcene and Salmon/Snow populations for the years 1995-2000.

(Table by WDFW and Point No Point Treaty Tribes 2007).

Recovery planning indicates that viability of the Hood Canal summer chum salmon requires: 24,700 spawners; multiple persistent spawning aggregations distributed across the historical range of the population; and spawning, rearing, and migratory habitats that function in a manner that is consistent with population persistence. The HCCC Plan includes discussion of the specific criteria for each of the relevant listing/delisting factors, to help to ensure that underlying causes of decline have been addressed and mitigated in order to consider the summer chum salmon ESU for delisting. The NMFS includes pertinent criteria here.

Each of the threats criteria described below is related to one or more of the major factors limiting recovery described in the HCCC Plan and are also listed in NMFS' 2005 Report to Congress on the PCSRF for Hood Canal summer chum salmon: (1) degraded floodplain and mainstem river channel structure; (2) degraded estuarine conditions and loss of estuarine habitat; (3) riparian area degradation and loss of in-river LWDin mainstem; (4) excessive sediment in spawning gravels; (5) reduced stream flow in migration areas; and (6) degraded nearshore conditions (NMFS 2005a).

The NMFS' evaluation of effects of implementing the NFIP on Hood Canal summer-run chum salmon focuses on three stocks: Union, Hamma Hamma, and Salmon/Snow. These stocks were chosen to represent: each of the 2 delineated populations (Strait of Juan de Fuca and Hood Canal); one-half of the conservation units; the varying biogeographical conditions inhabited by aggregations in the ESU; and areas of Hood Canal with varying levels of projected human population growth rates (high in the Union, low in the Hamma Hamma, and medium in the Salmon/Snow).

Union River. This is the only remaining chum population from Hood Canal. The Union River population has had a comparatively strong long-term level of productivity, at 1.08, meaning the population is slightly increasing. Average abundance over the last 5 years is 4,937 fish (with a high of 11,916 in 2003, declining annually to only 1,967 fish in 2007), (Tim Tynan, pers comm., 3/10/08). The Hood Canal population, despite the recent declining trend, has stayed above recovery goals for both abundance and escapement. While abundance and productivity are both relatively strong for the Union River population, this area is also projected to have a significant human population growth-rate, and has a significant proposed development pattern in floodplain areas as part of the local GMA Urban Growth Area. Therefore, NMFS expects floodplain development to exacerbate riverine and floodplain conditions to the detriment of spawning and survival in a manner that will trend productivity downward, slowing the rate of recovery.

Salmon and Snow. These summer chum salmon originating from the Eastern Strait of Juan de Fuca Conservation Unit are likely from the Salmon/Snow Creek and Jimmycomelately watersheds. The highest density of spawners in Salmon Creek is observed at approximately river mile (RM) 0.7 with the full extent of recently observed spawning up to RM 2.0. In Snow Creek the majority of spawning occurs below RM 1.5 with spawning extending up to RM 3.0. Restoring properly functioning conditions in both the Jimmycomelately and Salmon/Snow Creek watersheds would ensure the persistence and survival of the Strait population aggregation. Potential increase in the Salmon/Snow population abundance is greatest through restoration of freshwater reaches. Long-term productivity of this population is .99, meaning the population is declining slowly over time. Average abundance over the last 5 years is roughly 5,176 fish (Tim Tynan, pers. comm. 3/10/08), and this population has consistently exceeding the recovery goals for abundance and escapement goal of 1,020. The human population growth rate in this area is expected to be fairly low, so continued floodplain development adjacent to freshwater components of the Salmon/Snow riverine complex, consistent with NFIP minimum requirements will slowly aggravate channelization and scour conditions in chum spawning habitat, reducing spawning success. Similarly, continued floodplain development in estuarine floodplains will continue to impair conditions for juvenile development and migration. Together, these effects on spawning and rearing will impair productivity of the population, which is already below replacement, and is likely to will hasten the trend of the population toward extirpation.

Hamma Hamma. These summer chum salmon spawn in the mainstem of the Hama Hama River up to river mile (RM) 2 and in the lower 1.8 miles of John Creek (a tributary). Most spawning occurs below RM 1.8 in the Hamma Hamma and below RM 0.3 in John Creek. Factors for decline are: Loss of channel complexity (large woody debris, channel condition, loss of side channel, channel instability) most significantly affecting spawning and incubation lifestages; Estuarine habitat loss and degradation (diking, filling, log storage, road causeways) affecting juvenile rearing and migration (over 13 percent of the estimated 368.5 acre historic delta is diked in three areas, accounting for a loss of summer chum rearing habitat., negatively impacting juveniles). Long-term productivity of this population is .90, meaning the population is declining. Average abundance over the last 5 years is 1,871 fish (Tim Tynan, pers. comm. 3/10/08), consistently falling short of the recovery escapement goal of 4,800 fish. Continued floodplain development adjacent to freshwater components of the Hamma Hamma river, consistent with NFIP minimum requirements will exacerbate channelization and scour conditions in chum spawning habitat, reducing spawning success. Continued floodplain development in estuarine floodplains will continue to impair conditions for juvenile development and migration. Together, these effects will impair productivity of the population, which is already below replacement, and given already low abundance, will significantly hasten the trend of the population toward extirpation.

Relevance of Effects on Salmonid Population Viability to Evolutionarily Significant Units and Distinct Population Segments Those Populations Comprise. In considering the viability of an entire species, in addition to evaluating factors influencing abundance, productivity, spatial structure, and diversity of populations making up the ESUs and DPSs, additional consideration must be given to factors such as catastrophic events that can eliminate an entire population, long-term demographic processes that allow populations to colonize new or restored habitat areas, and long-term evolutionary potential. ESU viability guidelines include:

- ESUs should contain multiple populations.
- Some populations in an ESU should be geographically widespread.
- Some populations should be geographically close to each other.
- Populations should not all share common catastrophic risks.
- Populations that display diverse life histories and other attributes should be maintained.

• Some populations should exceed minimum VSP ranges.
• The level of uncertainty about ESU-level processes should be taken into account.

Puget Sound Chinook Salmon. The effects of NFIP implementation will reduce the likelihood of survival of White River Spring Chinook salmon and South Fork Nooksack Spring Chinook salmon, and Dungeness Chinook salmon which are particularly vulnerable due to their already extremely low abundance. Skagit River Chinook salmon productivity has been less than one for the last twenty years, and the number of juveniles produced by these spawners has been dropping, indicating there may be a significant recent loss in the ability of the habitat to allow for egg and juvenile survival. Future degradation of floodplain and channel habitat will further impair spawning success and juvenile survival of this population, leading to decreased abundance and productivity, with a corollary increase in the likelihood of extinction.

Impaired survival among White River, Skagit, Dungeness, and Nookasck populations leads to impaired ability of the PS ESU to recover, and makes long-term survival of the ESU less likely, because the reduction of ESU spatial structure, life history and genetic contribution significantly increases the vulnerability of the ESU to environmental and anthropogenic stochastic events within a 100 year time frame. Losses of spatial structure, life history and genetic diversity, and abundance in populations making up the ESU will reduce distribution, numbers, and reproduction of the ESU, decreasing the likelihood of recovery of the ESU and decreasing the likelihood of survival of the ESU.

To lower the risk of extinction of the PS Chinook salmon ESU, all existing independent populations of Chinook salmon must show improvement from their current conditions, and some will need to attain a low risk status. To minimize the risk of a catastrophic loss, viable populations of Chinook salmon must be spread throughout the region. At least two to four populations in each of the 5 bio-geographical regions of Puget Sound must attain a low risk status. To minimize the further loss of genetic diversity and life history characteristics of PS Chinook salmon, there should be at least one viable population from each major genetic and life history group in each of the five regions, based on the historical patterns present within that region (Shared Strategy 2005). However, current and future floodplain development and channel modification allowed under the minimum criteria and mapping portions of the NFIP are likely to appreciably impair viability of the ESU by diminishing the survival and recovery of populations of White River spring Chinook salmon, Skagit fall Chinook salmon, South Fork Nooksack Chinook salmon, and Dungeness Chinook salmon populations which are essential to maintain the number of ESU populations, the geographic distribution of the ESU's populations, and the genetic diversity of the ESU.

Puget Sound Steelhead. Insufficient population level information is available for the 51 steelhead populations to determine if risks from floodplain development and channel modification under the NFIP will disproportionately affect certain viability components such as abundance, spatial structure, genetic or life history diversity of the DPS. However, it is reasonable to extrapolate from the effects analysis for PS Chinook salmon, which indicates that the range of effects (decreased access to floodplain refugia during floods, leading to decreased juvenile survival and decreased fitness among surviving juveniles) will affect steelhead abundance and productivity negatively, though the trend will appear more slowly given the proportional use of floodplain habitats is lower among juvenile steelhead than for juvenile Chinook salmon.

The NFIP's adverse effect on floodplain rearing of Elwha River steelhead will limit productivity until the Glines and Elwha Dams are removed. The effects at the population level as a component of the DPS may impair recovery efforts if floodplain impacts become a bottleneck for survival of juvenile outmigrant steelhead. For both Skagit and Snohomish River populations, the NFIP will negatively impact productivity. Since both of these populations are major contributors to overall abundance of the DPS, the effects to the populations, when translated to the DPS scale, will be future decreasing numbers. These effects will accrue among multiple component populations of the DPS as permanent decreases of floodplain connectivity and channel function are added adjacent to Puget Sound's freshwater streams, rivers, and estuarine areas. Such system-wide declines in juvenile to adult survival will decrease numbers, distribution, and ultimately reproduction among the DPS, to the degree that both recovery and survival of PS Steelhead will be appreciably reduced.

Hood Canal Summer Run Chum Salmon. Chum salmon spawning success is highly dependent on availability of suitable habitat in the near floodplain areas of riverine systems, and juvenile survival is highly dependent on availability of estuarine floodplain. In all three populations examined, changes in natural hydraulic processes resulting from the placement of levees and addition of impervious surfaces will increase the severity and frequency of flood events, in varying degrees. Resultant constrained flow volumes and higher water velocities will decrease summer chum survival and productivity through scouring of gravel reaches harboring summer chum redds. The availability of estuarine areas will also continue to decline in an inverse relationship with increasing levels of floodplain development located below the extreme higher high tide line. However, the rate of this degradation will vary significantly among the populations as human population growth rates (and corollary rates of floodplain development) are expected at different rates. The Union River is expected to have the highest rate of adjacent development, and will therefore absorb the greatest adverse impact to the juvenile chum salmon incubation and rearing components of productivity for the Union summer chum population. However, these effects are to a population that shows the strongest abundance and productivity levels, therefore the effect will be to slow productivity, and NMFS does not expect that it will shift the trend to a lambda of one or below (to a level of non-growth or declining levels). Because of an anticipated lower rate of human population growth and floodplain development in the other locations examined, the NFIP implementation and the interrelated and interdependent actions' negative effects on the Salmon/Snow population - a decline in productivity and abundance is expected to be relatively modest trending lambda only slightly lower than its current long-term trend of .99; for the Hamma Hamma even a slight loss of productivity over the existing lambda of .90 will further depress its already very low abundance. Therefore both populations will see an increase in the likelihood of extirpation.

Recent data indicates only one stock, Union, meets all the recovery goal criteria for abundance and escapement, and that no stocks yet meet the productivity recovery goal criteria (WDFW and Point No Point Treat Tribes 2007). Preservation and recovery to a low extinction risk status of the Salmon/Snow, Hamma Hamma, and Union River populations is essential to maintain the remaining number of extant spawning aggregations within the ESU, the geographic distribution (spatial structure) of the ESU's populations, and the genetic diversity of the ESU. The productivity of the Union, Hamma Hamma, and Salmon/Snow populations will be adversely affected when floodplains are filled, impairing survival of Hamma Hamma, and Salmon/Snow populations, and impairing recovery of the Union populations. Impaired survival among Salmon/Snow and Hamma Hamma populations, and impaired recovery of the Union River population leads to impaired ability of the Hood Canal summer run chum salmon ESU to recover, and makes long-term survival of the ESU less likely, because the reduction of ESU spatial structure, life history, and genetic contribution significantly increases the vulnerability of the ESU to environmental and anthropogenic stochastic events within a 100 year time frame (Tim Tynan pers. comm. 2/28/08). Losses of spatial structure, life history and genetic diversity, and abundance in populations making up the ESU will reduce distribution, numbers, and reproduction of the ESU, appreciably decreasing the likelihood of recovery of the ESU and decreasing the likelihood of survival of the ESU.

Lake Ozette Sockeye Salmon. Effects of implementing the NFIP minimum criteria, mapping program, and CRS are discountable or insignificant at the scale of individual fish and to the population that makes up the ESU, based on low private ownership of lands adjacent to Ozette sockeye salmon habitat. As a result, the proposed action is not likely to adversely affect Lake Ozette sockeye salmon, or appreciably reduce their likelihood of survival and recovery.

Effects on Salmonid Critical Habitat

Section 7(a)(2) of the ESA directs Federal agencies to insure that their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of their critical habitat. This section considers the direct and indirect effects of the proposed action on the species and its critical habitat that will be added to the environmental baseline.

The NMFS did not use the regulatory definition of "destruction or adverse modification" at 50 CFR 402.02 in this Opinion. Instead, this analysis relies on statutory provisions of the ESA, including those in section 3 that define "critical habitat" and "conservation", in section 4 that describe the designation process, and in section 7 that set forth the substantive protections and procedural aspects of consultations, and on agency guidance for application of the "destruction or adverse modification" standard (Hogarth 2005).

Critical habitat is designated for each of the ESUs considered in this consultation (September 2, 2005, 70 FR 52685), except for the PS steelhead DPS.

The NMFS evaluates the effects of an action on critical habitat by first looking at the effects of the action on the PCEs of critical habitat. Effects include change in PCE functional condition caused by the action in the action area. The relevance or importance of localized changes in PCE function to the entire designation is difficult to discern. To discern the relative importance of effects on PCEs of salmonid habitat for this consultation, NMFS related the action area effects to the presence and condition of those PCEs in Fifth Field HUC (watershed) in which the action area lies. When designating critical habitat, NMFS considered the conservation value of each watershed in the designation of critical habitat, according a low, medium, or high conservation value to each one. Following the guidance in Hogarth 2005, NMFS then assessed whether changes in PCE condition at the local scale would bear on the conservation role or value of critical habitat at the watershed and designation scales.

When NMFS designated critical habitat for the PS Salmonid ESUs, NMFS identified the PCEs essential for the conservation of these ESUs. The PCEs NMFS identified are those sites and habitat components that function to support one or more life stages, including:

1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;
2. Freshwater rearing sites with: (i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; (ii) Water quality and forage supporting juvenile development; and (iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.
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 supporting juvenile and adult mobility and survival;
4. Estuarine areas free of obstruction and excessive predation with: (i) Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and (iii) Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.
5. Nearshore marine areas free of obstruction and excessive predation with: (i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.
6. Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation (September 2, 2005, 70 FR 52685).

The physical effects of hydromodification resulting from reduced floodplain function affects freshwater spawning, rearing, and migration PCEs . These results include induced flood damage, increased flood stages, increased volume of instream flows, increased velocity of instream flows, and erosion and sedimentation. Each of these results is described below. Estuarine area PCEs are modified and their function decreased directly by the placement of fill.

Induced flood damage-- When establishing a flood elevation, hydraulic engineers consider continuous floodplain encroachments until, on average, the flood levels increase 1 foot. Little consideration is given to the residual depths and velocities that will occur at this flood level. When setting the floor elevation, the requirements are that the lowest floor of a building be no lower than the mapped 1 percent chance flood water surface elevation with little or no consideration given to waves, or to future increases in the level of the 1-percent-chance flood. The increased future flood level usually results as there is more runoff from developing watersheds, or it is induced by floodplain encroachment allowable under the current regulations.

This established flood elevation allows up to a 1-foot increase in flood water depth will result once the entire flood fringe is encroached upon, but there is no requirement to consider the impact this increase in water surface will have on existing buildings or property. Further worsening this problem is the fact that the floodplain encroachments are displacing land area that the rivers naturally used to store floodwaters. If extensive filling of the floodplain occurs, flood stages are no longer attenuated in the floodplain but instead are passed downstream, further increasing flood levels. Finally, because of development within the watershed, more runoff will flow into the floodplains, but these future flows are not considered when establishing lowest floor elevations (Larson and Plasencia 2001).

The net result is that, due to land use actions within and outside the floodplain, existing and future development very likely will experience flood depths of 1 foot or more above the mapped levels, inducing significant new damage to both real and personal property, and to natural habitat conditions.

One category of induced flood damage is the extensive filling or encroachment of floodplains that translates into a more rapid movement of flood peaks or stages downstream. When there is natural storage within a watershed, flood stages on the main watercourse tend to attenuate between significant tributaries. Once the natural storage is filled, the stages instead accumulate into higher downstream flood stages.

Increased flood stages--One of the primary problems of managing floodplains and watersheds subject to development, is increased flood stages (or depths). The primary existing control on future flood stages is the NFIP floodway standard, which allows flood depths to be increased up to 1 foot above nature's floodway as a result of floodplain encroachments. The impacts of this 1-foot increase in the flood stage are not considered under the NFIP (Larson and Plasencia 2001). The effect of the NFIP's 1-foot-rise standard is that the future condition of the watershed or floodplain is given little or no consideration by states and communities.

Anticipating the effect of FEMA's allowance of a one foot rise in the BFE on structures in the floodplain, Washington State requires new buildings to be constructed 1 foot above the current flood elevation, rather than at the level of the BFE as the NFIP requires. King County has also adopted a modified floodway standard (called the no-rise floodway) that limits the allowed increase in the natural floodway to less than 0.1 foot. Although freeboard (freeboard is the amount by which the first floor of a structure must be elevated above the regulatory flood height) is an essential strategy for minimizing the potential of flooding to new construction, it exacerbates the potential for induced flood damage to existing structures and natural habitat in or near the floodplain.

The response of flood districts or diking districts has often been to channelize the river to increase velocity, which “gets rid of” the water more quickly but also leads to the loss of storage in the floodplain. In some cases this has led to the increased severity of downstream flooding.

Increased flow velocity--Whenever the discharge in a stream is increased without an offsetting increase in cross-sectional flow area, or when the cross-sectional flow area is decreased due to fill or development in the floodplain, velocities will increase. Increased velocity also commonly occurs when levees are installed, constraining the river. The impact of these actions includes erosion from increased velocity and/or increased flooding or damage downstream. High velocities will destabilize spawning gravels and scour out redds, killing eggs and alevins. Juvenile fish rearing in the system will be fatigued by efforts to hold in place, stressed by turbidity and debris, and will be flushed downstream, as refugia in the shallow flood fringe is no longer available. High velocities will also cause channel erosion, making the channel more uniform, and thereby decreasing habitat complexity. As well, eroded sediment will cause embeddedness of spawning gravels and degrade water quality

Increased flow volume--A third area of concern is the management of increased flow. These increases are generally the result of paving of watersheds or the loss of in-stream and floodplain storage due to filling or development. To address increasing stormwater flows from developed watersheds, communities continue to implement retention and detention basins. In most cases the standards focus on making sure that post-development flows do not exceed pre-development flow rates. However, these standards provide insufficient storage volume to actually mitigate the increased flow, especially with larger design floods, and they extend the duration of some discharges. While retention and detention systems can minimize some stormwater effects, they cannot match the natural flow volumes, frequency, and timing of storm events, nor the normal infiltration of precipitation that occurs prior to development. The lack of infiltration to support summer base flows in streams for salmon, and the extended duration of some flows, has adverse effects on juvenile salmon.

When floodplains are filled, the capacity of the floodplain and channel to store high volumes of flow caused by flood events is greatly diminished. Floodwaters can no longer spread out on the floodplain, decreasing flow velocities. Instead all floodwaters stay within the confined channel, causing channel erosion and habitat simplification. Without access to floodplains, floodwaters are not available to recharge groundwater on large areas of the floodplain, which is important for providing summer base flows to adjacent streams. And without storing floodwaters, floodplains do not provide the function of filtering pollutants and nutrients. As well, without floodwaters in the floodplain, sediment and nutrients will not be carried to and dropped out in the floodplain, decreasing soil fertility and vegetation growth and development on the floodplain.

Floodplain disconnection can also result from channel incision caused by changes in hydrology or sediment inputs. The loss of LWD can lead to channel incision and a loss of side channel habitat, while bank hardening hinders lateral migration that recruits LWD. The loss of large wood has contributed to the disruption of the natural processes that create and sustain floodplain habitat (Smith 2005).”

Increased erosion and sedimentation—These increases are generally the result of development in adjacent floodplains and channel confinement due to filling or levees. Communities often permit development that causes erosion or sedimentation problems at construction sites adjacent to the stream and throughout the watershed. These activities contribute to increased erosion of project sites and can cause increased amounts of sediment to be transported in the adjacent channel. In addition, in confined channel systems, erosion and sedimentation rates are increased due to increased flow volumes and velocities. In contrast, in highly functioning channel systems, natural rates of erosion and sedimentation occur, which allow for the development of productive off-channel and side channel areas as the channel migrates across the CMZ. As well, in response to increased erosion of channel banks, bank stabilization projects proliferate. These projects are generally measured for site-specific performance, but their impacts on channel geomorphology are often overlooked. In some cases this has led to the creation of instabilities, causing channel down-cutting and bank erosion. In many cases channels have been "bank protected" with little consideration of how the channel will respond. Often streams and rivers respond with accelerated erosion of other sections of the channel or floodplain to compensate for the loss of sediment supply from the protected reach.

Sediment transport and sedimentation are perhaps the least-understood functions of a floodplain, yet the consequences of disrupting them can be significant. Some communities are beginning to evaluate the use of erosion hazard setback zones, or they are developing sets of tools for an entire floodplain that can be used to evaluate systematic impacts of all proposed development. However, erosion setbacks while effective, generally do not address some of the systemic issues that influence erosion and lateral channel migration. In many cases channel downcutting can occur, as the result of changed hydrology (more frequent runoff) or channels being straightened leading to overall steeper channel slopes. Fluvial geomorphologists have developed techniques that restore channel meander and cross sections that are more appropriate for the soil, land form, and hydrology conditions for the area (Larson and Plasencia 2001).

Freshwater Spawning Sites. These sites require water quality and quantity conditions and substrate supporting spawning, incubation and larval development. The floodplain filling, confinement, and disconnection caused by the NFIP, degrade substrate availability and function by decreasing floodwater storage capacity, an essential floodplain function that maintains habitat. As a result, increased flow volume and decreased flood storage during higher water causes scour and lost spawning. In the longer term, decreased instream flood capacity alters the sediment transporting regime of a stream or river, leading to deposition and embeddedness in some cases and scour in others.

Unaltered stream channels sort sediment. When the sediment transport processes of the channel are in balance, and the dominant sediment size of the channel is gravel, these patches of gravel may remain stable for long periods. The stability and high permeability of gravel supports invertebrate communities that extend to the surface (Church 2002). Montgomery et al. (1999) found that salmon spawning patterns in mountain drainage basins of the Pacific Northwest are adapted to the timing and depth of channel bed mobility.

Sediment movement in rivers is affected by land surface condition. Some valley segments receive sediments from both upland sources and riverine transport and are extremely sensitive to fluctuations in sediment supply. Because of the small size and low inertia of individual grains, fine-grained material is mobile over a wide range of flows. When land use and channels are altered, the bed becomes unstable (Church 2002). This type of bed does not support salmon spawning egg incubation or alevin rearing. Unstable channels result from the hydrologic changes that result from loss of floodplain habitat, including fill and channel confinement, which alter stream capacity and stream competence.

Water quality is also degraded when stream bed materials are mobilized during high flows. Small sediment particles can plug interstitial spaces needed for transporting oxygenated water to eggs, decreasing their ability to support incubation.

Freshwater Rearing Sites. These sites require water quality and quantity, floodplain connectivity, forage, natural cover and shade, and side-channels and undercut banks to support juvenile growth and mobility. The loss of floodwater storage capacity that results from placing fill in the floodplain and/or excluding water from the floodplain with barriers such as dikes and levees reduce food availability. Loss of floodplain connectivity reduces forage (Sommer et al. 2001a). Floodplain forage areas are considered to be exceptionally biologically productive and thus ecologically important (Sommer et al. 2001a and 2004, Sparks 2007, Task Force on the Natural and Beneficial Functions of the Floodplain 2002, Junk et al. 1989).

Pess et al. (2003) found differences in relative salmon abundance in hydrologically altered and unaltered wetlands along the Snohomish River. Hydrologically altered wetlands included those ditched or separated from the stream channel by bank armoring or diking. Stream reaches with unaltered wetlands associated with the stream channel had adult salmon densities two to three times greater than spawner survey reaches with altered wetlands. Changing habitat characteristics at the habitat unit and reach scales from NFIP-related activities alter abundance patterns and redistribute salmon.

Levees absent of overhanging vegetation and trees reduces riparian functions. Ecological functions of submerged and overhanging wood and shade are eliminated with fill and channel confinement. Natural banks have a higher portion of wood and undercut banks when compared to hydromodified banks (Beamer and Henderson 1998). The importance of undercut banks is demonstrated in research conducted by Brusven et al. (1986). Wood cover in hydromodified banks explained 82 percent of the variation in fish abundance in a study of fish use of bank habitat on the Skagit Riever (Beamer and Henderson 1998).

Schmetterling et al. (2001) demonstrated the harmful effects of placing angular rock riprap on banks for levee reinforcement. This is the method of bank protection typically used to meet COE design and construction of levee regulations (COE 2000a). Since FEMA uses COE policy guidance and regulations (FEMA 2007, COE 2006a, COE 2006b) for levee certification, the NFIP program requires riprap reinforcement. By riprapping banks, wood recruitment is eliminated because lateral migration is stopped and less wood becomes established than on natural banks (Dykaar and Wigington 2000). This prevents development of undercut banks and overhead cover (Schmetterling et al. 2001). When riprap is added to streambanks with healthy riparian vegetation, shade, stable undercut banks, and large woody debris, the habitat value essential for providing food, cover and shade, to salmon will be diminished or eliminated with the addition of rip rap (COE 2003).

Loss of floodwater storage increases water velocities. Salmon are close to being neutrally buoyant and have elaborate strategies for holding their position, gathering food and moving with and against flowing water. In natural channels there are boundary layers, turbulent eddies, and the parceling of portions of the flow that move up, down, backward, and forward, creating complex flow dynamics. Peaks in the waves form riffles, troughs form pools, and meanders mimic their horizontal amplitude, creating a broad range of hydraulically unique habitats (Newbury and Bates 2006).

The quantity, quality and distribution of salmon habitat in Washington has changed dramatically since the mid 1800s after people removed beaver ponds, diked, ditched, and dredged streams and floodplains (Beechie et al. 2001). These activities are referred to collectively as channelization and continue to be enabled by FEMA's implementation of the NFIP. This occurs as a result of the program in two ways: as fill is placed in the floodplain, forcing the river to become confined in a narrow channel, and as a result of the operation and maintenance of levees recognized by FEMA. Channelization prevents the natural migration of the channel across the floodplain, where numerous side channels, oxbows, undercut banks and off-channel areas that shelter juvenile salmon are created (Montgomery, 2003).

The adverse effects of channelization on the physical and water quality conditions needed to support salmon have been detailed in numerous publications, for example Pess et al 2003, Bolton and Shellburg 2001, and Montgomery et al. 2003. These publications make a solid case for the profound effects of channelization on spawing, rearing, foraging, migration and water quality. Beechie et al. (2005) found most juvenile salmon prefer edge habitats with velocity less that 15 centimeters per second.

As a portion of the groundwater interface with surface water beneath the active channel and in the riparian zone of most streams and rivers, hyporheic zones also influence hydrology. , The hyporheic zone is important to salmon for many reasons: providing habitat for invertebrates and salmon eggs, moderating water temperature and flood flows, and supporting nutrient cycling.

For many streams and rivers, subterranean invertebrate production in the hyporheic zone rivals or exceeds that of the benthos (Dahm et al. 2006, Reidy and Clinton 2004). The hyporheic zone is prime habitat for spawning salmon, since oxygenated stream water downwelling through redds creates an environment ideal for egg development (Reidy and Clinton 2004). As water flowing from riparian zones to streams is cooler than surface waters during peak summer temperature and warmer than winter low temperatures, hyporheic zones moderate water temperature. By retaining and storing water, the magnitude of peak flows and sustenance of baseflows is provided by the hyporheic zone. They also promote habitat complexity in numerous ways that are beneficial to salmon and detailed in Bolton and Shellberg (2001).

Land use effects strongly influence biota in hyporheic zones (Dahm et al. 2006). Contaminants such as nutrients, metals and other contaminants that adsorb to sediments are filtered out in hyporheic zones (Reidy and Clinton 2004). The cycling of nutrients and organic matter in hyporheic zones affects riparian vegetation. Geomorphic and vegetative changes affect the size and average residence time of water in hypoheic zones. Spatial distribution of unconfined floodplains and hyporheic zones control pioproduction within channels of many stream and rivers. Constrained stream reaches show little hyporheic exchange flow (Dahm et al. 2006). Thus the loss of ecological benefits of hyporheic zones can also be attributed to channelization resulting from implementation of the NFIP.

Hydromodification eliminates essential habitat features for juvenile salmon including floodplain connectivity, forage, natural cover and shade, and side channels and undercut banks, by creating a uniform, high velocity channel. Loss of refuge and forage habitat for juvenile salmon is a leading factor limiting salmon recovery in Puget Sound. Actions that promote loss of floodplain function, including FEMA's authorization of fill and levee construction and maintenance, are harmful to salmon habitat.

Freshwater Migration Corridors. These sites require safe passage, water quantity, water quality, and natural cover for migration corridors supporting juvenile and adult mobility and survival. Controlling river morphology and dynamics as a result of confinement, disconnection, and filling of floodplains creates physical conditions that impede the safe and timely passage of both juvenile and adult salmon. These conditions prevent juvenile access to shallow, off-channel areas of low flow, exposing them to less food, higher flows, and risk of predation. Moreover, life history timing differences between salmonids and exotic species suggest that floodplain habitat may favor native over alien fishes because the timing of inundation is better suited to their life history. Loss of functional floodplain habitat could be reasonably assumed to confer advantage to exotic species that prey on juvenile salmonids (Moyle 2002).

Concentrating water quantity increases instream flow above levels to which juvenile fish can respond. This occurs during flooding into restricted conveyance areas. Increased instream flow can flush juveniles out of rearing areas or force them to expend significant energy to hold in location against flood volumes and velocities. Furthermore, floodwater flowing into the system from contact with developed land in the floodplain is reasonably certain to contain a variety of contaminants and pollutants, bearing a range of lethal and sublethal effects on juvenile salmonids, depending on concentration. The synergistic effects of exposure to multiple contaminants during floods is undetermined.

Maintaining levee vegetation to COE standards leads to reduced levels and/or absolute removal of vegetation. This is especially true for overhanging riparian vegetation that would otherwise function as natural cover. Eliminating trees from levees eliminates riparian shade, sources of juvenile forage, and recruitable large woody debris. Large woody debris creates structural complexity in streams, on which salmonids rely for pools, riffles, and cover from predators.

Channelization (confining and simplifying channels), creates a velocity barrier for juvenile salmon (due to limitations on swimming speed and energy). Loss of cover (vegetation, overhanging banks and wood) also impedes migration by removing shelter, not only from water velocities but from predation. Both juvenile and adult salmon require these features. By excluding water from floodplains the NFIP impedes migration.

Natural banks had a higher percentage of their area in wood, cobble, boulder, aquatic plants, and undercut bank compared to hydromodified banks. Chinook and coho salmon abundance were higher in stream reaches that had natural banks (Beamer and Henderson 1998).

Estuarine Areas. These sites require free passage, limited predation, water quality, quantity and salinity conditions, natural cover, and juvenile and adult forage to support growth and maturation. Estuarine floodplains are often the largest and most biologically diverse. As assessment of primary habitat issues affecting Chinook salmon in fifteen Washington watersheds concluded that estuarine loss was a limiting factor in fourteen of the watersheds (Bishop and Morgan 1996). In addition, of the ten representative salmon populations chosen to be analyzed in this consultation, 8 were located in watersheds where estuarine habitat was identified as a limiting factor (NMFS 2006). The FEMA's implementation of the NFIP leads to removal of these areas from floodplain maps and managed as upland with concomitant effects on estuarine habitat function. In an example described earlier, FEMA issued a letter of map revision recognizing fill in the Snohomish River estuary that would have been considered designated critical habitat before the fill occurred (Alexander 2005). Since nearly 75 percent of the tideland areas of the Snohomish River delta have already been lost (Bortleson et al. 1980), and destruction of off-channel habitat has eliminated approximately 95 percent of Chinook salmon rearing capacity and coho salmon smolt production in the Snohomish River estuary floodplain (Haas and Collins 2001), this type of action further reduces the potential for salmon survival and recovery in the Snohomish River (Snohomish Basin Salmon Recovery Forum 2005). Recognizing fill in floodplains under the NFIP is contrary to efforts to improve key limiting factors for salmon through floodplain restoration projects funded by the Salmon Recovery Funding Board (NMFS 2006c).

Estuaries are areas where freshwater and saltwater mix. As a result, they support the salmonid transition life history. They must continue to feed and find shelter while their bodies undergo an osmoregulatory change so they can extract oxygen from saline waters. Most fish are stenohaline, which means they are restricted to either salt or fresh water and cannot survive in water with a different salt concentration than they are adapted to. However, some fish show a tremendous ability to effectively osmoregulate across a broad range of salinities; fish with this ability are known as euryhaline species. Chinook salmon and chum salmon spend more time in estuarine areas that other species of Pacific salmon. They are considered to be particularly estuarine-dependent (Simenstad et al. 1982, Thom 1987, Aitkin 1998). In designating critical habitat, NMFS determined, "The highly productive estuarine environment is an important feeding and acclimation area for juveniles preparing to enter marine waters" (September 2, 2005 70 FR 52662).

For example, in the Skagit, the more time juvenile Chinook salmon spend in the bay, the better their growth rate Beamer and Larson 2004). But because this habitat type is limited in the delta, and Chinook salmon have a density dependent relationship here, the amount of remaining salmon rearing habitat in the delta appears to limit the Chinook salmon population size (Beamer and Larson 2004).

Estuarine areas, where fresh water and salt water mix, are physically and ecologically complex. Bortleson et al. (1980) found that approximately half the available habitat in eleven Puget Sound estuaries had been eliminated. Puget Sound Chinook salmon and Hood Canal summer-chum salmon recovery is considered to hinge to some extent on the amount and quality of available estuarine habitat. Consequently, further degradation to this PCE by the NFIP could have negative effects to salmon recovery.

Nearshore Marine Areas. These sites require free passage, limited predation, forage, water quality and quantity conditions, and natural cover to support growth and maturation. Nearshore marine areas with high quality forage are also important to listed salmon in Puget Sound. Some nearshore areas are nurseries for juvenile salmon even though they are distant from natal streams. For example, unmarked juvenile Chinook salmon were found foraging in Sinclair Inlet (Fresh et al. 2003). Chinook and chum in Puget Sound rely on nearshore migration corridors for foraging and shelter during their anadromous lives. The importance of these habitats is probably greater in circumstances when estuaries of natal streams have been reduced. This is particularly true in the Skagit, where juvenile Chinook salmon use of pocket estuaries has become more important as estuarine habitat associated with the mainstem has become more limited. Fill in shallow near shore areas eliminates valuable rearing and migration habitat for juvenile salmonids.

Relevance of Effects on Salmonid Primary Constituent Elements to Watershed Conservation Value. In conducting the critical habitat analysis, after identifying effects on PCEs, NMFS assesses how PCE effects influence the function or conservation role of the entire designated critical habitat. To facilitate that analysis for consultations in the NMFS Northwest Region, NMFS takes an intermediate step to assess whether and how impacts to PCEs affect conservation value of the watershed. The following subsections analyze the PCE effects on watershed conservation function by focusing on (1) whether PCE changes negatively influence the function of presently adequate habitat conditions at the watershed scale, and (2) how the NFIP implementation will influence the habitat restoration activities identified in recovery plans, since those are intended to improve the conservation potential in those habitat areas.

Changes Among PCEs that Negatively Influence the Function of Presently Adequate Habitat Conditions at the Watershed Scale. Floodplain connectivity and channel function in almost all habitat areas evaluated for this analysis have been identified as limiting species productivity. Despite the fact that these habitats all have PCE conditions that limit productivity, the habitat areas that are the focus of this analysis are all providing high conservation value because of the essential function they supply for spawning (chum salmon) and rearing (spring Chinook salmon, and stream-type Chinook salmon, chum salmon, and steelhead). As the NFIP causes floodplain development in or adjacent to these critical habitat areas across these watersheds (with the stated exception of Lake Ozette), the watersheds will be less able to support the fish life histories for which they were originally included in the critical habitat designation (spawning and rearing, respectively). Ironically, while these affected watersheds will retain their conservation value, as assessed by NMFS' CHART teams, their ability to function in the conservation role from which those CHART ratings were derived is undermined as the loss of PCE function continues as the result of the proposed action. A high degree of habitat loss may greatly enhance the biological significance of remnant floodplains in heavily modified systems (Sommer et al 2001a).

NFIP Implementation Influence on Habitat Restoration Activities Identified in Recovery Plans. A factor in determining the effects of a proposed action on the conservation value of the critical habitat is the effect of the proposed action on recovery plan elements and actions within that designated habitat. Since most recovery actions from salmonids recovery plans are intended to improve habitat conditions for the purpose of re-establishing or enhancing certain life-story stages of salmonids, determining how the proposed action influences those elements and actions reveals an indirect effect on conservation potential of the habitat.

The NFIP requirements that fill be placed to the BFE in order to elevate buildings, that fill above the BFE is a foundation for being removed from the mapped floodplain, and the program to award CRS points for berms, levees, and other structures to limit floodwater intrusion, individually and in the aggregate, create habitat and adjacent watershed conditions in opposition to the following recovery projects and elements:

Puget Sound Chinook Salmon--White River Recovery Efforts. A key strategy for salmon recovery in this basin is floodplain management. There is an active program in the Puyallup/White River system that is beginning to be funded. However, there is a significant amount of development underway in the lower river system that is putting major stress on the lower river floodplain and estuarine areas. Consequently, opportunities for large scale restoration in this part of the watershed are dwindling. Floodplain protection and functional restoration is critical for achieving plan outcomes.

According to EDT analyses, long-term and near-term management actions that will be most effective in improving conditions necessary to support increased fish populations are restoration of estuary habitat and floodplain connectivity in the lower Puyallup, lower White and lower Carbon Rivers (Shared Strategy 2005). Also important are increased protection and restoration of tributaries which currently have relatively high productivity, including South Prairie Creek, Boise Creek, Greenwater River, Huckleberry Creek, and the Clearwater River. Key environmental factors needing to be addressed include habitat diversity, channel stability and sediment load, as well as barriers to fish migration for both adults and juveniles. Areas of highest priority for restoration projects include Puyallup mainstem downstream of Orting (to estuary), the estuary, and the diversion screens associated with the Electron Dam. Areas of highest priority for protection include the South Prairie Creek mainstem and estuary.

Puget Sound Chinook Salmon--Nooksack Recovery Plan Efforts**.** Similarly in this basin, recovery efforts include ensuring floodplain management protects and enhances fish habitat (Shared Strategy 2005). A high percentage of the riverbanks along the mainstem as well as the North and South forks of the Nooksack is armored with rock for flood protection. These same areas support rearing and migrating life histories for both juvenile and adult salmonids. To integrate flood protection and salmon recovery plan action, Whatcom County is developing hydraulic models and revising their plan for flood hazard reduction in the Nooksack River. This work can be done with the habitat needs identified in this recovery plan for fish. A technical advisory committee will align flood control projects with salmon restoration needs. The habitat restoration priorities will be incorporated into floodplain management operations and projects, which will begin within 3 to 5 years.

As the restoration needs for fish are being integrated with floodplain management, Whatcom County will pursue a significant effort to protect existing river functions. By 2006, the County will map where the river naturally migrates across the floodplain. The Whatcom County Council and Washington Department of Ecology will consider regulations to protect this natural process. Channel migration zones will be set by late 2005 or early 2006, which will influence where and how development and armoring will occur in the floodplain. In ten years, protecting and restoring the river's ability to migrate will begin to improve egg and juvenile survival, and over time significantly enhance the productivity of the lower river.

Other parts of the floodplain strategy will include studies for how to manage sediment transport and storage in the river and potentially remove or setback levees, move roads, bridges and pipelines that constrain the river causing both property damage and fish impacts. Although much of the river has been altered, there are still significant areas that are functioning well for fish. Increased human population growth and development must not degrade these areas from current levels if the restoration plans for the river are to increase the numbers and productivity of the fish.

Puget Sound Chinook Salmon--Dungeness Recovery Efforts**.** Of the ten strategic elements to achieve recovery identified and described in "Restoring the Dungeness" (Shared Strategy 2005), six are related to floodplain, riparian, and in-channel conditions that are influenced by development in the floodplain:

1) Restoration of Lower River floodplain and delta to River Mile 2.6 to increase the quantity of essential rearing and salt/freshwater transition habitat

2) Protection of existing functional habitat (RM 2.6 - 11.3) within the watershed Riparian corridor protection/restoration to Highway 101 through land acquisition/easement and regulatory protection measures

3) Floodplain Restoration/Constriction Abatement (RM 2.6 - 11.3) to alleviate channel constrictions, thereby increasing corresponding channel meanders and reducing gradient, velocities, scour and bank erosion Removal of upper Haller Dike at the Weikal property. Property will be purchased for the Corps Dike setback. The area will be re-vegetated and engineered log jams will be constructed

4) Large Woody Debris Placement Lower river floodplain restoration, LWD between Schoolhouse Bridge and Woodcock Road Strategically placed LWD between Hurd Creek and Highway 101.

(5) Restoration of Functional Riparian and Riverine Habitat; and

(6) Nearshore Habitat Protection and Restoration

Dikes and levees limit fish refuge, overwintering, and scour eggs. The PS Chinook Salmon

Recovery Plan identifies removing nine miles of levee/dike as necessary to provided sufficient habitat for recovery of this population.

Puget Sound Chinook Salmon--Skagit Recovery Elements. Recovery actions in this watershed are proposed that benefit each life history strategy in an effort to maintain and strengthen diversity of Skagit Chinook salmon as well as their abundance, productivity and spatial structure. Among other habitat goals of the Shared Strategy (2005) is freshwater rearing restoration, which is focused on improvements to floodplain areas. Focus is especially directed where gaps in connectivity are known to exist and habitat restoration opportunities exist. Actions focus on removing or upgrading hydromodification along the main river channels, protecting functioning floodplain habitat, restoring natural floodplain processes and/or reconnecting historic floodplain channels. These actions are projected to increase riverine wetland areas, increase accessibility to off-channel habitats and increase channel edge complexity. This strategy largely benefits parr migrants.

Hood Canal Summer Run Chum Salmon—All Watersheds**.** The HCCC identifies several threats to habitat to be addressed to achieve recovery of the ESU. These threats are:

> 1. Channel function, including vegetated riparian areas, instream wood, stream bank stability, off-channel and side-channel habitats, natural substrate and sediment processes, and channel complexity is restored to provide rearing, migration and spawning habitat to meet the HCCC Plan's recovery goals.
>
> 2. Floodplain function and the availability of floodplain habitats for salmon are restored to a degree sufficient to support a viable ESU, including tidal wetland habitats in estuaries and the tidal freshwater portion of the lower rivers. This restoration should include connectedness between river and floodplain and the restoration of impaired sediment delivery processes and conditions affecting both estuaries and lower river reaches.
>
> 3. Land use and water management practices maintain suitable spawning habitat in watersheds with high-elevation headwaters to buffer against climate-related loss of spawning habitat in lower elevation drainages.
>
> 4. Urban and rural development, including land use conversion from agriculture and forest land to developed areas, does not impair water quality or result in dysfunctional stream conditions.

The subpopulation structure of summer chum salmon has important implications for designing successful strategies to recover the spatial structure and diversity attributes necessary for viable salmon populations. Efforts to rebuild sustainable populations by recovering habitat and reintroducing summer chum salmon to tributaries where they have been extirpated will be most successful if they focus on streams with major spawning aggregations, which can act as core natural production areas, and the smaller tributaries that are needed to reestablish the connections among these larger groups (HCCC 2007).

Hood Canal Summer Run Chum Salmon--Union River Recovery Efforts. Based on factors for decline (loss of channel complexity; riparian degradation; estuarine habitat loss and degradation), in this unit (includes the Union River and Tahuya River watersheds and the marine nearshore waters east of the town of Union near the mouth of the Skokomish River north to Rendsland), the following recovery actions have been identified: Remove dike, tide gates, fill, bulkhead, and levees to restore habitat. Protection of freshwater reaches shows the highest priority, followed closely by the natal sub-estuary. Within freshwater, sediment load and habitat diversity are seen as the most important factors to restore. Within the natal sub-estuary, several factors appear to be equally important for restoration, along with the amount of area available to be used for rearing.

Hood Canal Summer Run Chum Salmon--Hamma Hamma Recovery Efforts**.** Limiting factors in the Hamma Hamma include loss of channel complexity and in-channel wood in lower river due to dredging; bank hardening and channelization; bed instability and sedimentation in lower Johns Creek; impaired connectivity and loss of tidal prism in the estuary from dredging and dikes; restricted tidal action caused by the Highway 101 causeway; and isolation of estuarine marsh. To address estuarine limiting factors, recovery actions include 34.5 km road decommissioning and 9.2 km road conversion to trail. To address mainstem and floodplain limiting factors, recovery actions include upland silvicultural treatment to increase hydrologic maturity in Jefferson and Cabin Creek watersheds; following the results of watershed analysis for assessing, conserving, and restoring riparian conditions in and above areas of anadromous presence, and in lake riparian areas damaged by recreation.

Hood Canal Summer Run Chum Salmon--Snow Recovery Efforts**.** The greatest potential increase in chum population abundance would occur through restoration of freshwater reaches, estuarine waters, marine waters, and the natal subestuary appears. Within the natal sub-estuary, food and habitat diversity appear to be equally important for restoration, along with the amount of area available to be used for rearing. Within the estuarine and marine environment, the most important factor for restoration is food, associated with loss of eelgrass, shoreline development, and loss of riparian corridors

The Snow Creek mainstem (upstream of subestuary) provides the greatest potential for restoration benefits within the freshwater environment. Salmon Creek reaches are the highest priority with great strategic importance to the ESU. Within freshwater, habitat diversity and sediment load are seen as the most important factors to restore. In each location, with the exception of Lake Ozette, NFIP implementation further impairs limiting factors of listed species, and either impedes specific recovery actions or perpetuates and exacerbates conditions in additional locations beyond the baseline that will frustrate recovery elements at specific sites. Thus the NFIP implementation diminishes the ability of the watersheds to provide listed species with the conservation values for which the habitats were designated.

Local Salmon Recovery Efforts. As is clearly described above, many State and local effects are underway to restore or protect salmon habitat. The PCSRF and Washington State matching funds have provided more than $200 million for salmon recovery in Washington for the years 2000 through 2006 (Pacific Coast Salmon Recovery Fund 2006). Of the projects that have been funded, those that include reference to floodplain functions add up to approximately $34 million for the years 2000 through 2006. Some of the funding comes from Federal sources, and some from State and local sources.

A study on the cost of PS salmon habitat projects (Evergreen Funding Consultants (2003), identified floodplain restoration as ranging from $10,000 to $300,000 per acre. The cost of restoring estuary habitat ranges from $20,000 to $2 million per acre. Applying the most expensive restoration cost to the $34 million spent in the past eight years would yield only about 2.1 acres of restored habitat per year. Using the midpoint cost for freshwater floodplain habitat ($160,000) would yield 26.5 acres per year. These numbers show that the cost of restoring floodplain habitat is extremely high for this habitat type that is particularly valuable to salmon in Puget Sound and already in short supply.

In addition, a reduced level of floodplain function is at least initially associated with restoration projects. Even successful projects that include the full suite of floodplain functions take years to mature and perform as designed (Pacific Coast Salmon Recovery Fund 2006). Also, the number of acres restored does not reflect that some of the salmon recovery finding has been used for preservation rather than for restoration. This is important for two reasons: 1) preservation yields no increase in floodplain function, and 2) restoration costs far exceed preservation costs (Beechie et al. 2008, Cairn 1993, Roni 2005, and Roni et al. 2002).

The FEMA, in its administration of the NFIP, causes removal of floodplain functions. Because of their high restoration cost and limited availability, NMFS expects that the NFIP enables the loss of more floodplain function than recovery programs are able to restore. This conflicts with guidance for viable salmon populations (NOAA Tech Memo 42) that states, “Habitat patches should not be destroyed faster than they are naturally created.” The guidance also states that such a negative trend is deterministically adverse to viability of salmon populations.

Relevance of Changes in Watershed Conservation Role to the Conservation Value of Designated Salmonid Critical Habitat. The degree to which the NFIP activity affects local PCEs in watersheds in the Puget Sound Region, will determine the effect on the conservation role of those watersheds. Most of these watersheds were rated as having “high” conservation value by the NMFS CHARTs when NMFS designated critical habitat. Almost all watersheds will experience PCE and conservation value degradation through floodplain loss and channel alteration, though at variable rates depending on location. Therefore, the NFIP’s effects on PCEs will influence the risk to the present conservation role of critical habitat overall. Determining to what degree decreased floodplain function, floodplain connectivity, and channel function will influence the conservation value of critical habitat depends upon several factors. These factors include: the importance of affected watersheds to the conservation value of critical habitat, whether changes in watershed function will impair existing function and/or prevent re-establishment of the function where it is absent, and the continuing conservation needs of the ESUs or DPS for which critical habitat was designated.

For example, in a water body such as the Skagit River, which is designated as critical habitat for multiple listed species, loss of floodplain connectivity and function is more significant for those species that use the area as small outmigrant juveniles than those outmigrant juveniles that are older and larger during their migration. Also, the ESUs and DPSs that have a life history that includes rapid outmigration will be less impacted by floodplain losses than those that have preferential behaviors to rear and migrate slowly through the lower Skagit River. Thus, the abundance or lack of floodplain connectivity has different effects among multiple species, based on their different level of reliance on the floodplain for various life stages, and therefore offers different conservation values to those various species. These components of the analysis must be factored with the level of risk that the ESUs and DPSs face among the viability factors of population genetic variation, population spatial distribution, population abundance, and population productivity. When PCEs (or essential features of habitat) are degraded in areas that support populations identified as “essential-to-recovery” for a given ESU or DPS, then the degradation of those PCEs has greater likelihood of negatively limiting conservation at the designation scale.

Primary constituent elements degradation will impair conservation value of habitat in all study areas of this analysis (except Lake Ozette) to various degrees. The degree of effect is expected to be consistent with human population growth rates throughout the watersheds where designated critical habitat of PS Chinook salmon, and Hood Canal summer run chum salmon occurs. The NMFS’ review indicates systemic, aggregate degradation of PCEs that in most watersheds are already impaired to the point that they limit productivity. Moreover, specific habitat-focused recovery efforts will be impeded by the effects of the NFIP, impairing conservation efforts. The majority of HUCs in which this PCE degradation will occur are ranked as having high conservation value, and all the watersheds which supported the representative salmon populations NMFS selected for this analysis are ranked as having high conservation value. The PCE degradation, together with the limitations of specific habitat actions identified for recovery, will negatively affect conservation values at the full scale of the respective designations.

Effects on Southern Resident Killer Whales

The proposed action has the potential to reduce prey availability, and this analysis considers whether effects of prey reduction may reduce the reproduction, numbers, or distribution of SRKWs. The NMFS evaluated the potential effects of the proposed action on SRKWs based on the best information currently available regarding metabolic needs of the whales, salmon abundance, and reductions in prey resulting from the proposed action. The direct effects of the proposed action within freshwater systems of Washington State will not result in direct effects to Southern Residents in the marine environment; however, the proposed action will reduce prey for the whales in the marine environment over the long term. Based on the distribution patterns of the whales and the areas affected by reduced prey from the proposed action, the entire population of SRKWs will experience a reduction in prey abundance associated with the action.

The NMFS focused on effects to the PS Chinook salmon ESU and, to a lesser extent, on PS steelhead and Hood Canal summer chum salmon to evaluate the effects on prey abundance. The best available information indicates that Southern Residents prefer Chinook salmon in inland waters, although at least a portion of the population may switch to chum salmon during the fall. The total abundance of all salmon species within inland waters of the action area is much greater than the abundance of Chinook salmon in this area.

The salmon analysis of this Opinion examines individual populations of salmon as indicators of population-level consequences for the broader health of listed entities of salmon. The NMFS' conclusion is that the proposed action is likely to reduce the productivity of individual populations. Over the long term the loss of individual populations will jeopardize the continued existence of the PS Chinook salmon ESU, the Hood Canal summer-run chum salmon ESU, and the PS steelhead DPS, potentially leading to extinction of these listed entities of salmon. Additionally, the proposed action will adversely modify designated critical habitats of PS Chinook salmon and Hood Canal summer-run chum salmon.

The NMFS evaluated the effects of NFIP on prey availability by considering: 1) the percent of available prey removed by the NFIP, and 2) the remaining prey base compared to the whales' needs. In addition we discuss the uncertainties involved in prey estimates and where we have made conservative assumptions. To give the benefit of the doubt to listed whales, NMFS evaluated prey availability after critical habitats become adversely modified and the identified ESUs and DPS become extinct as the long-term consequence of the proposed action.

Prey Reduction. The NMFS compared the availability of Chinook salmon with and without the proposed action. To estimate the availability of Chinook salmon without the proposed action, NMFS used the number established in the environmental baseline of total Chinook salmon prey available in the inland range of Southern Residents (447,421 Chinook)[19]. The NMFS subtracted from this number the current abundance of all 22 extant populations of the PS Chinook salmon ESU at risk of extinction to estimate the availability of Chinook salmon with the proposed action (Table 10).

Based on our estimates of effects on prey availability, there would eventually be up to 132,724 fewer Chinook salmon available to the whales if the proposed action were implemented. The NFIP reduction (132,724 of 447,421) constitutes a 30 percent reduction in the total Chinook salmon prey resources available to SRKWs in inland waters. The reduction in prey would likely occur over time as the PS Chinook salmon ESU declined and went extinct. Hatchery programs, which constitute 59 percent of the PS Chinook salmon ESU, may provide a short-term buffer, but it is uncertain whether a 100 percent hatchery-based stock could be sustained over the long term.

Although Chinook salmon are the primary prey of Southern Residents in Puget Sound, preliminary study of Southern Resident diet during fall months when the whales' are more likely to occur in southern Puget Sound suggests that at least J pod (which represents 30 percent of the Southern Resident population) may switch to a mostly-chum diet (Hanson et al. 2005, NMFS - NWFSC unpubl. data). In this case, the percent reduction in prey availability would be smaller compared to Chinook salmon alone, as the total abundance of adult chum salmon returning to Puget Sound (1,866,594 chum) (summary of WDFW data for 1998-2002 by T. Tynan pers. comm. March 13, 2008) combined with the total abundance of adult Chinook salmon in the inland range of Southern Residents, would provide greater prey availability. The NMFS has not

[19] This estimate of overall Chinook abundance in inland waters is likely an underestimate as it does not include immature Chinook (age 2 to 3), which if readily consumed by Southern Residents may add an additional 20 percent of Chinook resources available in inland waters (D. Simmons, NMFS, Co-Chair of Pacific Salmon Commission, Joint Chinook Technical Committee, pers. comm., March 18, 2008). Additionally, this estimate does not account for natural predation of fish before escapement, including fish consumed by killer whales and other predators.

estimated the potential reduction in abundance of PS chum salmon that are not listed under the ESA. For the same reasons that this opinion projects declines in the abundance of Hood Canal summer-run chum salmon, the proposed action would also likely result in declines in the abundance of unlisted PS chum salmon.

Table11. Reduction of Chinook Prey Resources in Inland Waters of the Action Area by the NFIP Proposed Action

Chinook Stocks in Inland Waters	Abundance
Puget Sound Chinook ESU	132,724
Other Puget Sound Chinook (not part of the listed entity) Upper Fraser Chinook Lower Fraser Late Chinook Georgia Strait Chinook	314,697
Total Abundance in Baseline[1] (without Action)	447,421
Total Abundance with Action (Baseline minus PS Chinook ESU)	314,697
Total Reduction in Abundance	**132,724**

[1] Chinook stock estimates from Table 2.

Remaining Prey Base Compared to Whales' Needs. The NMFS compared the amount of prey available to the whales after the action to the estimated number of fish needed by the whales. To be conservative NMFS relied on scenarios that assume the whales' diet consists of mostly Chinook salmon. Considering the scenarios provided, Southern Residents could need as many as 140,380 Chinook in inland waters (Table 2). Based on this scenario, the availability of Chinook salmon in the inland portion of the whales' range affected by the action would be 2.2 times the bioenergetic needs of the whales. Thus, the result of the proposed action is that the Chinook salmon prey available in inland waters would be reduced from 3.2 to 2.2 times prey needs.

Based on our analysis, there would eventually be as little as 2.2 times prey needs when the Southern Residents occur in inland waters. This reduction in prey availability could reduce the amount of prey consumed by killer whales, with effects on fitness. It would also increase the energy individual whales would need to expend locating and capturing prey. The loss of the PS Chinook salmon ESU would also affect the abundance of Chinook salmon in the coastal range of killer whales, but the percentage reduction within the coastal portion of the action area would be far less because of the variety of Chinook salmon and overall abundance in coastal waters.

Because of their life histories and the location of their natal streams, adult salmon are not evenly distributed across inland waters during the summer and early-fall months when Southern Residents occur in this general area. Therefore, in addition to the overall reduction in prey, the loss of the PS Chinook salmon ESU could cause local depletions, further affecting the ability of the whales to meet their bioenergetic needs. The potential extirpation of all individual populations of the listed PS Chinook salmon ESU from the proposed action decreases the geographic continuity of salmon-bearing watersheds in inland waters, which would reduce local abundance of prey as well as alter the movement of migrating salmon, increasing the likelihood for localized depletions in prey within inland waters. A fundamental change in the prey base in Puget Sound could result in the whales abandoning areas in search of more abundant prey.

Effects on killer whales would be compounded by the permanent loss of all populations of the PS Steelhead DPS and the Hood Canal summer-run chum salmon ESU, which although not identified as preferred prey, are potentially consumed when present at the same times and in the same location as Southern Residents. Additionally, much of the same habitat that supports listed salmonids also supports unlisted salmonids in Puget Sound. As the critical habitat of listed salmonids is adversely modified, the habitat of unlisted salmonids is also likely to be degraded, leading to a reduction in the productivity and long-term abundance of non-listed salmonids returning to watersheds across inland waters. These factors would further reduce the prey base available to Southern Residents throughout the action area, decreasing the buffer of prey available, and further increasing the likelihood of local prey depletions.

Uncertainties and Assumptions. The ESA requires Federal agencies to ensure their actions are not likely to jeopardize the continued existence of threatened and endangered species. Accordingly we used conservative assumptions to estimate effects on prey available to SRKWs in inland waters. For example we used the maximum estimated energy for metabolic needs of Southern Residents in calculating the number of fish needed per day. We also used conservative scenarios for all salmon diets composed mainly of Chinook salmon. In addition, the estimated inland abundances of Chinook salmon did not include all stocks, or all other sources of abundance, i.e., natural mortality.

Additionally, we do not have data with sufficient detail regarding whale and salmon movements to support a quantitative analysis of potential localized depletions over shorter time frames or in smaller areas than the extent of the Southern Residents' range in inland waters and seasons of occurrence as a long-term consequence of the proposed action. It is likely that the action could reduce prey available to the whales in specific places at specific times by a larger percent than is currently estimated by our analysis of a broader area and time frame. Regardless, the potential for localized prey depletions is great given the extent of salmon populations jeopardized by the proposed action and the large reduction in prey attributed to the action.

Effects on Southern Resident Killer Whale Critical Habitat

This assessment determines whether the proposed action will destroy or adversely modify designated critical habitat (50 CFR 402.02). The NFIP is likely to adversely affect critical habitat designated for SRKWs. Based on the natural history of the Southern Residents and their habitat needs, NMFS identified the following physical or biological features essential to conservation of the species: (1) Water quality to support growth and development; (2) Prey species of sufficient quantity, quality and availability to support individual growth; and (3) Passage conditions to allow for migration, resting, and foraging.

As described in the above section, effects of the NFIP on salmonids critical habitat and salmonids will be a long-term decrease in habitat suitability, decreasing spawning success, increasing levels of mortality, and corollary decreases in abundance, productivity, spatial structure, and genetic diversity. Therefore, the long-term effects of the NFIP would permanently reduce prey quantity to support individual and population growth of the Southern Residents (discussed in more detail below, in"Effects on the SRKWs") in all areas designated as critical habitat. Sufficient quantity, quality and availability of prey are an essential feature of the critical habitat designated for SRKWs. As previously described, the NFIP is expected to reduce abundance, reproduction and distribution of several species of listed salmon, potentially permanently removing the PS Chinook salmon ESU, in addition to the Hood Canal summer-run chum salmon ESU and the PS Steelhead DPS from the prey base available to Southern Residents. Reducing the quantity and availability of prey for Southern Residents reduces the conservation value of critical habitat.

As with our analysis of effects to the species, below, NMFS anticipates that the adverse modifications of PCEs of critical habitat for the listed salmonids would also negatively affect productivity and abundance of non-listed salmonids returning to watersheds across the State of Washington, further reducing the prey base available to Southern Residents. The long-term extirpation of all populations of the PS Chinook salmon ESU, Hood Canal summer-run chum salmon ESU, and PS Steelhead DPS in addition to anticipated long-term population-level effects on non-listed salmonids would decrease the geographic continuity of salmon-bearing watersheds in inland waters, which would alter the movement of migrating salmon and increase the likelihood for localized depletions in prey.

Cumulative Effects

Cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur (50 CFR 402.02). The present consultation was conducted at a large scale, Puget Sound, Hood Canal, and the Straits of Juan de Fuca. For such large scale consultation, actions considered within the cumulative effects definition is somewhat coarse grained. For this consultation, NMFS identified two general groups of actions to conduct the cumulative effects analysis. These groups include land-use change, and the environmental results of climate change as related to predicted patterns of future floodplain management. Cumulative effects to salmon translate to cumulative effects on prey availability for SRKWs.

Continuing Land-use Change in the Floodplain

The NMFS views the cumulative effects of land-use change through trends in population growth in an action area. Between 2000 and 2006, Puget Sound counties added 315,965 people, a rate of more than 50,000 people per year. The population is projected to grow another 1.9 million people by the year 2030, resulting in a population of 8,509,161. The Puget Sound basin includes five of the top ten fastest-growing counties in the State, with growth rates varying from 60 percent (in Skagit County) to 21 percent (in Clallam County). Thus, NMFS assumes that future private and state actions will continue within the floodplains, rivers and estuaries across the State of Washington, increasing as population density rises along similar trends. As the human population in the action area continues to grow, the burden on land presently used for agricultural, commercial, or residential development is also likely to grow. As land-uses shift from natural, to rural, to suburban, the watershed functions related to processing precipitation decrease. The ability of land to accept and slowly transport water to streams and aquifers decreases in the upper watershed as does the flood storage capacity in the lowlands.

The watershed functional changes mentioned above result in several of the habitat affecting processes mentioned earlier in this Opinion. The result of these process changes include induced flood damage, increased flood stages, increased volume of instream flows, increased velocity of instream flows, and erosion and sedimentation (see, *Effects on Critical Habitat,* above).

As the human population in the action area continues to grow, new development is likely to further reduce the habitat function in watersheds through water withdrawals, storm water quality and quantity degradation, loss of riparian functions, and encroachment in channels and 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).

Climate Change

One of the likely cumulative effects on salmon and their associated aquatic habitat throughout the Puget Sound is ongoing and future climate change. Climate change has the potential to profoundly alter aquatic habitat (Bisson et al. in press). These effects would be expected to be evident as alterations of water yield, peak flows, and stream temperature. Other effects, such as increased vulnerability to catastrophic wildfires, may occur as climate change alters the structure and distribution of forest and aquatic systems. Given the increasing certainty that climate change is occurring and is accelerating (IPCC 2007; Battin et al. 2007), we can no longer assume that climate conditions in the future will resemble those in the past.

In Washington state, most models project warmer air temperatures, increases in winter precipitation, and decreases in summer precipitation. Average temperatures in Washington State are likely to increase between 1.7°and 2.9°C (3.1°and 5.3° F) by 2040 (Casola et al. 2005). Warmer air temperatures will lead to more precipitation falling as rain rather than snow. As the snow pack diminishes, seasonal hydrology will shift to more frequent and severe early large storms, changing stream flow timing and increasing peak river flows, which may limit salmon survival (NMFS 2008c).

In a study to project impacts of climate change on salmon habitat restoration in the Snohomish Basin, model results indicate a large negative impact of climate change on freshwater salmon habitat. The largest driver of climate-induced decline in salmon populations is projected to be the impact of increased winter peak flows which scour the streambed and destroy salmon eggs (Battin et al. 2007). Higher water temperatures and lower spawning flows, together with increased magnitude of winter peak flows are all likely to increase salmon mortality in the Snohomish Basin and in hydrologically similar watersheds throughout the region. This is expected to make recovery targets for these salmon populations more difficult to achieve. Recommendations to mitigate the adverse impacts of climate change on salmon include restoring connections to historical floodplains and freshwater and estuarine habitats to provide fish refugia and areas to store excess floodwaters, protecting and restoring riparian vegetation to ameliorate stream temperature increases, and purchasing or applying easements to lands that provide important cold water or refuge habitat (ISAB 2007, Battin et al. 2007).

The apparent dependence of stream-type Chinook salmon on snowmelt-dominated flow regimes, makes it hard to predict whether efforts to conserve and expand the stream-type life history in PS Chinook salmon will be hindered by climate change and the potential loss of snowmelt-dominated habitats. Climate and hydrology models project significant reductions in both total snow pack and low-elevation snow pack in the Pacific Northwest over the next 50 years (Mote et al., 2003) – changes that will shrink the extent of the snowmelt-dominated habitat available to salmon. Such changes may restrict our ability to conserve diverse salmon life histories, as the stream-type life history appears to be dependent on a diminishing habitat (Beechie, et al 2006).

Higher ambient air temperatures will likely cause water temperatures to rise (ISAB 2007). Salmon and steelhead require cold water for spawning and incubation. Suitable spawning habitat is often found in accessible higher elevation tributaries and headwaters of rivers. In addition, as climate change progresses and stream temperatures warm, thermal refugia will be essential to persistence of many salmonid populations. Thermal refugia are important for providing salmon and steelhead with patches of suitable habitat while allowing them to undertake migrations through or to make foraging forays into areas with greater than optimal temperatures. To avoid waters above summer maximum temperatures, juvenile rearing may be increasingly found only in the confluence of colder tributaries or other areas of cold water refugia.

There is still a great deal of uncertainty associated with likely changes in timing, location and magnitude of future climate change. It is also likely that the intensity of effects will vary by region (ISAB 2007). However, several studies have revealed that climate change has the potential to affect ecosystems in nearly all tributaries throughout the state (ISAB 2007, Battin et al. 2007; Rieman et al. 2007)

The cumulative effects from land-use change and climate change on salmon further hinder salmon survival and recovery. As well, these effects further hinder prey availability for SRKWs, and demonstrate additional sources of uncertainty that reinforce the effects analysis for Southern Residents.

Integration and Synthesis of Effects on Salmonids

Summary of the Effects of the Action

Spring Chinook salmon and stream-type Chinook salmon, as well as steelhead, all spend a minimum of a year in the freshwater system before migrating to the estuaries where they will adapt to their adult phase in the ocean. As species with a long juvenile phase in freshwater, each of these species is adapted to flooding as part of the natural hydrograph, relying for survival on their ability to shelter from high volumes and high velocities at the fringes of the floods, where the water is slower moving and more shallow. Studies have indicated much higher rates of juvenile survival during floods when there is floodplain access, as well as greater growth rates among the juveniles that have access to the floodplain, making them less vulnerable to predation and more fit for outmigration and smoltification in the post-flood environment. However, almost all populations among these species are already limited in their productive ability by degraded floodplain conditions and/or eliminated floodplain connectivity. Chum salmon, which do not linger in freshwater riverine systems, are still significantly impacted by loss of floodplain connectivity, because their spawning areas are preferentially located in nearby off-channel habitat and floodway areas near the ordinary high water mark, and they are dependent upon estuarine floodplain areas for rearing.

The regulatory function of the NFIP recognizes placement of fill in floodplains for two purposes – 1) to place habitable structures at or above the elevation of the 100 year flood to reduce risk of loss of life and property, and 2) to remove areas from the floodplain altogether. Where the NFIP is in effect, barring local regulations that preserve floodplain function, the eventual effect of operation of the regulation to place fill, is to allow more development to be "safely" placed in the floodplain. By its very purpose, the NFIP reduces available floodplain storage of water, in particular the slower velocity, more shallow volumes of water of the "flood fringe, which juvenile salmonids rely on for their survival. The NFIP allows floodplains to be filled with development up to the point that the 100-year or base flood is constrained to the point of increasing the elevation of that flood by one foot. By its stated terms, the NFIP functions to restrict development only when the volume of concentrated water to be conveyed is so constrained by floodplain development that the floodway is no longer sufficient for "safe" conveyance of floodwaters. Thus, with each successive flood event, fish within the flooding system will have less floodplain refugia, and more volume and velocity of water within the main floodway, decreasing their chances for survival, and among those that do survive, their fitness for future developmental stages.

When the anticipated effects of NFIP implementation, including indirect effects, are added to the baseline condition, the trends for habitat will be accelerated degradation, negatively impacting conservation values of habitat in most watersheds, and negatively impacting trends in all VSP parameters for most salmonid populations.

Effects of the Action in Context of Baseline and Cumulative Effects

This section discusses the effects of the action in the context of the status of the species, the status of critical habitat, the effects in the environmental baseline, the indirect effects, and cumulative effects. Because the effects of the action do not occur in isolation, NMFS must evaluate the effects of the proposed action in the aggregate of current and anticipated conditions faced by the listed species, to assess the risk posed by the proposed action for the continued existence of PS Chinook salmon, Hood Canal chum salmon, PS steelhead, and Lake Ozette sockeye salmon, and to determine whether the proposed action is likely to diminish the conservation value or impair the conservation role of the designated critical habitat for PS Chinook salmon, Hood Canal chum salmon, and Lake Ozette sockeye salmon.

To assess risk to species, NMFS selected three to four sensitive salmon populations ("representative" populations that NMFS had previously identified as having an essential role in species recovery) to represent each ESU/DPS in this analysis. These populations each have differing levels of viability, and use habitat in NFIP communities experiencing varying levels of floodplain habitat change. This approach enabled NMFS to conduct a site-scale analysis forming a foundation for the larger watershed and species level analysis required to make a jeopardy determination.

Each of the representative salmon populations have low present abundance compared to historical levels. In fact, the number of extant populations has also declined in each of the ESUs and DPSs considered in this consultation. The PS Chinook salmon ESU is facing moderately high risks in all VSP categories. Similarly, the BRT noted high risk in all four VSP categories for the Hood Canal chum salmon ESU due to a widespread loss of estuary and lower floodplain habitat. The PS steelhead DPS is at high risk for productivity and abundance, and moderate risk for spatial structure and diversity. The effects of large scale habitat change including stream and river channelization, freshwater and estuarine floodplain disconnection, and riparian vegetation loss are indentified as primary limiting factors for each ESU/DPS. Thus, anthropogenic conditions are the largest factor in the status of each species listed as threatened. Moreover, each ESU and DPS is at increasing risk trending toward extinction, given the levels of risk and trends among the four viability parameters of abundance, diversity, spatial distribution, and productivity.

The importance of floodplain habitat to each of the species considered in this consultation is evidenced in the high utilization of those habitats where they exist in functional condition. Studies have shown much higher growth and survival rates for juveniles of each species that have access to floodplains. The Spring-run and stream-type life histories of Chinook salmon and steelhead are particularly dependent on floodplains because they spend a year in the freshwater environment before migrating to the ocean, and need to be able to rear, feed, and grow larger in refuge habitat during periods of higher instream flow. Chum salmon migrate to saltwater areas soon after emergence from the gravel and are therefore less vulnerable to periods of high instream flow, but are nonetheless dependent on freshwater floodplains for spawning sites, and on estuarine floodplains for rearing areas. The environmental baseline for this consultation reflects conditions highly influenced by land use. The results of fill have degraded and eliminated these habitats with less than ten percent of Puget Sound basin wetlands and floodplains still intact (Collins and Montgomery 2002). In addition, habitat changes include decreased channel complexity and limited habitat forming processes, particularly in river systems that are constrained by levees. These habitat factors are a large contributor to the decline of genetic diversity, abundance, and spatial structure in the ESUs and DPSs. These same habitat factors currently are considered limiting to productivity, meaning that the baseline conditions prevent multiple populations from recovering to adequate abundance levels. Abundance is essential to re-establishing spatial structure, as large populations lead to fish straying and use of new spawning sites. In turn, broader spatial structure is essential to genetic, phenotypic, and life-history diversity, as natal stream fidelity over successive generations of spawning increases the potential for adaptation to unique habitat conditions.

The proposed action includes effects arising from mapping, minimum criteria, and CRS, as well as indirect effects arising from placement of fill in floodplains for development and management of levees. In the long-term, the combined effects of the action would permanently reduce the quantity of freshwater and estuarine floodplain habitat and channel habitat, as the actions identified above lead to floodplain fill and levee construction and maintenance. The quality of floodplain and channel habitat would also be reduced as floodwaters would increasingly be spread out in developed areas of the floodplain where fish would be exposed to infrastructure, contaminants, and decreased riparian habitat, or confined between levees (that are frequently armored and managed to limit bank vegetation)in places that were once floodplain habitat. Freshwater spawning, rearing and migration PCEs, as well estuarine PCEs for juvenile survival, growth and development would be degraded, compromising the conservation value of designated critical habitat. Habitat reductions will limit salmon survival, reducing diversity in life-histories, resiliency in withstanding stochastic events, and redundancy to ensure there is a margin of safety for the salmon to withstand catastrophic events. These reductions decrease survival of listed salmonids. The NFIP effects will exacerbate habitat conditions that already have been identified as factors for the decline in species, and as limiting factors.

Human population growth rate and resulting land use are expected to remain high in the Puget Sound region (with up to a 60 percent growth rate in some counties) over the next 20 years. While there will be an increase in the number of actions taken under the recovery plan for PS Chinook salmon, NMFS assumes that other future State and private actions that diminish habitat function and availability will continue in Puget Sound floodplains as land is developed at rates similar to the population growth rate. In addition, climate change is expected to increase flood risk, as more precipitation will fall as rain instead of snow, causing increased frequency and volumes of flood events which will scour eggs in the gravel and diminish available habitat for salmon (Beechie et al 2006). As well, increased land development will exacerbate already increased flooding in river systems. Salmon habitat restoration projects will be implemented, but floodplain restoration projects will not occur fast enough to replace floodplain areas that will be filled if the NFIP program continues unchanged. The NMFS expects that the cumulative effects of new development for residential, commercial, and urban uses in floodplains will likely reduce the conservation value of the habitat in these developed areas. In addition, other pressures from human population growth that will compound the habitat problems arising from NFIP compliance, are increasing water pollution, increasing water consumption, increasing summer ambient temperatures, decreasing biotic integrity and increasing problems of invasive exotic species.

In summary, salmon populations in these ESUs are currently vulnerable to falling below sustainable levels, and available floodplain and natural channel critical habitat is either in poor condition and/or remaining habitat is significantly reduced from historical habitat quantities. The NMFS expects the on-going actions of the NFIP will continue to decrease high quality floodplain and channel habitat, further degrading conservation value of critical habitat and limiting the value of recovery actions. Juvenile to adult survival as well as productivity would be limited, which would likely delay or preclude recovery. Cumulative effects will compound NFIP effects by exacerbating flooding and development, and further degrading habitats essential to the survival and recovery of the species.

Integration and Synthesis of Effects on Southern Resident Killer Whales

This section discusses the effects of the action in the context of the status of the species, the status of critical habitat, the environmental baseline, and cumulative effects, and offers our opinion as to whether the effects of the proposed action will jeopardize the continued existence of the Southern Residents. The critical habitat analysis determines whether the proposed action is likely to destroy or adversely modify the designated critical habitat for listed species by examining any change in the conservation value of the essential features of the critical habitat.

A reduction in prey or a requirement for increased foraging efficiency may have physiological effects on the whales. In response to fewer or less dense prey patches, the whales will need to expend additional energy to locate and capture available prey (i.e., as a function of available prey reduced to one Chinook salmon needed for every two available). Increased energy expenditure or insufficient prey are likely to result in poor nutrition, which could lead to reproductive or immune effects or, if severe enough, death. Reductions in the whales' prey base is likely to lead to reduced growth and development, which in turn will delay the age at which animals reach reproductive maturity, reduce fecundity, and reduce individual whales' annual or lifetime reproductive success. A reduction in prey is also likely to work in concert with other threats to produce an effect. For example, insufficient prey will lead to mobilization of lipids increasing levels of harmful contaminants affecting reproduction or immune function.

Killer whales are currently experiencing an increasing population trend; however, the Southern Resident population is small, less resilient to stochastic events, and has a risk of extinction inevitable for small populations. In the long term, effects of the action would permanently reduce prey availability and increase the likelihood for local depletions of prey in inland waters where Southern Residents reside during summer and early-fall. Additional threats other than prey (i.e, sound and vessel disturbance) may work in concert to affect the whales' foraging by masking echolocation signals and decrease the effective range for detecting prey. Our analysis indicates that the proposed action will result in a permanent prey reduction, greater likelihood of local depletions in prey densities, and an increase in foraging effort across inland waters when Southern Residents are present.

Critical habitat was designated for SRKWs in November, 2006, with essential physical and biological features identified as water quality; sufficient quantity, quality, and availability of prey species; and passage conditions. Threats to the quantity, quality, and availability of prey species cumulatively include the reduction in salmon populations resulting from habitat degradation and loss, fishing pressure, hydropower system management, and harmful hatchery practices. The permanent loss of prey resources that return to watersheds within the critical habitat of Southern Residents compromises the conservation value of designated critical habitat and is not consistent with the recovery goals of SRKWs.

Loss of PS Chinook salmon populations and adverse modification of the critical habitat they rely on will impact the ability of the habitat to support not only the current population of Southern Residents, but also a greater number of whales consistent with the recovery goals. Fewer populations contributing to the whales' prey base reduces the representation of diversity in life-histories, resiliency in withstanding stochastic events, and redundancy to ensure there is a margin of safety for the salmon and whales to withstand catastrophic events. These reductions increase the extinction risk of salmon and Southern Residents.

Conclusion

After reviewing the status of the affected listed species and their designated critical habitats, the effects of the environmental baseline condition of the action area, the effects of the proposed action, including effects of interrelated and interdependent activities, and cumulative effects, NMFS concludes that the action, as proposed, is likely to jeopardize the continued existence of the following salmon ESUs: PS Chinook salmon, Hood Canal summer-chum salmon, and PS steelhead. Implementation of the three NFIP components in the Puget Sound region is not likely to jeopardize Lake Ozette sockeye salmon. The NMFS also concludes that implementation of the NFIP is likely to destroy or adversely modify designated critical habitats of PS Chinook salmon, and Hood Canal summer-chum salmon. The NFIP is not likely to destroy or adversely modify designated critical habitat of Lake Ozette sockeye salmon.

After reviewing the current status of the endangered population of SRKWs, their critical habitat and the environmental baseline for the action area, the effects of the NFIP, and the cumulative effects, it is NMFS' Opinion that the NFIP is likely to jeopardize the continued existence of SRKWs and likely to adversely modify their critical habitat. This conclusion is based on the following factors:

- The proposed action will permanently reduce the amount of fish available to the whales in the action area, which includes designated critical habitat. According to our estimates, the long-term effects of the NFIP reduction of Chinook salmon alone (132,724) will be a 30 percent reduction in the total number of Chinook salmon available to the whales in inland waters and their designated critical habitat.

- Based on the best available information that Chinook salmon are the killer whales' preferred prey species in inland waters and their designated critical habitat, our most conservative estimate is that after reductions in prey due to implementation of the NFIP, Southern Resident killer whales would need to consume one Chinook salmon per every 2.2 Chinook salmon available. This low level of prey availability would increase the likelihood of an unreasonably high level of foraging efficiency required to obtain prey.

The NMFS acknowledges that we may overestimate the effects of the action on killer whale prey availability because:

  - The NMFS' estimate of the number of Chinook salmon required each year to sustain the SRKW population may be an overestimate because NMFS considered the maximum bioenergetic needs for all individuals of the population.

  - Our estimate of the total number of Chinook salmon available in inland waters during the time the killer whales are present is likely an underestimate because our estimate does not include immature Chinook salmon, and did not account for natural mortality and predation.

However, the following factors increase the likely severity of effects from the proposed action:

- Reduced productivity and abundance and eventual extinction of PS Chinook salmon populations contributing to the whales' prey base reduces the representation of diversity in life-histories, resiliency in withstanding stochastic events, and redundancy to ensure there is a margin of safety for the salmon and whales to withstand catastrophic events. These reductions increase the extinction risk of salmon and Southern Residents.

- Long-term extirpation of all populations of the PS Chinook salmon ESU, Hood Canal summer-run chum salmon ESU, and PS Steelhead DPS in addition to anticipated long-term population-level effects on non-listed salmonids would decrease the geographic continuity of salmon-bearing watersheds in inland waters, which would alter the movement of migrating salmon in space and time and increase the likelihood for localized depletions in prey.

- Adverse modification of PCEs of critical habitat for listed entities of salmon degrades the same habitat for non-listed salmonids. This habitat degradation is likely to reduce the long-term productivity and abundance of non-listed salmonids returning to watersheds across the State of Washington, further reducing prey available to Southern Residents.

The NMFS concludes that the proposed action is likely to appreciably diminish the likelihood of the Southern Resident's survival and recovery by affecting their numbers, reproduction, or distribution, and significantly changes the conservation value of essential features of its critical habitat. It is, therefore, NMFS' determination that implementation of the NFIP is likely to jeopardize the continued existence of the species and adversely modify critical habitat.

Reasonable and Prudent Alternative

During formal consultation, NMFS determined that the proposed action would jeopardize the continued existence of PS Chinook salmon, PS steelhead, Hood Canal chum salmon, and SRKWs. The proposed action would also destroy or adversely modify critical habitat for PS Chinook salmon, Hood Canal chum salmon, and SRKWs. Therefore, NMFS must discuss with FEMA, the availability of Reasonable and Prudent Alternatives (RPA) that FEMA can take to avoid violation of FEMA's ESA section 7(a)(2) responsibilities (50 CFR 402.14(g)(5)). Reasonable and prudent alternatives refer to alternative actions identified during formal consultation that 1) can be implemented in a manner consistent with the intended purpose of the action, 2) can be implemented consistent with the scope of the Federal agency's legal authority and jurisdiction, 3) are economically and technologically feasible, and 4) that the Director believes would avoid the likelihood of jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of critical habitat (50 CFR 402.02) This section presents FEMA with an RPA which can be implemented to avoid jeopardy and adverse modification of critical habitat, while meeting each of the other requirements listed above.

The RPA outlined below consists of modifications to the discretionary elements of the NFIP that will prevent or minimize additional displacement of floodplain habitat important to the survival and recovery of listed species in the Puget Sound region. By minimizing future habitat losses and by utilizing its authorities to encourage the restoration of floodplain habitat through the removal of structures and other measures where feasible, FEMA can both avoid the likelihood of jeopardizing listed species through NFIP implementation and fulfill the NFIP's purpose of reducing the risk of flood losses by encouraging land-use practices that constrict floodplain development.

The NMFS' jeopardy and adverse modification determinations were based on the action's effects on habitat and habitat forming processes essential to supporting salmon and steelhead life histories in riverine and floodplain portions of the watersheds surrounding Puget Sound. Therefore, an RPA needs to address the ways in which the action affects those habitats. The RPA is designed to guide future development away from floodplains that are essential to the recovery of listed species. The FEMA, working with local and state governments, will encourage appropriate land use decisions that constrict development of land that is exposed to flood risk. Implementation of the RPA will simultaneously reduce adverse effects to listed salmonid species and reduce risk of economic loss from flood events. Where development that harms species or habitat takes place, appropriate mitigation is required to restore habitat functions.

Reasonable and Prudent Alternative Element 1 -- Notification of Consultation Outcome.

The FEMA shall notify all NFIP participating communities in Puget Sound that development consistent with the NFIP jeopardizes listed Chinook salmon, chum salmon, steelhead, and killer whales based on potential take of listed fish, and the destruction or adverse modification of critical habitat. The notification will include information identifying communities that influence Tier 1 and Tier 2 fish populations (See Appendix 3).[20] The notification will also suggest measures for avoiding and minimizing take including but not limited to, 1) recommending that communities voluntarily implement a temporary moratorium on floodplain development that adversely impacts species or their habitat, and 2) explaining that when jurisdictions adopt the criteria in RPA Element 3, they will have ESA coverage under the take exemption of this Opinion. This element is to be implemented within 30 days of the issuance of this Opinion.

This element informs all NFIP participating jurisdiction that rely on the NFIP minimum standards for their floodplain management ordinances that their current implementation will harm listed salmonids and adversely affect critical habitat. This information affords such jurisdictions the opportunity to take immediate steps to revise floodplain management practices and ordinances pro-actively to reduce or avoid such effects, and in many circumstances this action can be taken more quickly than FEMA's implementation of some RPA elements. Earlier implementation would be beneficial to all listed species' survival and recovery potential. Such notification is within FEMA's jurisdiction, and requires only a moderate expenditure of resources.

[20] Appendix 3 is a prioritized listing of fish populations intended to assist FEMA in focusing its RPA implementation efforts on areas most important to the survival and recovery of the listed species subject to this consultation. NMFS may revise this list as new information becomes available and will advise FEMA as to any revisions relevant to implementation of this RPA

Reasonable and Prudent Alternative Element 2--Mapping.

The FEMA shall make the following changes to the mapping program of the proposed action to achieve the habitat-based objectives stated above, to avoid jeopardy of the species and adverse modification of the critical habitat. The FEMA shall implement the following changes to the mapping program within six months of the issuance of this Opinion, and report progress to NMFS on an annual basis on all sub-elements below.

A. The FEMA shall process Letters of Map Change caused by manmade alterations only when the proponent has factored in the effects of the alterations on channel and floodplain habitat function for listed salmon, and has demonstrated that the alteration avoids habitat functional changes, or that the proponent has mitigated for the habitat functional changes resulting from the alteration with appropriate habitat measures that benefit the affected salmonid populations. The FEMA will ensure that effects from habitat alterations that are reasonably certain to occur but might occur later in time, such as changes in storm water quantity, quality, and treatment, decreased riparian vegetation, lost large woody debris, increased bank armoring, and impaired channel migration, are also mitigated. The FEMA will report to NMFS on the results of mitigation for manmade floodplain changes that become the basis for map revision requests. During the time period subsequent to the issuance of this Opinion and prior to full implementation of this element, FEMA will engage in ESA consultation with NMFS prior to processing LOMCs related to manmade floodplain alterations.

B. The FEMA will prioritize their mapping activities based upon the presence of sensitive salmon populations as identified in Appendix 3.

C. The FEMA shall ensure that floodplain modeling incorporates on-the-ground data to increase the accuracy of maps depicting the floodplain. For multi-thread channels, FEMA shall produce and distribute a Technical Bulletin recommending the use of unsteady state hydraulic models to map the boundaries of the 100-year floodplain. In addition, FEMA will use a 2-dimensional model in estuarine floodplains and in other areas, when applicable.

The FEMA will also revise map modeling methods to consider future conditions and the cumulative effects from future land-use change, to the degree that such information is available (e.g. zoning, urban growth plans, USGS Climate study information. Future conditions considered should include changes in the watershed, its floodplain, and its hydrology; climate change, and other conditions that affect future flood risk. The FEMA shall ensure that jurisdictions use anticipated future land use changes when conducting hydrologic and hydraulic calculations to determine flood elevations.

D. The FEMA shall encourage communities to evaluate and identify the risk of flooding behind 100 year levees based on anticipated future conditions and the cumulative effects from future land-use change. Future conditions considered should include changes in the watershed, its floodplain, its hydrology, and climate change.

Taken together, these changes to the proposed mapping element of the NFIP contribute to avoiding jeopardy and adverse modification of critical habitat by increasing the accuracy of maps depicting floodplains, which are a habitat resource for salmonids. The changes also protect habitat function through the tracking of LOMRs, and requiring mitigation for LOMCs (FEMA would only issue LOMCs for man made changes when the for floodplain functional change is provided). The FEMA prioritization of mapping activities to focus on areas necessary to support VSPs means that the protection of floodplain resources for priority populations will occur earlier than in other locations. The RPA mapping element requires the use of more accurate computer models from those typically used under the proposed action, where appropriate to map the 100-year floodplain for multiple thread channels and estuarine floodplains, providing more comprehensive and accurate mapping of these resources in complex areas.

Tracking floodplain development and analyzing effects enables better application of habitat protection and mitigation measures. Assessment and analysis in the mapping process is likely to moderate land-use changes in floodplains providing functional salmon and steelhead habitat by either avoiding or mitigating for land use changes that affect salmon habitat. The FEMA can work with affected communities to adjust previous approaches to construction in these areas in response to their analysis of effects on the existing salmonid habitat value.

Refining the modeling used to identify complex channels enables FEMA to better protect salmon and their habitat in modeled areas by more accurately identifying floodplains. Prioritizing map updates in NFIP participating communities identified by NMFS as areas particularly important to conserving PS Chinook salmon, steelhead, and chum salmon, gives those communities the most accurate information possible with which to evaluate and respond to the effects of land use change and construction on listed species. Detailed maps also help protect salmon and steelhead habitat by enabling more refined application of minimum floodplain management criteria.

The mapping RPA element meets each of the other RPA criteria (economic feasibility, intended purpose of the action, and within the agency's authority) in that the RPA element merely refines activities within the existing program to account more specifically for the effects of the mapping element on listed salmon and steelhead. The FEMA has four areas of discretion in their mapping program. These include the level of study performed in the FIS, including the designation of a regulatory floodway, review and issuance of CLOMRs, CLOMR-Fs and LOMAs, requirements associated with LOMRs and LOMR-Fs, and Map Modernization/Risk MAP. The RPA does nothing to exceed or abridge that authority. Therefore, actions described in the mapping RPA element are within the scope of FEMA's legal authority for mapping actions and meet the intended purpose of the proposed action.

<u>Reasonable and Prudent Alternative Element 3 – Floodplain Management Criteria .</u>

The FEMA shall modify its implementation of the NFIP minimum criteria in NFIP communities in the Puget Sound Region in order to prevent and/or minimize the degradation of channel and floodplain habitat, as described below. In addition FEMA will report progress to NMFS on an annual basis on all sub-elements below.

A. As soon as possible upon issuance of this Opinion, FEMA shall revise its implementation of the current NFIP minimum criteria so that the following measures, necessary for protecting listed salmonids, are carried out in the Puget Sound Region as described in Appendix 4 (Minimum Criteria) and summarized below:

1. Allow no development in the floodway, the, CMZ plus 50 feet (as identified according to Ecology 2003), and the riparian buffer zone (RBZ, as described by the Department of Natural Resources 2007 stream typing system and WDFW's 1997 stream buffer guidelines), and floodway (as mapped by the FIRM).

Or

2. The local jurisdiction with permitting authority must demonstrate to FEMA that any proposed development in the FEMA designated floodway, the CMZ plus 50 feet (as identified according to Ecology 2003), and the riparian buffer zone (RBZ, as described by the Department of Natural Resources 2007 stream typing system and WDFW's 1997 stream buffer guidelines) does not adversely affect water quality, water quantity, flood volumes, flood velocities, spawning substrate, and/or floodplain refugia for listed salmonids .

3. In addition to either 1 or 2 above, either:

a. Prohibit development in the 100-year floodplain,

OR

b. If development within the 100year floodplain but outside the RBZ, is permitted, any loss of floodplain storage shall be avoided, rectified or compensated for. An example of compensation is the creation of an equivalent area and volume of floodwater storage and fish habitat through a balanced cut and fill program that provides fish refugia habitat and prevents fish stranding. Additionally, indirect adverse effects of development in the floodplain (effects to stormwater, riparian vegetation, bank stability, channel migration, hyporheic zones, wetlands, etc.) must also be mitigated such that equivalent or better salmon habitat protection is provided. (See Appendix 4 for more detail on how to comply with this criteria). Using option 3.A.3.b will require tracking the projects that occur and reporting to FEMA on a semi-annual basis (see 3.D. below).

For development within the 100 year floodplain permitted under 3.A.3.b, construction in the floodplain shall use Low Impact Development (LID) methods (generally requiring infiltration of all on-site stormwater), such as those described in the Low Impact Development Technical Guidance Manual for Puget Sound (Puget Sound Action Team and WSU/Pierce County Extension 2002) to minimize or avoid stormwater effects.

4. Any improvements or repairs to existing structures that result in a greater than 10 percent increase of the structure footprint must mitigate for any adverse effects to species or their habitat as described in 3.A.3.b.

B. The FEMA shall implement RPA Element 3.A by ensuring that all participating NFIP communities in the Puget Sound region implement land-use management measures consistent with the criteria as soon as practicable, but in no event later than three years from the date of this Opinion.

1. The FEMA shall focus its implementation efforts first on communities located in areas of "Tier 1" salmon populations, secondly on communities located in areas of "Tier 2" salmon populations, and then on the remaining Puget Sound NFIP communities (see Appendix 3 for an explanation of Tier 1 and 2 populations and a list of jurisdictions where they are located). The FEMA shall demonstrate compliance with the following benchmarks:

a. Thirty-five percent of NFIP jurisdictions in the Puget Sound Region shall have implemented the criteria set forth in RPA Element 3.A within two years of this issuance of this opinion, including 100 percent of Tier I jurisdictions;

b. Seventy percent of NFIP jurisdictions in the Puget Sound Region shall have implemented the criteria set forth in RPA Element 3.A within two and a half years of the issuance of this opinion, including 100 percent of Tier 2 jurisdictions; and

c. One hundred percent of NFIP jurisdictions within the Puget Sound Region shall have implemented the criteria set forth in RPA Element 3.A within three years of the issuance of this Opinion.

2. Until all Puget Sound communities have implemented the criteria set forth in RPA Element 3.A, the FEMA shall report annually to NMFS on the status of its efforts to implement the RPA and the number of Puget Sound NFIP jurisdictions that have implemented the revised criteria.

C. Interim Actions. In the time period between the issuance of this Opinion, and the full implementation of RPA 3.A by participating communities, FEMA shall advise the Puget Sound NFIP communities that they must keep track of all floodplain permits that they issue and report this information to FEMA on an annual basis. The FEMA will provide this information to NMFS annually, highlighting any permits that allowed development affecting channel or floodplain habitat, or resulted in indirect effects to salmonid habitat from stormwater, removal of riparian vegetation, bank armoring, changes in the CMZ, large wood input, or gravel recruitment, etc. If NMFS finds that any unmitigated actions affecting listed species have occurred as a result of these permits, NMFS will advise FEMA to this effect, and FEMA will ensure that mitigation is provided prior to the next reporting period. Mitigation actions shall comport with those habitat restoration and enhancement actions consulted on in the programmatic consultation between NMFS and the COE, entitled *Washington State Fish Passage and Habitat Enhancement Restoration Programmatic*, NMFS Tracking No. 2008-03598.

D. Long term actions. Communities that have adopted the minimum criteria option allowing equivalent cut and fill (3.A.3.b. above), must report to FEMA on the number of projects that take place in the floodplain and the effectiveness of the mitigation. If based on FEMA's annual reporting, NMFS finds that the mitigation is not fully effective, FEMA shall ensure that further mitigation is provided for these actions through RPA Element 6 or through other means available to the community (e.g., mitigation banks) and shall reflect these actions in the next annual report. Mitigation actions shall comport with those habitat restoration and enhancement actions consulted on in the programmatic consultation between NMFS and the COE, entitled *Washington State Fish Passage and Habitat Enhancement Restoration Programmatic*, NMFS Tracking No. 2008-03598.

Under RPA Element 3, Floodplain Management Criteria, the performance measures for developing in the floodway, CMZ and RBZ will ensure that development within a designated riparian buffer zone (RMZ, measured from the OHW of the stream channel depending on stream type), the CMZ plus 50 feet, the mapped floodway, and the 100-year floodplain, will not result in adverse habitat effects. This will also allow activities with primarily beneficial effects to still occur within those zones. The NFIP as currently implemented allows development in the floodplain, the CMZ, and the riparian buffer, as long as it is at or above the BFE. The NMFS expects that this part of the RPA will prevent further degradation of channel function and estuarine and freshwater floodplain function in areas that would otherwise be prone to new development, thus maintaining the current value of the habitat in the RBZ and 100-year floodplain for listed salmon.

If communities choose to address impacts with equivalent cut and fill measures, development will be allowed in the floodplain with accompanying mitigation (similar area and volume of habitat and flood storage are provided to protect listed salmon and habitat). In addition, no unmitigated effects from floodplain development are allowed arising from changes in stormwater discharge, riparian vegetation, channel migration, large wood input, gravel recruitment, the hyporheic zone, wetlands, and bank stability. The NMFS expects that this option will provide protection equivalent to the no development in the floodplain criteria in most cases, thereby maintaining the value of existing habitat in areas of new development. If NFIP and FEMA annual reporting reveals that equivalent protection is not provided, NMFS shall advise FEMA, and FEMA or the community are responsible for providing the remaining mitigation through either RPA Element 6, or other means available to the community.

For both minimum criteria options, the use of LID (Low Impact Development) methods to minimize increased volumes and decreased water quality of stormwater from development is required. As currently implemented, the NFIP does not specify any requirements for stormwater management in the floodplain, even though increased stormwater runoff from development contributes to increased streams flows that cause flood damage, and to decreased water quality during flood events. This requirement for stormwater control and treatment will minimize the effects on both water quality and quantity from new development, as LID methods will require infiltration and dispersion of stormwater runoff to duplicate the frequency, timing, duration and quality of pre-development (historic) stormwater discharges.

The RPA at element 3 also addresses re-development of existing buildings in the floodplain by addressing the effects of re-development of structures that exceed ten percent of the current footprint instead of the 50 percent of market value, which is currently allowed. The NMFS expects this will minimize the adverse effects of re-development associated with existing buildings in the floodplain, thereby further minimizing the effects on critical habitat and listed species. In addition, any re-development in the floodplain requires mitigation for all direct and indirect effects of re-development.

The FEMA must report to NMFS on their progress in meeting timelines and benchmarks for implementing the revised floodplain management criteria and ensuring communities adopt these criteria as soon as possible, and in no event later than the specified deadlines. These timeline and benchmarks are intended to ensure that protection is provided to channel and floodplain habitat and listed salmon species in a timely manner. In addition, FEMA will provide floodplain permit information to NMFS on an annual basis, until the new criteria are fully implemented, highlighting any permits that allowed development affecting channel or floodplain habitat, or resulted in indirect effects to salmonid habitat from stormwater, removal of riparian vegetation, bank armoring, etc. If NMFS finds that any unmitigated actions affecting listed species have occurred as a result of these permits, FEMA will ensure mitigation for these actions through RPA Element 6.

Also, communities will provide information to FEMA on a semi-annual basis, documenting the projects that took place in the floodplain using the mitigated equivalent cut and fill option. Communities will report on the expected effects to listed salmon habitat, the planned mitigation to compensate for the effects, and the success of the mitigation outcome. If the mitigation is found to not provide equivalent compensation for effects, the community or FEMA is responsible for providing additional mitigation to address the shortfall in habitat function. Providing this shortfall protection will ensure that development that occurs in the floodplain will provide habitat function similar to the no development in the floodplain criteria, thereby maintaining the value of existing habitat in areas of new development. This step is necessary as several scientific publications document the limited success of compensatory mitigation to date, particularly for wetlands (National Academy of Sciences 2001, Washington Department of Ecology 2001). Evaluating the results also provides an opportunity to adapt actions and/or implement alternatives to more effectively maintain habitat function in the 100-year floodplain (e.g., increasing mitigation ratios, more monitoring, etc.).

This RPA element meets each of the other RPA criteria (intended purpose of the action, within the agency's authority, and economic feasibility) in that the RPA element merely refines activities within the existing program to account more specifically for the effects of the minimum criteria on listed salmon and steelhead. This RPA element is consistent with the intended purposes of the NFIP as these measures would constrict the extent of new development in the floodplain, achieving a decrease of property exposed to flood damage. The minimum criteria actions would limit development of the floodplain or provide equivalent mitigation for development in the floodplain (preventing more structures from being at risk of flooding and preserving salmon habitat), maintaining or minimizing stormwater runoff inputs to rivers (maintaining flood severity or frequency of floods and water quality), and maintaining currently functioning riparian corridors, CMZs, and bank stability.

According to the BE and the governing law, FEMA has discretion in establishing the minimum floodplain management criteria. The NFIA states that the purposes of the minimum criteria are to: (1) constrict the development of land which is exposed to flood damage where appropriate, (2) guide the development of proposed construction away from locations which are threatened by flood hazards, (3) assist in reducing damage caused by floods, and (4) otherwise improve the long-range land management and use of flood-prone areas. 42 U.S.C. 4102(c). Also, the statute indicates that FEMA is to revise the criteria "from time to time."[21] *Id.* Therefore, actions identified in the minimum criteria element of the RPA are all within FEMA's legal authority.

Finally, many of the measures in this RPA element have already been suggested and/or supported by FEMA's own Model Floodplain Ordinance (FEMA 2002a). As such FEMA has demonstrated its finding that they are economically feasible. Furthermore, they are addressed in other scientific and technical literature on the subject (see for example, Association of State Floodplain Managers 2007, among others). Also, many of the RPA minimum criteria elements are already carried out by NFIP participating communities such as King and Pierce counties, under their own local authorities, further demonstrating their economic feasibility.

<u>Reasonable and Prudent Alternative Element 4 -- Community Rating System</u>.

The FEMA shall make the following changes to the CRS to achieve some or all of the habitat-based objectives stated above, within 9 months following the issuance of this Opinion by providing examples and models on specific elements of the CRS, and through newsletters, meetings, e-mails, etc. (e.g., the CRS class offered spring 2009). In addition FEMA will work with NMFS to ensure that the next version of the CRS manual (2011), will incorporate these new requirements.

A. Change CRS stormwater credits to create an incentive for the use of Low Impact Development (LID) methods (decreasing the need for added stormwater treatment) in the floodplain, per the Low Impact Development Technical Guidance Manual for Puget Sound (PSAT 2005).

B. Change the CRS point awards to increase the number of points available for preservation of open space where listed species are present, giving additional credits for areas to be preserved that have been identified in NMFS adopted salmon recovery plans.

C. Change the CRS criteria to award points for retaining and increasing riparian functions, particularly in areas where riparian function has been identified as a limiting factor for listed ESUs by the limiting factors analysis in salmon recovery plans. (For example, on the White River and lower Skagit for PS Chinook salmon populations and on Salmon and Snow Creeks for Hood Canal summer chum salmon populations, riparian function has been identified as a most influential limiting factor, that is currently in poor condition) (see Appendix 1).

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[21] FEMA's regulations provide that, when FEMA revises the criteria, communities have six months within which to revise their floodplain management regulations to meet the new criteria. 44 CFR 60.7.

D. Change the CRS point awards to reduce the number of points available for structural changes that reduce the amount of functional floodplain, such as levees, berms, floodwalls, diversions, and storm sewer improvements, including enclosing open channels and constructing small reservoirs.

E. Award points for setting levees back (moving levees out of the CMZ and/or as far away from the channel as possible) and restoring riparian and floodplain function. Points shall also be awarded for dismantling pre-existing levees in part or whole, in order to restore floodplain function in the reconnected floodplain, when such action is part of a comprehensive flood damage reduction plan.

F. Increase CRS criteria and credit for encouraging pre-FIRM development to move out of the floodplain.

G. In conjunction with NMFS, FEMA shall encourage the use of levee vegetation management maintenance practices that benefit listed salmonids under Activity 620. The FEMA shall clarify and emphasize that when levee owners document NFIP levee maintenance as part of annual CRS recertification, professional engineers other than the COE can serve in this capacity. This may enable jurisdictions to retain larger woody vegetation on levees for the benefit of listed salmonids, and receive the maximum number of CRS credits under Activity 620.

H. Include a category of actions that benefit listed salmonids, and weight these credits so that communities seeking CRS class improvements will have incentive to choose actions that are beneficial to salmon in order to achieve such class improvement.

I. Add CRS criteria to credit communities that implement an active buyout program for purchasing and removing buildings from the floodplain, for acquisition of property, flood easements, and/or development rights to preserve open space areas of floodplain.

The CRS RPA element upgrades the CRS criteria, increases credits for actions beneficial to salmon, and decreases credits for actions that are detrimental to fish. Participation would be voluntary but encouraged through potential decreases in flood insurance rates and decreased extent of property exposed to potential flood damage. These changes combine to provide communities with incentive to minimize the effects of stormwater runoff generated by NFIP-covered development and construction in the floodplain. In addition, the CRS RPA element would encourage open space and riparian vegetation preservation, discontinue the maintenance of small levees, move levees farther away from the channel, receive maximum CRS credits for maintaining levee vegetation that benefits listed salmonids, and implement a property buyout program that would decrease the extent to which previously insured, flood damaged property is rebuilt. Simultaneously, the CRS would reduce the incentive to construct new levees and other flood control structures. As well, the CRS program would emphasize actions beneficial to listed salmon and steelhead, by including a category of actions beneficial to salmonids and weighting credits in that category to provide an incentive for communities to implement those activities. Taken together, all of these changes would enable certain floodplain functional processes to improve supporting each of the salmonid lifestages supported in those places. These habitat-based objectives would be accomplished through decreasing constraints on channel migration leading to increased channel complexity and the creation of off-channel refugia from high flows that are especially important to juvenile salmon. Increased riparian vegetation reduce water temperature, increase bank stability, cover, detritus and food availability, and recruit large wood (in some cases, at some point in the future). Improving these processes increases the ability of those places to better support salmonid life histories that occur there.

This RPA element is consistent with the intended purposes of the NFIP as these measures would constrict new development in the floodplain, achieving a decrease of property exposed to flood damage. The CRS-creditable actions could include minimizing stormwater runoff inputs to rivers (potentially decreasing flood severity or frequency of floods), move development out of the floodplain (reducing the number of structures at risk of flooding), and moving levees away from the channel (increasing low velocity flood storage areas, rather than confining and moving flood flows downstream at high volumes and velocities).

The CRS criteria and credit rating system are largely discretionary. Therefore, the CRS element of the RPA (requiring revisions to some of the credit points and credit criteria), are all within FEMA's authority. Also, an express purpose of the CRS program, as stated by Congress, is to "encourage the adoption of measures that protect natural and beneficial floodplain functions," which supports the conclusion that FEMA has discretion to adapt the program so as to protect listed species and their habitats.

Finally, many of the measures in this RPA element have already been suggested and/or supported by FEMA's own Model Floodplain Ordinance (FEMA 2002a). As such FEMA has demonstrated its finding that they are economically feasible. Many of RPA elements are already carried out by NFIP participating communities under their own local authorities, where they are classified as exceeding the NFIP minimum criteria, and often earn credits under the CRS program. As such, this RPA element is also consistent with the intended purpose of the proposed action and within FEMA's agency authority to implement.

<u>Reasonable and Prudent Alternative Element 5 -- Addressing the Effects of Levee Vegetation Maintenance and Certain Types of Construction in the Floodplain</u>. To address the effects of these two factors, FEMA shall make the following changes to the proposed action to achieve some or all of the habitat-based objectives described above. In addition, FEMA will report progress to NMFS on an annual basis on all sub-elements below. These elements shall be implemented within one year from the date of this Opinion.

A. The FEMA shall not recognize levees that are certified by the COE utilizing COE vegetation standards unless it is demonstrated that the standard will not adversely affect species or their habitat.

B. The FEMA shall revise their procedure memoranda to reflect that levee owners that opt for an increased levee vegetation standard that removes them from the PL 84-99 program shall not be disqualified from emergency funding for repairs from flood damage if the levee is otherwise certified by a professional engineer. These memoranda shall be revised and adopted within one year of issuance of this Opinion.

C. To address the contribution of increased runoff and modified flood hydrographs from development, FEMA shall use and encourage grantees to use Hazard Mitigation grant funding and the Flood Mitigation Assistance Program for projects that reduce flood risk and also benefits salmonids, such as floodplain acquisition, purchase of floodplain development rights, levee setbacks, and/or creation of flood easements, placing priority on lands identified for salmon recovery (by salmon recovery plans). For example, in Salmon and Snow Creeks, increases in peak flows are a limiting factor for Hood Canal chum salmon, that lead to scour of redds in both creeks Appendix 1). The number of projects completed each year shall be reported to NMFS for the first three years of implementing the RPA.

D. Recognize new levees and floodwalls only if they include all of the following features:

- the natural channel migration pattern remains intact (or if presently confined, is allowed to expand to its natural pattern),
- bioengineering methods are used to stabilize the banks,
- large wood is incorporated into the levee setback area,
- riparian vegetation is included in the design, and
- no increase occurs to upstream and downstream flood levels, volumes and velocities.

These RPA changes to the proposed action addressing vegetation management issues require FEMA to recognize only vegetation management standards that enable the riparian vegetation to function in support of salmon habitat forming processes. Some of the habitat processes that occur in riparian habitat are listed above, including temperature maintenance, bank stability, food and cover for rearing and migrating juvenile salmon. Under the RPA, levee owners that maintain riparian vegetation would remain eligible for funding for flood repairs, eliminating the existing incentive to denude levees of even minimally functional riparian vegetation. Furthermore, FEMA would encourage Washington state to prioritize funding for floodplain acquisition, purchase of development rights, levee setbacks, and creation of flood easements in areas identified in salmon recovery plans that have already been reviewed and approved by NMFS as supporting the conservation of affected populations of PS Chinook salmon and Hood Canal chum salmon. The combination of recognizing new levee vegetation standards and funding for flood repairs will encourage more levee owners to follow FEMA standards instead of COE standards, which will increase riparian function and the quality of salmon habitat. The NMFS also expects increased funding for floodplain–related projects will speed up the process of acquiring and/or protecting these important lands, and aid in salmon recovery. And, any new floodwalls and levees recognized by FEMA would not be allowed to confine channel dynamics, or alter flood flows and habitat elements that are necessary for salmon survival and recovery.

These changes to the NFIP are both within the intended purpose of the NFIP and within FEMA's authority under the NFIP. Under its existing regulations, FEMA has discretion to recognize "fish friendly" vegetation maintenance standards in 44 CFR 65.10. Furthermore, FEMA has policy authority ("Policy for Rehabilitation Assistance for Levees and Other Flood Control Works -No. 9524.3") regarding eligibility for emergency repair funding. The FEMA has authority to access Hazard Mitigation grant funding under the Stafford Act, even though it is a separate law from the NFIA, as the ESA states that action agencies shall use their authorities to further the purposes of the ESA. And FEMA has the direct authority to use Flood Assistance Account Program for floodplain related actions.

<u>Reasonable and Prudent Alternative Element 6 -- Floodplain Mitigation Activities</u>
For any development actions in floodplains proceeding consistent with current NFIP requirements, that occur during the period prior to full implementation of RPA elements 2, 3, and5, and that degrade channel or floodplain habitat in NFIP communities (including from the indirect effects of development in the floodplain), and for any development for which FEMA, in coordination with NMFS pursuant to RPA 3 finds that additional mitigation is necessary, FEMA shall ensure that appropriate mitigation occurs. For example, FEMA may assist in floodplain mitigation/restoration activities as identified in the PS Recovery Plan, via contribution of financial, technical, or physical (labor or equipment) support. The FEMA shall focus floodplain restoration activities and assistance first in Tier 1 areas, to provide the most significant habitat protections. Mitigation actions shall comport with those habitat restoration and enhancement actions consulted on in the programmatic consultation between NMFS and the COE, entitled *Washington State Fish Passage and Habitat Enhancement Restoration Programmatic*, NMFS Tracking No. 2008-03598.

This RPA element is intended to mitigate for effects from any NFIP actions that occur during implementation of RPA elements 2, 3, and 5 that degrade channel or floodplain habitat in NFIP communities, including from the indirect effects of development in the floodplain. This mitigation RPA element provides a mechanism for ensuring that if unmitigated development takes place in the floodplain during the interim period while the RPA is being implemented, that the loss of those floodplain and habitat functions will be mitigated by either FEMA or the community where the development occurred. In concert with RPA elements 7 (monitoring) and 1 (notification), this element is intended to address the possible increase in development in floodplains resulting from the implementation of stricter floodplain requirements, and provide equivalent mitigation for direct and indirect impacts to the channel and floodplain. This element, together with RPA 3.D. will also ensure that mitigation efforts function effectively over the long term. The FEMA has authority to access Hazard Mitigation Grant Funding under the Stafford Act, and the Flood Assistance Account Program for floodplain related actions. As such this RPA element meets the RPA criteria of being within the agency's authority, the intended purpose of the program, and the economic feasibility.

<u>RPA Element 7 -- Monitoring and Adaptive Management</u>
The FEMA shall report to NMFS on an annual basis regarding progress on meeting timelines and implementing RPA elements 1- 6 and all sub-elements as specified above. As a result of this review, NMFS will determine, in coordination with FEMA, if some alternate actions or additional changes in RPA elements are needed to avoid jeopardy and adverse modification of critical habitat. This will be particularly important in assessing on-the-ground NFIP effects that are occurring, such as continued development in the floodplain, through either issuance of LOMCs or floodplain development permits. If NMFS determines that adverse effects to channel and floodplain habitat were not avoided or not mitigated as intended as a result of NFIP actions, FEMA will ensure that mitigation for these floodplain and/or channel impacts is provided consistent with RPA element 6, described above.

This monitoring and adaptive management RPA element provides a mechanism to check on three components of FEMA's progress in avoiding jeopardy during the implementation of the RPA: 1) checking on FEMA's success in meeting the timelines for implementing each element of the RPA, 2) evaluating whether additional or alternate actions are needed to achieve the same outcomes as the original RPA elements, and 3) determining whether NFIP actions have avoided or mitigated effects to salmon habitat in floodplains in the interim period, while the longer term RPA actions are being fully implemented. This last component is in part intended to address the concern that more rapid development may take place in floodplains during this period when pending change in regulations would restrict floodplain development. The combination of RPA element 1 (notifying communities regarding their take liability) and RPA element 7 (keeping track of development actions during the interim period) is expected to decrease the rate and extent of development in the floodplain during this period following the issuance of this Opinion. If floodplain development is not being avoided or mitigated, restoration actions must be implemented (RPA element 6). This RPA element meets the intended purpose of the action as development in the floodplain would only occur if all effects to salmon habitat are mitigated, and if this is the case, development would be reasonably safe from flooding. This RPA element is within the Agency's authority and is economically feasible, as it is only checking on implementation of the program as it moves toward addressing more specifically the primary effects of the mapping and minimum criteria elements of the program on listed salmon and steelhead.

Findings on the Reasonable and Prudent Alternative. A reasonable and prudent alternative to the proposed action is one that avoids jeopardy by ensuring that the action's effects do not appreciably increase the risks to the species' potential for survival or to the species' potential for recovery. It also must avoid destruction or adverse modification of designated critical habitat. The alternative action must also be 1) consistent with the intended purpose of the action, 2) within the scope of the Federal agency's legal authority and jurisdiction, and 3) economically and technologically feasible. The discussion above includes an element-by-element explanation of how the RPA meets these standards. This section contains supplemental information showing that the combined RPA elements meet these requirements.

The RPA avoids jeopardy to listed salmonids and Southern Resident Killer Whales.
There will be a period of time during which FEMA will have to undertake revisions to its implementation of the NFIP in order to fully implement the RPA. Therefore, NMFS must ensure in its evaluation of the RPA, that any adverse effects that occur during the implementation period will also avoid jeopardy to listed species.

The RPA at element 2, changes to floodplain mapping, will occur within six months of the issuance of this Opinion. After that time, FEMA will not process LOMCs based on manmade floodplain alterations unless the proponent demonstrates that any adverse habitat effects are mitigated. Prior to full implementation, FEMA will continue to engage in ESA 7(a)(2) consultations with NMFS on LOMCs (as they have done during this consultation process), which will provide a mechanism for ensuring that any mitigation necessary to avoid jeopardizing listed species will be required during the implementation period. Other provisions of RPA element 2 are aimed at improving the long-term accuracy of FEMA's floodplain mapping program. The NMFS does not believe that measurable adverse effects will accrue during the six month implementation period for these mapping elements because: (1) the amount of development in floodplains that is likely to occur in the six months following the issuance of this Opinion is likely to be significantly lower than the human population growth rate, due to current conditions of economic downturn; and (3) this anticipated low level of degraded or lost floodplain function could diminish carrying capacity where it occurs, but only influences the short term risk of jeopardy in those landscapes that affect habitat of Tier 1 fish populations.

The RPA at element 3 includes an implementation schedule that ensures that the most sensitive (Tier 1) populations will obtain the benefit of the enhanced floodplain management criteria within one year of the issuance of this Opinion; Tier 2 populations will obtain those benefits within two years; and all populations within three years. While floodplain development adversely affecting these populations could occur during the implementation period, mitigation for such effects would be required under RPA elements 3, and 6, thereby ensuring that overall habitat function is retained. The Incidental Take Statement provided with this Opinion contains an estimate of the amount of land that may be adversely affecting by floodplain development during the implementation period, as follows:

- Whatcom County at the rate of 2.1 percent per year over 72.6 square miles of floodplain, equaling a loss of approximately 1.5 square miles of floodplain per year.
- Skagit County at the rate of 1.9 percent per year over 180.9 square miles of floodplain equaling a loss of approximately 3.4 square miles of floodplain per year
- Mason County at the rate of 1.6 percent per year over 56.9 square miles of floodplain equaling a loss of approximately .9 square miles per year
- Kitsap County at the rate of .7 percent per year over 7.6 square miles of floodplain equaling a loss of approximately 0.05 square miles
- Clallam County at the rate of .3 percent per year over 77 square miles of floodplain equaling a loss of approximately 0.2 square miles per year
- Jefferson County at the rate of .8 percent per year over 33.8 square miles of floodplain equaling a loss of approximately 0.2 square miles per year
- Island County at the rate of .9 percent per year over 8.9 square miles of floodplain equaling a loss of approximately 0.08 square miles per year
- San Juan County at the rate of 2.7 percent year over 9.6 square miles of floodplain equaling a loss of approximately 0.2 square miles per year
- Snohomish County at the rate of 2.2 percent year over 116 square miles of floodplain equaling a loss of approximately 2.5 square miles per year

In the above jurisdictions, NMFS estimates that the degradation or loss of a given percentage of 100- year floodplain habitat will expose a percentage of the fish from populations that rely on those habitats, to unfavorable conditions during 100 year flood events. Although the RPA requires that these impacts be mitigated, habitat losses that occur prior to the implementation of the mitigation may adversely affect fish populations, if 100-year or lesser flood events occur during that time-frame.

The NMFS assumes that because juvenile Chinook salmon prefer edge habitats, and salmonids with protracted life history in freshwater environments rely on floodplains for refugia from high volume and velocity floodwaters, that the percentage of a fish population exposed to degraded or diminished floodplain refugia could be very high. Of the percentage of fish from a given population exposed to floodplain habitat loss or degradation through floodplain development, a subset would be injured or killed, but this percentage is impossible to estimate given the distribution of fish within the inundated area will not be uniform and the reduction in floodplain function would not affect all individual fish equally. Applying the basic biological principle of carrying capacity, NMFS assumes that the percentage of floodplain degradation will result in a comparable percentage of harm among juveniles of the fish populations exposed to the modified habitat during the base flood. By this, NMFS means that the likelihood of injury or mortality is increased due to behavioral changes in the juvenile fish, resulting from changes in the floodplain habitat, at a 1-to-1 ratio of harm to habitat degradation.

The likelihood of a "base flood" that would inundate the 100 year floodplain is predicted by FEMA at one percent chance of occurrence per year (smaller flood events occur with greater frequency, which will also expose fish to effects of floodplain habitat loss or degradation, though less extensively because the duration of inundation shorter and amount of landscape inundated is smaller). Because the prioritization for implementing the RPA requires that communities affecting Tier 1 populations implement the revisions within one year, the chance that fish will be exposed to unmitigated floodplain development in any particular location influencing Tier 1 populations, is only one percent. Due to the small amount of floodplain habitat anticipated to be affected during the implementation period, the low likelihood of a significant flood event in any given location, and the required mitigation measures, NMFS does not believe that adverse habitat effects during the implementation period for RPA 3 will rise to a level that will appreciably reduce the survival or recovery of the listed species.

The RPA at element 4, changes to the CRS program, must be implemented within nine months of the issuance of this Opinion. The CRS changes are expected to provide benefits to listed species over the long term, by providing incentive for communities to undertake actions that enhance salmonid habitat. Because the CRS program is voluntary, NMFS does not rely heavily on RPA 4 in this 7(a)(2) analysis. The NMFS does not believe that appreciable adverse effects will accrue to listed species during the nine month implementation period, because most elements of the CRS have beneficial effects to salmonid habitat, and few elements have adverse effects. Few Puget Sound communities that participate in the CRS are currently implementing those CRS elements with adverse effects to salmonid habitat habitat (Dan Sokol, pers. comm. Sept. 17, 2008).

The RPA at element 5 contains a number of sub-elements that will be phased in over a 1-year period. Levee vegetation and new levee and floodwall standards consistent with RPA elements 5.A, 5.B, and 5.C are expected to result in enhanced edge shoreline habitat, increasing the value of habitat for juvenile rearing as the RPA is implemented. Although the status quo may be retained during the one-year implementation period, NMFS believes that any short-term adverse effects will be offset by long-term habitat improvements, as the revised levee and floodwall standards are implemented. Also element 5.C will ensure that Hazard Mitigation grant funding and the Flood Mitigation Assistance Program are used for projects that both reduce flood losses and enhance floodplain habitat, which NMFS expects will result in long-term benefits to listed species.

The RPA at elements 6 and 7 require mitigation for any otherwise-unmitigated adverse effects that occur during the implementation period, as well as a monitoring and adaptive management program to ensure that both interim and long-term mitigation actions function as intended. These elements provide further assurance that any manmade floodplain alterations that occur during the RPA implementation period would not be likely to appreciably reduce the survival or recovery prospects of the species subject to this consultation.

After full implementation of the RPA, the rate of floodplain development is expected to slow across all NFIP jurisdictions, and losses of floodplain habitat are expected to be mitigated by creation of additional floodplain storage areas designed to afford fish refugia during riverine and estuarine flooding. The NMFS expects that there will be a degree of temporary degradation to floodplain habitats during the period of time that the mitigation floodplain areas become successfully revegetated to provide the full range of habitat values (e.g., preybase). This may result in a small amount of injury or mortality among juvenile fish seeking floodplain refugia, over a period of roughly 5 years in each mitigation site, while plantings become established to create fully functional floodplain refugia for listed fish; the amount of mortality or injury attributable to the individual mitigation sites will be variable, and will depend in part upon the quality of the habitat that the mitigation site is replacing. Changes in instream conditions and channel characteristics arising from floodplain development (due to stormwater contaminants, increased velocity and volumes during floods, and decreased baseflows from interrupted hyporheic recharge) are expected to remain relatively static after the RPA is fully implemented.

The RPA elements requiring floodplain preservation through more stringent minimum floodplain management criteria, when combined with more accurate mapping of floodplains, together would maintain functional floodplain and channel habitat at close to current levels in undeveloped floodplains throughout Puget Sound. The RPA elements requring mitigation for effects to salmon habitat caused by development allowed in the floodplain and CMZ, may enhance survival among juvenile salmonids by creating more floodplain refugia in suitable habitat areas, even as floodplain development removes refugia in degraded locations. Together, by revising the floodplain mapping and floodplain development criteria, degradation and loss of floodplain function and connectivity as limiting factors will not be further aggravated. By preserving current levels of floodplain function and connectivity, the risk to survival of listed salmonids from FEMA's NFIP program implementation will not increase. Protecting these floodplain areas from additional development is particularly important given the expected increases in flood frequency and severity caused by new development and climate change as cumulative effects.

In existing developed areas of the floodplain, future adverse effects to floodplain and channel habitat would be minimized compared to current land use practices, however even current levels of floodplain function would not be maintained even with the more stringent minimum standards. The RPA at element 5 over the long term, will increase riparian function and enlarge areas of floodplain function, as existing levees are moved farther away from the channel, and levee vegetation management enhances riparian function. The RPA element 5 requirements to mitigate for stormwater runoff will result in retention of flood storage and conveyance areas, and will minimize the impact of watershed changes which normally increase the severity and frequency of floods, flood damage, and habitat damage in the action area. Mitigation for development in floodplains (RPA element 3) and mitigation in floodplain areas affecting Tier 1 Chinook salmon populations will create habitat over the baseline condition, and the alleviation of some degree of disconnected floodplain and or degraded floodplain condition. Because these actions will restore conditions that improve productivity and abundance among populations that are at high risk of extirpation themselves, and which provide significant contribution of viability elements to the overall ESUs, these mitigation actions effects will increase the likelihood of salmonid recovery. Improved likelihood of salmonids recovery creates a corollary increase in the likelihood of SRKW recovery due to the improvements to preybase availability throughout much of the SRKW habitat

Together, each of these sub-elements add up to changes in the proposed action so that the NFIP would avoid jeopardy (decrease risks to survival potential and recovery potential) of PS Chinook salmon, PS steelhead, Hood Canal chum salmon. By avoiding jeopardy to salmonids, the primary prey of and SRKWs, jeopardy to SRKW is also avoided.

The alternative avoids the destruction or adverse modification of critical habitat of salmonids and Southern Resident Killer Whales. The RPA also avoids the destruction of PS Chinook salmon, Hood Canal chum salmon critical habitat because several RPA elements both slow the rate of loss, and limit the amount of loss, of floodplain connectivity, a primary constituent element of critical habitat. Other RPA elements require enhancement of floodplain connectivity, and the improvement of that PCE will in turn improve the conservation value of critical habitat where those improvements occur. Other PCEs that will be maintained or improved through the RPA are water quality, water quantity conditions, riparian habitat conditions, and channel function through habitat forming processes that will be preserved and enhanced by both the more stringent minimum criteria and the mitigation requirements of the RPA. The RPA also avoids adverse modification of SRKW critical habitat by preserving and enhancing the salmonids preybase, prey being a primary constituent element of SRKW critical habitat.

The alternative is consistent with the intended purpose of the NFIP. The primary purposes of the NFIP is to reduce the risks of flooding to life and property by encouraging development away from property within the one percent per year flood hazard landscape, and to reduce government costs in the repair of post flood conditions by requiring insurance among those who live in the one percent per year flood hazard landscape. The RPA is consistent with both of these purposes by identifying more accurately where the likelihood of flooding exists, and then by making future development in such locations less likely to occur. In this way, those who should be insured will be identified and this will assist in shifting more recovery costs away from the government; less development in floodplains means less property and fewer lives will be exposed to flood risks. Furthermore, when FEMA requested consultation on the proposed NFIP, the agency identified the range of its discretion in administering the NFIP, in the consultation initiation package. When developing the RPA, NMFS considered information in the initiation package, in addition to FEMA's express statutory and regulatory authority for each aspect of the NFIP program that NMFS analyzed in making the jeopardy and adverse modification determinations.

The alternative is economically and technologically feasible. Many RPA elements will involve additional administrative responsibilities for FEMA, such as tracking floodplain development, evaluating mitigation activities, and reporting to and coordinating with NMFS. This may require moderate expenditures of additional resources. Almost all RPA elements regarding the minimum criteria were drawn from FEMA's own publication on higher regulatory requirements designed to safeguard aquatic habitat conditions for fish, which was drafted with the assistance of the Services as an ESA 7(a)(1) effort. Many RPA elements are currently practiced by local jurisdictions in Washington State. The FEMA and COE partnership for Map Modernization currently focuses on digitizing current maps, and verifying whether levees provide sufficient protection against the 100 year flood to be identified as the edge of the 100 year floodplain. To implement RPA elements on mapping, FEMA could redirect its map modernization fiscal and staff resources to more correctly identifying where the risk of the 1 percent chance flood will occur, rather than merely digitizing old and potentially inaccurate maps.

Based on these considerations and the foregoing description of the RPA, NMFS finds that the RPA meets each of the criteria stated at 50 CFR 402.02.

Incidental Take Statement for the Reasonable and Prudent Alternative

Listed fish species occur in the action area and are exposed to the effects of FEMA's NFIP implementation. The NFIP sets the criteria for identifying floodplains and mapping them. The NFIP also sets the minimum standards used by participating cities and counties to manage development in floodplains. Taken together, these program elements result in the modification of habitat and the habitat forming processes that fish rely on to express their normal behaviors and life histories. Some exposed individuals will respond to these habitat effects by changing normal behaviors; in some cases to their detriment. Some fish will be injured by changed habitat conditions, and some will die because of habitat changes affected by NFIP implementation. The habitat modification caused by the NFIP include adverse effects on water quality (contaminants causing olfactory inhibition, impairing prey-base, and increasing sub-lethal health effects) and adverse effects on water quantity conditions in streams and river channels (scouring out suitable spawning substrate, increasing fine sediment load, excess velocity and volume fatiguing and flushing out juvenile fish, insufficient summer flows), as well as declining function in, and declining amounts of, floodplain habitat (increasing mortality among juveniles that require but cannot find flood refugia). Take will continue to occur from these sources at a rate generally consistent with past rates of development-related adverse effects until the RPA is implemented. Such take of listed fish is not the purpose of the proposed action, but is incidental. The rate of incidental take will decline as the RPA is implemented.

The NMFS must estimate the extent of take expected to occur from implementation of the RPA so as to frame the limits of the take exemption provided in this Incidental Take Statement. These limits set thresholds which, if exceeded, would be bases for reinitiating consultation. Despite the use of best scientific and commercial data available, NMFS cannot quantify the specific number of adult or juvenile fish, or incubating eggs, or fry, that would be injured or killed by implementation of the NFIP RPA. Assessing the number of animals injured or killed by implementing the NFIP RPA is not possible because FEMA's implementation of the NFIP RPA will occur over an period of time, during which time the presence of listed fish is variable, the numbers of fish that will occur in any given cohort of fish are also highly variable, and the number of exposed animals and the susceptibility of those fish to injury or death is highly variable and unpredictable. In contrast, the extent of habitat likely to be affected by the NFIP RPA can be estimated. In cases where specific numbers of animals injured or killed cannot be estimated, NMFS quantifies the extent of take by identifying geographic and temporal limits for take.

The following sections of this document describe the extent of take that NMFS anticipates will occur as a result of the Proposed Action as modified by the RPA. If actual take exceeds an amount or (geographic and temporal) extent specified here, the exemption from the prohibition on take will be invalid for that excess amount, and re-initiation of consultation will be required.

<u>Method for Calculating the Extent of Take</u>

NMFS expects that take from habitat modification from floodplain development authorized by local governments consistent with the minimum criteria provided in the NFIP RPA will occur according to three factors: the human population growth-rate, the amount of developable mapped floodplain, the effectiveness of the required mitigation, and the timeframe in which FEMA implements the RPA.

Human Population Growth-rate. The NMFS' estimate of the rate of development is based on recent human population growth rates by county, as identified by the Washington State Office of Financial Management and Growth Management Plans by County. Because growth is expected to be at higher rates inside mapped urban growth boundaries of urban areas, and lower outside (in rural, non-planning areas), NMFS relies on the WOFM growth rates by county as its starting point, since counties include both urban (GMA planning areas) and rural (non-GMA planning areas). The NMFS assumes that a county's population growth-rate influences development similarly among developable floodplain and non-floodplain lands, as floodplain areas include both urban growth areas, and rural settings.

Floodplain Lands by County. Floodplain areas fall into three categories: 1) areas inside the current city limits, which are largely already developed, and therefore retain very little habitat function or value for listed fish, and as a baseline condition contribute to lost floodplain connectivity and function as a limiting factor; 2) areas designated as UGA (outside the city limits, inside the UGA, inside the county), where future development is expected to occur earlier and more densely than in the rural county lands, as intended by the GMA; 3) areas in the county (outside the city limits and outside the designated UGAs). Therefore, the basic equation for estimating a rate of floodplain loss by county due to human population growth would be

(Square miles of SFHAs by county), minus (current city
Limits) equals (SFHAs in UGA and in the County), times (the projected annual
population growth-rate).

The amount of mapped floodplain in the action area, exclusive of floodplains in incorporated towns and cities, in:

Whatcom County is 72.6 square miles
Skagit County is 180.9 square miles
Mason County is 56.91 square miles
Kitsap County is 7.6 square miles
Clallam County is 77.09 square miles
Jefferson County is 33.8 square miles
Island County is 8.93 square miles
San Juan County is 9.64 square miles
Snohomish County is 116.42 square miles
King County is 46.01 square miles
Thurston County 49.18 is square miles
Pierce County is 65.44 square miles

RPA Implementation Period. The RPA will be implemented over a period of time not to exceed 3 years, after which all NFIP jurisdictions in the Puget Sound area will have implemented the enhanced floodplain management criteria that will avoid or minimize degradation of floodplain habitat. During the implementation period, NMFS expects some habitat modification will result from floodplain development that takes place consistent with the current NFIP minimum standards and mapping protocols, at roughly the same rate and pattern as existed prior to this consultation. The rate of development and consequent habitat impact is expected to be influenced by two additional issues – economic conditions and regulatory pressure. Economic conditions are currently in a downturn, which would serve to depress growth from the WOFM projections, however anticipated regulatory "tightening" of development criteria may act as an inducement to growth, as landowners seek to vest their development options before new regulatory restrictions become effective. In these circumstances, the incentive to build before the RPA is implemented within a given jurisdiction may increase the rate of development. Because the result of these competing pressures cannot be predicted, NMFS relies on the best available information regarding growth rate levels from the preceding decade to estimate development and corollary take, as identified by WOFM, per county.

<u>Extent of Anticipated Take</u>

For the RPA implementation period, which shall not exceed 3 years, NMFS expects take in the form of harm to occur in:

- Whatcom County at the rate of 2.1 percent per year over 72.6 square miles of floodplain, equaling a loss of approximately 1.5 square miles of floodplain per year.

- Skagit County at the rate of 1.9 percent per year over 180.9 square miles of floodplain equaling a loss of approximately 3.4 square miles of floodplain per year
- Mason County at the rate of 1.6 percent per year over 56.9 square miles of floodplain equaling a loss of approximately .9 square miles per year
- Kitsap County at the rate of .7 percent per year over 7.6 square miles of floodplain equaling a loss of approximately 0.05 square miles
- Clallam County at the rate of .3 percent per year over 77 square miles of floodplain equaling a loss of approximately 0.2 square miles per year
- Jefferson County at the rate of .8 percent per year over 33.8 square miles of floodplain equaling a loss of approximately 0.2 square miles per year
- Island County at the rate of .9 percent per year over 8.9 square miles of floodplain equaling a loss of approximately 0.08 square miles per year
- San Juan County at the rate of 2.7 percent year over 9.6 square miles of floodplain equaling a loss of approximately 0.2 square miles per year
- Snohomish County at the rate of 2.2 percent year over 116 square miles of floodplain equaling a loss of approximately 2.5 square miles per year.

In the above jurisdictions, NMFS estimates that the degradation or loss of a given percentage of 100-year floodplain habitat will expose a percentage of the fish from populations that rely on those habitats, to unfavorable conditions during 100 year flood events. Although the RPA requires that these impacts be mitigated, habitat losses that occur prior to the implementation of the mitigation may adversely affect fish populations, if 100-year or lesser flood events occur during that time-frame.

The NMFS assumes that because juvenile Chinook salmon prefer edge habitats, and salmonids with protracted lifehistory in freshwater environments rely on floodplains for refugia from high volume and velocity floodwaters, that the percentage of a fish population exposed to degraded or diminished floodplain refugia could be very high. Of the percentage of fish from a given population exposed to floodplain habitat loss or degradation through floodplain development, a subset would be injured or killed, but this percentage is impossible to estimate given the distribution of fish within the inundated area will not be uniform and the reduction in floodplain function would not affect all individual fish equally. Applying the basic biological principle of carrying capacity, NMFS assumes that the percentage of floodplain degradation will result in a comparable percentage of harm among juveniles of the fish populations exposed to the modified habitat during the base flood. By this, NMFS means that the likelihood of injury or mortality is increased due to behavioral changes in the juvenile fish, resulting from changes in the floodplain habitat, at a 1-to-1 ratio of harm to habitat degradation.

The likelihood of a “base flood” that would inundate the 100 year floodplain is predicted by FEMA at 1 percent chance of occurrence per year (smaller flood events occur with greater frequency, which will also expose fish to effects of floodplain habitat loss or degradation, though less extensively because the duration of inundation shorter and amount of landscape inundated is smaller). Because the prioritization for implementing the RPA requires that communities affecting Tier 1 populations implement the revisions within one year, the chance that fish will be exposed to unmitigated floodplain development in any particular location influencing Tier 1 populations, is only one percent.

Because King and Pierce Counties have floodplain management regulations significantly more restrictive than the NFIP minimum requirements, NMFS expects the extent of take in the form of harm due to floodplain loss from development will be at significantly lower rates than the population growth rates:

- King County's growth rate over the last decade was 13 percent, which would translate to approximately 1.3 percent per year. In King County, 70 percent of the urban growth area is in floodplain. However, King County has multiple floodplain management ordinances that exceed the current NFIP minimum criteria, which allow less development than would occur with the FEMA minimum criteria, and which also requires mitigation for that development that does occur within the floodplain – together these minimize the effects of floodplain development on fish habitat and habitat forming processes.   These criteria include a zero-rise floodway requirement (.01 foot rise in conveyance areas is measurable – and development that creates this much rise is not allowed); a balanced cut and fill requirement to avoid loss of flood water storage , and which must be hydraulically connected and constructed at the same topographic elevation; no development is allowed at all in the floodway except for farmhouses and farm pads for livestock; the floodway includes velocity and depth criteria (3feet deep or 3ft per second is part of the no build criteria); in order to subdivide floodplain lots there must be at least 5,000 square feet of buildable land outside of the zero rise floodway; severe CMZs are not buildable; dry-proofing is required, rather than FEMA's "wet flood-proofing" to avoid contamination of floodwaters with stored chemicals; no substantial improvement is allowed for buildings located in floodways except farmhouses or historic buildings; and temporary structures must be removed from zero rise floodway prior to flood season. King County has also withdrawn several levees from the PL 84-99 and FEMA certification processes, allowing King County to retain larger amounts of vegetation on levees to benefit riparian and aquatic habitat and habitat forming processes.

- Pierce County's growth rate over the last decade was 17 percent, or an approximate 1.7 percent per year. Pierce County regulates most floodplains as floodways, using flood depth and flood velocity data to additionally restrict development. Because fill is largely prohibited in floodways, identifying significant portions of the floodplain as floodway due to depth or velocity, Pierce County precludes more floodplain development than it would under the NFIP minimum standards, Pierce County also requires compensating volume of flood storage, hydrologically connected to the affected river, when fill is authorized in floodplains. Pierce County recently completed its designation of a channel migration for the Puyallup and Carbon system, further restricting areas where development can occur. Pierce County has also completed two miles of levee setbacks, re-establishing floodplain function, and levee vegetation management on the Lower Puyallup levee system is governed by a Lands Claim Settlement Agreement recognizing that increased levels of vegetation are necessary to ensure a minimum level of riparian habitat to benefit the Puyallup Tribe's reserved fishing rights.

Thus, despite human population growth rates commensurate with other fast-growing counties, NMFS' expectation is that levels of take from arising from floodplain loss will accrue at roughly

0.15 percent in King and Pierce Counties, exclusively. Development permitted by the incorporated cities or towns inside the boundaries of these Counties is not governed by County ordinances, and instead rely primarily on current NFIP minimum requirements

After full implementation of the RPA, the rate of floodplain development is expected to slow across all NFIP jurisdictions, and losses of floodplain habitat are expected to be mitigated by creation additional floodplain storage areas designed to afford fish refugia in during riverine and estuarine flooding. The NMFS expects that there will be temporary degradation to floodplain habitats during the period of time that the mitigation floodplain areas become successfully revegetated to provide the full range of habitat values (eg, preybase). This may result in a small amount of take over a period of up to 5 years in each mitigation site, while plantings become established to create fully functional floodplain refugia for listed fish. Changes in instream conditions and channel characteristics arising from floodplain development (due to stormwater contaminants, increased velocity and volumes during floods, and decreased baseflows from interrupted hyporrheic recharge) are expected to remain relatively static after the RPA is fully implemented.

Take Exemption. Take from reduced carrying capacity corollary to all floodplain development is exempt up to a rate of 0.15 percent per year floodplain loss, within the regulatory jurisdictions of King and Pierce Counties, based upon the more stringent floodplain management requirements of those jurisdictions. Take is exempted in all other county and municipal NFIP jurisdictions as soon as they implement the floodplain management criteria set forth in RPA element 3, provided the activity resulting in take is carried out in conformance with RPA element 3, including applicable mitigation requirements.

Take is exempted for all floodplain development that occurs within the regulatory jurisdictions of Kitsap, and San Juan Counties, and the municipalities therein, because the amount of developable floodplain is low, the anticipated amount of development is low, there are no PS Chinook salmon in freshwater environments in these jurisdictions, and the number of listed steelhead in freshwater environments is low in these geographies.

For the remaining counties in the Puget Sound region, take accruing from decreased carrying capacity corollary to floodplain loss or degradation is exempted as followings:

- In Whatcom County at the rate of 2.1 percent per year, equaling a loss of approximately 1.5 square miles of floodplain per year.
- In Skagit County at the rate of 1.9 percent per year equaling a loss of approximately 3.4 square miles of floodplain per year
- In Mason County at the rate of 1.6 percent per year equaling a loss of approximately .9 square miles per year
- In Clallam County at the rate of .3 percent per year equaling a loss of approximately 0.2 square miles per year
- In Jefferson County at the rate of .8 percent per year equaling a loss of approximately 0.2 square miles per year
- In Island County at the rate of .9 percent per year plain equaling a loss of approximately 0.08 square miles per year

- In Snohomish County at the rate of 2.2 percent year equaling a loss of approximately 2.5 square miles per year.

Take that results from floodplain modification in excess of these measurable levels is not exempt. Take that occurs from actions not in compliance with the RPA (above) is not exempt – specifically, take at the above described rates is exempt only for a period of 1 year following the issuance of this Opinion in NFIP jurisdictions influencing Tier 1 populations, for 2 years in NFIP jurisdictions influencing Tier 2 populations, and for 3 years in all other NFIP jurisdictions, and is exempt only to the extent that the mitigation required by the RPA is provided. Take that occurs for development not in compliance with the Reasonable and Prudent Measures (RPMs) and/or the Terms and Conditions (T and Cs) (below) is also not covered by the exemption described in this Opinion.

<u>Reasonable and Prudent Measures</u>

Reasonable and prudent measures (RPMs) are nondiscretionary measures to avoid or minimize take that the action agency and its cooperators must carry out for the exemption from the prohibition against taking listed species in ESA section 7(o)(2) to apply. During the course of consultation, NMFS determined that the proposed action would both jeopardize the listed species considered in this consultation and destroy or adversely modify their critical habitat. As required in such circumstances, NMFS developed an RPA with FEMA that meets each of the RPA criteria, including the requirement that the RPA avoids jeopardy of the species and adverse modification of critical habitat. In achieving these results, the RPA changes the proposed NFIP in a way that reduces, minimizes, or avoids habitat modification that would have resulted in take of the species considered. Since implementing the RPA fully minimizes take in and of itself, NMFS has not identified further measures for minimizing the anticipated extent of take beyond full implementation of the RPA.

The FEMA has the continuing duty to regulate the activities covered by the NFIP RPA where discretionary Federal involvement or control over the action has been retained or is authorized by law. The protective coverage of section 7(o)(2) will lapse if FEMA fails to exercise its discretion to adhere to, or to require adherence (where an applicant is involved), to the terms and conditions of the incidental take statement. Similarly, if any community that participates in the NFIP fails to act in accordance with the terms and conditions of the incidental take statement, protective coverage for that community will lapse.

The FEMA shall minimize incidental take caused by implementing the NFIP by:

1. Ensuring implementation of a monitoring and reporting program to confirm that the take exemption based on the extent of habitat modified by the NFIP according to the rates identified in this statement is not exceeded. Reporting shall occur annually on October 1, beginning one year from the date of this biological opinion.

2. Ensuring that take caused during construction and function of mitigation projects is minimized. This includes FEMA's mitigation via funding or otherwise facilitating floodplain restoration projects affecting Tier 1 populations during the RPA

implementation period (RPA 6); and mitigation required for all Floodplain development projects that otherwise have no other Federal nexus.

3. Ensuring that all NFIP participating communities that influence Tier 1 salmonid populations have mitigation for all floodplain development after the issuance of this biological opinion, including during the period prior to full implementation of the RPA.

Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, FEMA and its cooperators must fully comply with the elements of the RPA described above.

a. To implement RPM1 (Compliance and Effectiveness Monitoring) - In the interim period pending complete implementation of the NFIP RPA, FEMA shall report to NMFS on an annual basis regarding progress on meeting timelines and implementing RPA elements 1-5.

b. To implement RPM 2 (Mitigation) – If FEMA's reporting indicates that floodplain function was lost through fill and/or development, then FEMA shall ensure that floodplain mitigation and/or restoration activities take place. This may include FEMA's contribution of financial, technical, or physical (labor or equipment) support or other activities by FEMA or the affected communities. These actions are intended to mitigate for any NFIP actions that will occur during implementation of RPA elements 2-5 (Terms and Conditions B through E) that degrade channel or floodplain habitat in NFIP communities, and FEMA shall coordinate with NMFS to determine that adequate compensation will result from such mitigation. Moreover, such mitigation projects shall have design or review with NMFS or WDFW to ensure a minimum of construction related effects, and that enhanced or offset floodplain habitat will function as intended.

c. To implement RPM 3 (Tier One Area Mitigation) – the FEMA reporting shall detail development and corollary mitigation for those NFIP jurisdictions that affect Tier One populations.

Section 7(a)(1) Conservation Recommendations.

The FEMA should coordinate levee maintenance protocols with COE and Services in a watershed based approach that reduces floodplain encroachment and minimizes flood volume, velocity, and scour problems caused by confining the channel by levees. This should include working with sponsors to identify levees that restrict floodplain function, and developing a process to start setting back levees and restoring floodplain functions.

The FEMA should work with the COE and NMFS to develop joint levee vegetation standards to allow retention of native riparian vegetation, based on the most recent best available science. Examples of potential changes include using height restriction rather than diameter restriction in order to minimize potential levee damage from toppling, and giving preference to limbing lower branches to allow visual access and flood fight access rather than tree removal.

The FEMA should consider identifying certain CRS activities that are beneficial to listed salmon and floodplain function, and phasing them in as additional standards and requirements for community participation in the NFIP.

The FEMA should revise the criteria for floodplain acquisition, easements, and development right purchases to include acquisition of land currently without structures as a means to preserve flood storage and reduce future costs of flooding.

The FEMA should develop and implement procedures by which the Director can mandate implementation of mitigation measures for structures that would be beneficial to fish where it would be cost effective. Those who use their flood insurance claim payment for mitigation should be further rewarded by receiving an additional increment of support in the form of a grant.

The FEMA should adopt a coordinated, watershed-based, multi-objective approach for all water resource activities. This approach should include coordination with efforts to improve water quality, quantity, and supply; the creation and maintenance of upland storage; and coordinated planning among upstream, downstream, rural, and urbanized localities within the same watershed.

The FEMA should evaluate the Pre-Disaster Mitigation Program to determine the kinds of mitigation measures that are being funded and implemented, and their effectiveness in reducing losses and protecting floodplain resources. Likewise, the activities funded by the Flood Mitigation Assistance Program, especially those related to reducing repetitive losses, should be compiled and long-term impacts analyzed, to establish future program priorities.

Compliance with Executive Order 11988 should be overseen and enforced to provide the stated protection for, and preservation of, floodplain functions and values.

The FEMA should approach the Office of Management and Budget to seek a reassessment of the regulations governing benefit/cost analyses. Benefits in a benefit/cost analysis should include recreation benefits, avoided damage to land use (erosion, crop losses, etc.), increase in real estate values due to proximity to open space, ecosystem improvements including protection of salmon habitat, and revenue of discount rates.

The FEMA should re-establish its National Benefit/Cost Analysis Team—a group of experts that can offer advice and guidance in program policy and implementation—to evaluate FEMA's benefit/cost procedures. The team should include representatives of a broad range of stakeholders, including state and local personnel. A study should be done of the feasibility of a unified floods-only benefit/cost method that would be used by both FEMA and the COE. Better methods for quantifying the economic benefits of natural resources (such as salmon habitat) and cultural resources should be developed, adopted, and applied.

The FEMA should establish a riparian zone policy (include if we don't impose this regulatory change). Continuous buffer zones along rivers, streams, coasts, and smaller waterways need to be encouraged. This is needed to clarify the importance of, and the steps needed to protect, maintain, and restore the areas along our rivers and streams so that they can not only provide their natural benefits to today's population but also survive as sustainable ecosystems into future generations. A first step would be recognizing the multiple benefits of riparian zones for habitat, water quality, flood protection, recreation, cultural resource protection, and others. This would help to shape program interaction and clarify the need for holistic management.

As part of its floodplain mapping program, FEMA should collaborate with the EPA, the National Oceanic and Atmospheric Administration, and the USFWS to produce resource mapping of the nation's floodplains. As part of future Federal investments in the floodplain, a resource management strategy should be developed as part of the preferred plan that includes consideration of the effects of climate change.

The FEMA should develop flood hazard maps that depict all related hazards, for example, the failure zones of all dams, levees, diversions, and reservoirs. Not only is this identification important for notification and warning purposes, but also development in these zones should have added flood protection, and flood insurance should be mandatory, with rates based on the residual risk. The area that would be inundated when a levee fails or is overtopped or when internal drainage systems are overwhelmed or incapacitated should be mapped as a residual risk flood hazard area and depicted on FIRM.

The FEMA should continue to develop and use more accurate and flexible engineering models that are more accurate and consistent that existing two-dimensional flow models, reflect unsteady state flow conditions, levee breaches, split flows, and hazards of unstable land forms and debris flows. Efforts should be made to make engineering models available publicly and more easily understood by non-engineers. The FEMA should require that all state and community all-hazard plans, comprehensive plans, and special area plans include goals, strategies, and actions to analyze the potential for future adverse impacts on flooding and floodplains, the degree of impact, and measures to mitigate these future adverse impacts. This requirement also should be incorporated into Federal incentive based programs such as the NFIP's CRS, and local/state mitigation plan update requirements. This action would avoid problems such as those that occurred in Mecklenberg County North Carolina, where studies concluded that the current 100-year flood elevation increased by between 4 and 7 feet when future development conditions and the floodway surcharge were considered.

To further prevent future flood damage, the following changes to the NFIP regulations should be Implemented:

- A no-rise floodway with no impact on water surface and velocity should be required, so that *only* those areas of insignificant hydraulic conveyance could be filled. Allowing cumulative filling of the floodplain until a 1-foot increase in base flood height is achieved (the current standard) causes additional flood damage on other owners' properties in the floodplain, increases downstream flood peaks, and promotes the filling of riparian zones that would be valuable natural resources if left undisturbed.

- In addition, FEMA standards for a Letter of Map Change that allow rises even beyond one foot should be revised to minimize community liability and ensure that no takings are occurring where floodheights have been increased on undeveloped land.
- New construction of critical facilities should not be allowed in the 100-year floodplain. The FEMA should develop more detailed floodplain management standards for the siting and construction of critical facilities. This should begin with a definition of which facilities are considered "critical," and require that they be protected from and accessible during the 500-year flood. When new critical facilities are constructed, at least the primary access route should also be at an elevation at least equal to the level of the 500-year flood to avoid the facility's being isolated during a flood. (It is recognized that additional work must be done to improve estimates of the 500-year flood.)
- A floodway analysis should be required for all subdivisions and large scale developments proposed for floodprone areas, in addition to developing 100-year flood data as required by NFIP standards. Additional consideration should be given to lowering the thresholds of the number of lots and acreage that trigger this requirement.

FEMA should require that any adverse environmental consequences resulting from the construction, rehabilitation, or reconstruction of any structural measure in the floodplain must be mitigated.

FEMA should redefine "Substantial improvement" under the NFIP so that improvements made to a structure over time are calculated cumulatively, rather than being considered individually. FEMA should require flood insurance in 100-and 500-year floodplains and discontinue the practice of waiving flood insurance after issuance of LOMRs and behind levees.

MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

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. 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 to 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 may be taken by the action agency to conserve EFH.

The Pacific Fishery Management Council (PFMC) designated EFH for groundfish (PFMC 2005), coastal pelagic species (PFMC 1998), and Chinook salmon, coho salmon, and PS pink salmon (PFMC 1999). The proposed action and action area for this consultation are described in the Introduction to this document. The action area includes areas designed as EFH for various life history stages of the species listed in Table 11, which occur in estuarine and nearshore areas of the Puget Sound. Specific areas designated as EFH for various life-history stages of pink salmon, coho salmon, and Chinook are shown in table A-1, (from Appendix A, Amendment 14 to the Pacific Coast salmon Plan).

Table 11. Essential Fish Habitat species applicable to the proposed action.

Groundfish Species	Sablefish *Anoplopoma fimbria*	**Coastal Pelagic Species**
Spiny Dogfish *Squalus acanthias*	Bocaccio *S. paucispinis*	anchovy *Engraulis mordax*
California Skate *R. inornata*	Brown Rockfish *S. auriculatus*	Pacific sardine *Sardino Puget Sound sagax*
Ratfish *Hydrolagus colliei*	Copper Rockfish *S. caurinus*	Pacific mackerel *Scomber japonicus*
Lingcod *Ophiodon elongatus*	Quillback Rockfish *S. maliger*	Market squid *Loligo opalescens*
Cabezon *Scorpaenichthys marmoratus*	English Sole *Parophrys vetulus*	**Pacific Salmon Species**
Kelp Greenling *Hexagrammos decagrammus*	Pacific Sanddab *Citharichthys sordidus*	Chinook salmon *Oncorhychus tshawytscha*
Pacific Cod *Gadus macrocephalus*	Rex Sole *Glyptocephalus zachirus*	Coho salmon *O. kisutch*
Pacific Whiting (Hake) *Merluccius productus*	Starry Flounder *Platichthys stellatus*	Puget Sound Pink salmon (*Oncorhynchus gorbuscha)*

Table 12. Pacific salmon freshwater EFH identified by USGS hydrologic unit number. (Note that the inclusion of sockeye salmon in the table below is an error. All other salmon species listed are accurate.)

USGS Hydr. Unit	State(s)	Hydrologic Unit Name	Salmon Species
17110001	WA	Fraser (Whatcom)	coho salmon
17110002	WA	Strait of Georgia	chinook and coho salmon Puget Sound pink salmon
17110003	WA	San Juan Islands	chinook and coho salmon
17110004	WA	Nooksack River	chinook and coho salmon Puget Sound pink salmon
17110005	WA	Upper Skagit	chinook and coho salmon Puget Sound pink salmon Puget Sound sockeye salmon
17110006	WA	Sauk River	chinook and coho salmon Puget Sound pink salmon
17110007	WA	Lower Skagit River	chinook and coho salmon Puget Sound pink salmon Puget Sound sockeye salmon
17110008	WA	Stillaguamish River	chinook and coho salmon Puget Sound pink salmon
17110009	WA	Skykomish River	chinook and coho salmon Puget Sound pink salmon
17110010	WA	Snoqualmie River	chinook and coho salmon Puget Sound pink salmon
17110011	WA	Snohomish River	chinook and coho salmon Puget Sound pink salmon
17110012	WA	Lake Washington	chinook and coho salmon Puget Sound sockeye salmon
17110013	WA	Duwamish River	chinook and coho salmon
17110014	WA	Puyallup River	chinook and coho salmon Puget Sound pink salmon
17110015	WA	Nisqually River	chinook and coho salmon Puget Sound pink salmon
17110016	WA	Deschutes River	chinook and coho salmon
17110017	WA	Skokomish River	chinook and coho salmon
17110018	WA	Hood Canal	chinook and coho salmon Puget Sound pink salmon
17110019	WA	Puget Sound	chinook and coho salmon
17110020	WA	Dungeness -Elwha	chinook and coho salmon Puget Sound pink salmon
17110021	WA	Hoko • Crescent	chinook and coho salmon

Based on information provided in the BE 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 Chinook salmon, coho salmon and PS pink salmon.

Habitat forming processes will be hindered, including

- freshwater and estuarine floodplain connection,
- riverine channel migration,
- side-channel formation,
- formation of quality edge habitat,
- wood recruitment,
- riparian function, and
- gravel recruitment.

The inhibition of these processes would degrade the active-channel and associated floodplains over time. Water quality would be reduced as floodwaters spread out over increasingly developed floodplains.

Based on information provided in the BE 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 the non-salmonid species listed in Table12.

Floodplain and riparian functions will be decreased from changing land use, and water quality will be decreased, as a result of increased contaminants and fine sediment delivered to estuarine and nearshore waters of the action area (for more detail on these effects see the Effects on Critical Habitat section earlier in this document).

Essential Fish Habitat Conservation Recommendations

The NMFS believes that implementation of the following conservation measures are necessary to avoid, minimize, mitigate, or otherwise offset the impact of the proposed action on EFH. Full consideration of the proposed action described in the ESA portion of this document leads NMFS to the conclusion that there are insufficient measures to avoid the adverse impacts to EFH described above.

The NMFS recommends that FEMA utilize its authorities to protect habitat forming processes and floodplain function by implementing the following measures as requirements of the NFIP. These measures are intended to provide protection for the designated EFH of both salmonid and non-salmonid species in the affected area. This can be accomplished by tailoring the NFIP to protect EFH throughout Puget Sound, or through any other kind of program modification available to FEMA.

<u>Recommendation 1 -- Notification of Consultation Outcome</u>.
In order to expedite local government adoption of ordinance changes to revise floodplain development criteria, FEMA should notify all NFIP participating communities in Puget Sound about the results of this EFH consultation and the potential harm to EFH associated with issuing development permits in the floodplain. The FEMA should indicate that development consistent

with the NFIP is determined by NMFS to adversely affect EFH. The notification should also suggest measures for avoiding and minimizing adverse effects to EFH, including but not limited to, 1) suggesting communities implement a temporary moratorium on floodplain development, or 2) explaining that jurisdictions who adopt the revised Model Ordinance (described in Recommendation 3) will avoid harm from floodplain development. NMFS further recommends that this element be implemented within 30 days of the issuance of this EFH consultation document.

Recommendation 2 -- Mapping.
In order to more accurately identify floodplain areas, FEMA should make the following changes to the mapping program and so reduce or avoid adverse effects to designated EFH. NMFS recommends that FEMA implement the following changes to the mapping program within six months of the issuance of this EFH consultation document, and report progress to NMFS on an annual basis on all sub-elements below.

A. The FEMA should process Letters of Map Change caused by manmade alterations only when the proponent has factored in the effects of the alterations on channel and floodplain habitat function for listed salmon, and has demonstrated that the alteration avoids habitat functional changes, or that the proponent has mitigated for the habitat functional changes resulting from the alteration with equivalent habitat creation benefitting the affected salmonid population. In analyzing these effects, FEMA will need to ensure that effects from habitat alterations that are reasonably certain to occur but might occur later in time, such as changes in storm water quantity, quality, and treatment, decreased riparian vegetation, lost large woody debris, increased bank armoring, and impaired channel migration, are also mitigated. The FEMA will report to NMFS on the results of mitigation for manmade floodplain changes that become the basis for map revision requests.

B. The FEMA should prioritize their mapping activities based upon the presence of critical salmon populations as identified in appendix 3. The FEMA's mapping activities shall evaluate a community's flood hazard areas in the context of a watershed analysis.

C. The FEMA should ensure that floodplain modeling incorporates on-the-ground data to increase the accuracy of maps depicting the floodplain. For multi-thread channels, FEMA shall produce and distribute a Technical Bulletin indicating a preference for use of unsteady state hydraulic models to map the boundaries of the 100-year floodplain. In addition, FEMA will use a 2-dimensional model in estuarine floodplains and in other areas, when applicable.

The FEMA should also revise map modeling methods to consider future conditions and the cumulative effects from future land-use change, to the degree that such information is available (e.g. zoning, urban growth plans, USGS Climate study information. Future conditions considered should include changes in the watershed, its floodplain, and its hydrology; climate change. The FEMA shall ensure that jurisdictions use anticipated future land use changes when conducting hydrologic and hydraulic calculations to determine flood elevations.

D. The FEMA should evaluate and identify the risk of flooding behind 100-year levees based on anticipated future conditions (e.g. flood levels that will likely result from the cumulative effects of development, climate change, and modified land use patterns).

Recommendation 3 -- Minimum Criteria Revisions.
In order to reduce the amount or rate of floodplain loss, FEMA should modify its implementation of the NFIP minimum criteria in NFIP communities in the Puget Sound Region in order to prevent and/or minimize the degradation of channel and floodplain habitat designated as EFH, as described below. In addition FEMA should report progress to NMFS on an annual basis on all sub-elements below.

A. As soon as possible upon issuance of this Opinion, FEMA should revise its implementation of the minimum criteria so that the following measures, necessary for protecting listed salmonids, are carried out in the Puget Sound Region as described in Appendix 4 (Minimum Criteria) and summarized below: Either

1. Allow no development in the floodway, the, CMZ plus 50 feet (as identified according to Ecology 2003) ,and the riparian buffer zone (RBZ, as described by the Department of Natural Resources 2007 stream typing system and WDFW's 1997 stream buffer guidelines), and floodway (as mapped by the FIRM).

Or

2. The local jurisdiction with permitting authority must demonstrate to FEMA that any proposed development in the FEMA designated floodway, the CMZ plus 50 feet (as identified according to Ecology 2003), and the riparian buffer zone (RBZ, as described by the Department of Natural Resources 2007 stream typing system and WDFW's 1997 stream buffer guidelines) has no adverse effects to water quality, water quantity, flood volumes, flood velocities, spawning substrate, and/or floodplain refugia for listed salmonids .

3. In addition to either 1 or 2 above, either:

a. Prohibit development in the 100-year floodplain,

OR

b. If development within the 100-year floodplain but outside the RBZ, is permitted, any loss of floodplain storage should be avoided, rectified or compensated for. An example of compensation is the creation of an equivalent area and volume of floodwater storage and fish habitat through a balanced cut and fill program. Additionally, indirect adverse effects of development in the floodplain (effects to stormwater, riparian vegetation, bank stability, channel migration, hyporheic zones, wetlands, etc.) must also be mitigated such that equivalent or better salmon habitat protection is provided. (see Appendix 4 for more detail on how to comply with this criteria). Using option 3.A.3.b will require tracking the projects that occur and reporting to FEMA on a semi-annual basis (see 3.D. below).

For development within the 100 year floodplain permitted under 3A3b, construction in the floodplain shall use Low Impact Development (LID) methods (generally requiring infiltration of all on-site stormwater), such as those described in the Low Impact Development Technical Guidance Manual for Puget Sound (Puget Sound Action Team and WSU/Pierce County Extension 2002) to minimize or avoid stormwater effects.

4. Any improvements or repairs to existing structures that result in a greater than 10 percent increase of the structure footprint must mitigate for any adverse effects to species or their habitat as described in 3b.

B. The FEMA should implement Recommendation 3.A by ensuring that all participating NFIP communities in the Puget Sound region implement land-use management measures consistent with the criteria as soon as practicable, but in no event later than three years from the date of this Opinion.

1. The FEMA should focus its implementation efforts first on communities located in areas of "Tier 1" and "Tier 2" salmon populations, and then on the remaining Puget Sound NFIP communities (see Appendix 3 for an explanation of Tier 1 and 2 populations and a list of jurisdictions where they are located). The FEMA should demonstrate compliance with the following benchmarks:

a. 35 percent of NFIP jurisdictions in the Puget Sound Region should have implemented the criteria set forth in RPA Element 3.A within two years of this issuance of this opinion, including 100 percent of Tier I jurisdictions;

b. 70 percent of NFIP jurisdictions in the Puget Sound Region should have implemented the criteria set forth in RPA Element 3.A within two and a half years of the issuance of this opinion, including 100 percent of Tier 2 jurisdictions; and

c. 100 percent of NFIP jurisdictions within the Puget Sound Region should have implemented the criteria set forth in RPA Element 3.A within three years of the issuance of this Opinion.

2. Until all Puget Sound communities have implemented the criteria set forth in RPA Element 3.A., FEMA should report annually to NMFS on the status of its efforts to implement the RPA and the number of Puget Sound NFIP jurisdictions that have implemented the revised criteria.

C. Interim Actions. In the time period between the issuance of this Opinion, and the full implementation of RPA 3.A by participating communities, FEMA should advise the Puget Sound NFIP communities that they must keep track of all floodplain permits that they issue and report this information to FEMA on an annual basis. The FEMA should provide this information to NMFS, highlighting any permits that allowed development affecting channel or floodplain habitat, or resulted in indirect effects to salmonid habitat from stormwater, removal of riparian vegetation, bank armoring, changes in the CMZ, large wood input, or gravel recruitment, etc. If NMFS finds that any unmitigated actions affecting listed species have occurred as a result of these permits, NMFS will advise FEMA to this effect, and FEMA should ensure that mitigation is carried out.

D. Long term actions. Communities that have adopted the minimum criteria option allowing equivalent cut and fill (3.A.3.b. above), must report to FEMA on the number of projects that take place in the floodplain and the effectiveness of the mitigation. If based on FEMA's reporting, NMFS finds that the mitigation is not fully effective, FEMA should ensure that further mitigation is provided for these actions through RPA Element 6 or through other means available to the community (e.g., mitigation banks).

Recommendation 4 -- Community Rating System

In order to increase the likelihood that local governments will incorporate "fish friendly" land use ordinances in their floodplain management, FEMA should make the following changes to the CRS to achieve some or all of the habitat-based objectives stated above, within 9 months following the issuance of this consultation, by providing examples and models on specific elements of the CRS, and through newsletters, meetings, e-mails, etc. (e.g., the CRS class offered next spring). In addition FEMA will work with NMFS to ensure that the next version of the CRS manual (2011), will incorporate these new requirements.

A. Change CRS stormwater credits to create an incentive for the use of Low Impact Development (LID) methods (decreasing the need for added stormwater treatment) in the floodplain, per the Low Impact Development Technical Guidance Manual for Puget Sound (PSAT 2005).

B. Change the CRS point awards to increase the number of points available for preservation of open space where listed species are present, giving additional credits for areas to be preserved that have been identified in NMFS adopted salmon recovery plans.

C. Change the CRS criteria to award points for retaining and increasing riparian functions, particularly in areas where riparian function has been identified as a limiting factor for listed ESUs by the limiting factors analysis in salmon recovery plans. (For example, on the White River and lower Skagit for PS Chinook salmon populations and on Salmon and Snow Creeks for Hood Canal summer chum salmon populations, riparian function has been identified as a most influential limiting factor, that is currently in poor condition) (see Appendix 1).

D. Change the CRS point awards to reduce the number of points available for structural changes that reduce the amount of functional floodplain, such as levees, berms, floodwalls, diversions, and storm sewer improvements, including enclosing open channels and constructing small reservoirs.

E. Award points for setting levees back (moving levees out of the CMZ and/or as far away from the channel as possible) and restoring riparian and floodplain function. Points shall also be awarded for dismantling pre-existing levees in part or whole, in order to restore floodplain function in the reconnected floodplain, when such action is part of a comprehensive flood damage reduction plan.

F. Increase CRS criteria and credit for encouraging pre-FIRM development to move out of the floodplain.

G. In conjunction with NMFS, FEMA shall encourage the use of levee vegetation managment maintenance practices that benefit listed salmonids under Activity 620. The FEMA shall clarify and emphasize that when levee owners document NFIP levee maintenance as part of annual CRS recertification, professional engineers other than the COE can serve in this capacity. This may enable jurisdictions to retain larger woody vegetation on levees for the benefit of listed salmonids, and to receive the maximum number of CRS credits under Activity 620.

H. Include a category of actions that benefit listed salmonids, and weight these credits so that communities seeking CRS class improvements will have incentive to choose actions that are beneficial to salmon in order to achieve such class improvement.

II. Add CRS criteria to credit communities that implement an active buyout program for purchasing and removing buildings from the floodplain, for acquisition of property, flood easements, and/or development rights to preserve open space areas of floodplain.

Recommendation 5 -- Addressing the Effects of Levee Vegetation Maintenance and Certain Types of Construction in the Floodplain. To address the effects of these two factors affecting fish habitat conditions, FEMA should make the following changes to the proposed action to achieve some or all of the habitat-based objectives described above. In addition, FEMA should report progress to NMFS on an annual basis on all sub-elements of this recommendation below.

A. Coordinate with NMFS to develop specific FEMA levee vegetation standards that local jurisdictions may use instead of the COE's PL-84-99 standard for levee vegetation, allowing levees to be recognized as providing 100-year flood protection while minimizing riparian vegetation removal. The NMFS recommends that completion of such standards should occur no later than 18 months after the issuance of this EFH consultation.

B. Revise FEMA procedure memoranda to reflect that levee owners that opt for the levee vegetation standard identified in Recommendation5A shall not be disqualified from emergency funding for repairs from flood damage. The NMFS recommends that these memoranda should be revised and adopted within one year of issuance of this EFH consultation..

C. To address the contribution of increased runoff and modified flood hydrographs from development, FEMA should use Hazard Mitigation grant funding and the Flood Assistance Account Program for floodplain acquisition, purchase of floodplain development rights, levee setbacks, and/or creation of flood easements, placing priority on lands adjacent to EFH. The number of projects completed should be at least 5 per year for the first three years after this EFH consultation is completed.

D. The NMFS recommends that FEMA recognize new levees and floodwalls only if they include all of the following features:

- the natural channel migration pattern remains intact (or if presently confined, is allowed to expand to its natural pattern),
- bioengineering methods are used to stabilize the banks,
- large wood is incorporated into the levee setback area,
- riparian vegetation is enhanced according to the FEMA standards developed for this EFH consultation, and
- no change occurs to upstream and downstream flood levels, volumes and velocities.

Recommendation 6 -- Floodplain Mitigation Activities
In order to improve habitat conditions for fish, FEMA should assist in floodplain mitigation/restoration activities via contribution of financial, technical, or physical (labor or equipment) support. The FEMA should focus its floodplain restoration assistance in areas designated as EFH. These actions are intended to mitigate for any NFIP actions that occur during implementation of recommendations 2-5 that degrade channel or floodplain habitat that is EFH in NFIP communities.

Recommendation 7 -- Monitoring and Adaptive Management
In order to verify the implementation and effectiveness of these conditions, FEMA should report to NMFS on an annual basis regarding progress on meeting timelines and implementing Recommendations 1-5 and all sub-elements as specified above. As a result of this review, NMFS will determine, in consultation with FEMA, if some alternate actions or additional changes in Recommendations are needed to reduce adverse effects to EFH. This will be particularly important in assessing on-the-ground NFIP effects that are occurring, such as continued development in the floodplain, through either issuance of LOMRs or floodplain development permits. If NMFS determines that effects to channel and floodplain habitat designated as EFH were not avoided or not mitigated as a result of NFIP actions, FEMA should mitigate for these floodplain and/or channel impacts, consistent with Recommendation 6, described above.

DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Data Quality Act) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the Opinion addresses these Data Quality Act (DQA) components, documents compliance with the DQA, and certifies that this Opinion has undergone pre-dissemination review.

Utility: Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users.

This ESA consultation concludes that the implementation of the NFIP will jeopardize listed species in Washington State. Therefore, FEMA cannot carry out this program as currently implemented. The intended users of this document are FEMA, the State of Washington, local governments, the National Wildlife Federation, and similarly interested or concerned members of the public.

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.

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.

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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APPENDIX 1.

Excel spreadsheet showing habitat limiting factors for Puget Sound Rivers

Appendix 1												
ESU/ WRIA	**Population/Stock**	**Community/ Start Date/ Total Yrs**	**River**	**Number of Policies**	**(Total census, FEMA), % Pop Growth by WRIA 1990-2001, PSAT**	**[% change in County since Start Date, OFM] % change in County by 2025**	**Watershed Rating/ LF-Floodplain**	**Watershed Rating/ LF-Riparian**	**Watershed Rating/ LF-Flows**	**Watershed Rating/ LF-Bank and Channel**	**ESU Limiting Factors/ FP, Rip, Flow, B&C**	**Future threats**
P.S.Chinook							From: Ratings from State Salmon Limiting Factors Analysis, Shared Strategy for Puget Sound. 2007. Puget Sound Salmon Recovery Plan.472 pgs. Vol 1, Watershed Profiles (WP)					Same source as preceeding column.
	Nooksack	Ferndale 1983, 24	MS	93	9155		Poor-Y: One of 7 significant habitat factors listed, particularly on the SF (p. 157, WP). Levees and dikes constrain river, eliminate sides channels for fish rearing and refuge.	Poor- Loss of large trees along the rivers and tribs limits shade and instream wood (p.160, WP)	Poor- Low flows discussed, not related to floodplains (p. 161, WP)	Poor- increased sediment from erosion and mass wasting due to lack of riparian and LWD, channel instability of the both Forks due to levees and dikes (p. 160 WP)	Yes	Human Pop growth increase of 50% by 2022 (p. 152)
		Lynden 1982, 25	MS	13	9740		Poor-Y	Poor	Poor	Poor	Yes	
		Whatcom Co. 1977, 30	MS, NF, SF	801	77796 (33%)	[67.98%]32%	Poor-Y	Poor	Poor	Poor	Yes	
	Skagit	Mt. Vernon 1985, 22	MS	994	22280		Poor-Y: Five of twelve limiting factors related to floodplain issues are: degraded riparian zones, sedimentation and mass wasting, hydromodification, loss of delta habitat and connectivity, loss of pocket estuaries and connectivity (p. 181, WP).	Poor - Lower Skagit, Upper Skagit and Suiattle rivers have significant riparian degradation; between 38-75% of riparian area that support spawning and early rearing are degraded (p.181, WP).	Poor - Low flows related to water withdrawals not floodplains (p. 182 WP).	Data not known at time of publication - Hydromodification (bank armoring) - Lower Skagit has lost 60% of its natural banks and off-channel areas. Overall loss of delta area is 73%. Net reduction in pocket estuary habitat at 80%. Sediment budgets show current levels are higher than historic and contribute to scouring and filling of channel (p. 181, 182 WP).	Yes	

ESU/ WRIA	Population/Stock	Community/ Start Date/ Total Yrs	River	Number of Policies	(Total census, FEMA), % Pop Growth by WRIA 1990-2001, PSAT	[% change in County since Start Date, OFM] % change in County by 2025	Watershed Rating/ LF-Floodplain	Watershed Rating/ LF-Riparian	Watershed Rating/ LF-Flows	Watershed Rating/ LF-Bank and Channel	ESU Limiting Factors/ FP, Rip, Flow, B&C	Future threats
		Burlington 1985, 22	MS	1183	7190		Poor-Y	Poor	Poor	Unknown	Yes	
		Skagit Co. 1985, 22	LS, US	2544	45442 (31%, 29%)	[56.8%]40%	Poor, Good –Y	Poor-Good	Poor-Good	Unknown	Yes	
	Pu- White	Pierce Co 1987, 20	Pu, White	982	332980 (28%)	[33%]25%	Good/Poor-Y: One of significant habitat limiting factors – loss of floodplain processes and off-channel habitat from levees especially the Puyallup, White and Carbon (p. 278, WP).	Poor- one of significant habitat limiting factors- only about 5% of the riparian habitat is rated as high quality; lack of LWD; riparian habitat is fragmented and disconnected, increased channel instability from lack of LWD (p, 278 WP).	Poor - flow issues related to dam diversions discussed (p. 277-278, WP).	Poor - Fish access to spawning and rearing habitat limited by dikes and stream channelization projects plus others. Sediment deposition in Dumas Bay occurring at accelerated rate due to increases in shoreline armoring and clearing vegetation on slopes (p. 277, WP).	Yes	Setback opportunities for floodplain restoration difficult with continued pop growth Hard to protect remining habitat areas in floodplain (p. 278)
		Puyallup 1980, 27	Puyallup	282	29865		Poor –Y	Poor	Poor	Poor	Yes	
		Sumner 1980, 27	White	169	7657		Good –Y	Poor	Poor	Poor	Yes	
	Mid-Hood Canal	Jefferson Co. 1982, 25	Duckabush	119	14370 (22%)	[59.6%]38%	Poor –Y: Floodplain modification for ag and residential development is significant habitat factor (p. 309, WP).	Good? - Logging of riparian forest has reduced LWD recruitment affecting channel complexity and reducing bank and floodplain stability (p. 309 WP).	Good? - high flow issues are related to logging practices - sediment related (p. 309, WP).	Good/Fair? - Diking and channelization in lower reaches and logging roads in upper reaches has increased sediment aggradation (p. 309, WP).	Yes	Human caused threats (p. 310) and pop growth 43-54% (p. 305)

ESU/ WRIA	Population/Stock	Community/ Start Date/ Total Yrs	River	Number of Policies	(Total census, FEMA), % Pop Growth by WRIA 1990-2001, PSAT	[% change in County since Start Date, OFM] % change in County by 2025	Watershed Rating/ LF-Floodplain	Watershed Rating/ LF-Riparian	Watershed Rating/ LF-Flows	Watershed Rating/ LF-Bank and Channel	ESU Limiting Factors/ FP, Rip, Flow, B&C	Future threats
	Dungeness-Elwha	Clallam Co. 1980, 27	Dungeness	355	33800 (16%)	[25.9%]18%	Poor-Y: Dikes and levees (p. 323, WP) limit fish refuge, overwintering and scour eggs. Need 9 miles of floodplain restoration; to reduce gradient, velocities, scour and bank erosion (p. 325, WP)	Good?- Both upper and lower watershed logged (p. 323, WP). Restore riparian corridor throughout lower mainstem to improve habitat and functions (p. 325, WP).	Good?? - Water withdrawal issues related to irrigation, domestic and business uses limit salmon spawning and rearing habitat (p. 325, WP).	Poor - Need 9 miles of dike removal and bank revegetation to increase meanders and reduce gradient, velocities, scour and bank erosion (p. 325, WP)	yes	16% pop growth (p. 319)
							From: Hood Canal Coordinating Council. 2005. Draft Summer Chum Salmon Recovery Plan. 334 pgs.					Same source as preceeding column.

ESU/ WRIA	Population/Stock	Community/ Start Date/ Total Yrs	River	Number of Policies	(Total census, FEMA), % Pop Growth by WRIA 1990-2001, PSAT	[% change in County since Start Date, OFM] % change in County by 2025	Watershed Rating/ LF-Floodplain	Watershed Rating/ LF-Riparian	Watershed Rating/ LF-Flows	Watershed Rating/ LF-Bank and Channel	ESU Limiting Factors/ FP, Rip, Flow, B&C	Future threats
Hood Canal Chum							Chum – General in Recovery Plan – Floodplain loss listed as factor of decline (p. 76) increasing peak flow rates, increasing redd scour.	Riparian degradation listed as factor for decline: riparian removal and modification reduces floodplain stability and LWD recruitment; lack of LWD increases scour, contributes to channel instability and limits holding pools (p. 76).	no discussion	Altered sediment dynamics listed as factor for decline: channel aggradation leads to egg/fry entombment, redd dislocation (p. 76).		(p. 41-42 population density. most of pop outside areas of current runs but this is a problem for re-introduction pop density: 3130/sq mile to 0
	Union (15)	Belfair (no NFIP) or Mason Co 1988, 19	Union	295	(49405) 26%	[45.1%]30.5%	Fair – Y (Side channel): Loss of side channels and estuarine habitat due to diking as LF (p. 216)	Fair - Basin logged by 1930; residential development, ag and roads cover 46% of riparian area. Trees in riparian area are 96% deciduous (p.217).	Poor - no discussion	Good/Fair - Low levels of large size instream LWD may result in redd scour and channel instability (p. 216).	Yes	(p. 226-7) need to address loss of side channels and estuarine habitat
	Hamma-H (16)	Mason Co	H-H	295	49405 (22%)	[45.1%]30.5%	Poor-Y (sc): Loss of FW side channel affecting spawning incubation. Loss of estaurine habitat by diking affecting rearing and juv migration (p.164-5), .	Good?- 48% of the forested buffer is small trees, LWD loading extremely poor in John Creek, LWD completely absent from Hama Hama (p. 164).	Good?- subsurface flows in summer (from sediment aggradation) reduce flow needed for spawning (p. 164).	Good/Poor ?- bank hardening with removal of LWD reduces channel complexity; extensive sediment aggradation in lower John Creek impedes spawning access (p. 164).	Yes	(p. 179) Need floodplain mgt plan for L Hamma-H

ESU/ WRIA	Population/Stock	Community/ Start Date/ Total Yrs	River	Number of Policies	(Total census, FEMA), % Pop Growth by WRIA 1990-2001, PSAT	[% change in County since Start Date, OFM] % change in County by 2025	Watershed Rating/ LF-Floodplain	Watershed Rating/ LF-Riparian	Watershed Rating/ LF-Flows	Watershed Rating/ LF-Bank and Channel	ESU Limiting Factors/ FP, Rip, Flow, B&C	Future threats
	Ducka-bush (16)	Jefferson Co 1982, 25	DB	119	14370 (22%)	[59.6%]34%	Poor –Y: Loss of FW floodplain for ag and residential dev. affecting spawning and incubation, loss of estuarine habitat by diking affecting juv rearing and migration (p. 166-7) .	Poor - Floodplain forest logged of old growth reducing potential for LWD recruitment to channel (p.167).	Good - no discussion	Good/Poor - Channel simplified in late 1800s by scouring from splash dams, LWD removal, and floodplain conversion; lower reaches channelized and diked causing channel aggradation, FS logging roads contribute to sedimentation problems (p. 166).	Yes	(p. 184) Need to address loss of floodplain habitat.
	Dose (16)	Jefferson Co 1982, 25	DS		14371 (22%)	[59.6%]34%	Poor-Y: same w/ conversion of fp to ag and residential, diking for dev (p. 168-9).	Poor - same as Duckabush (p. 168-9).	Fair - no discussion	Poor - same as Duckabush (p. 168-9).	Yes	(p. 178) Need floodplain mgt plan for Dosewallips
	Lilliwaup-16	Mason Co 1988, 19	LW	295	49405 (22%)	[45.1%]30.5%	Poor-Y (sc): Loss of side channel and diked estuarine area for dev as LF, location of dev critical having disproportionate effect on functional value of estuary (p.194-5).	Good? - Elimination of riparian forest decreased LWD recruitment sources for creek and estuary (p.195).	Good? - no discussion	Good/Poor - Altered age and species composition of riparian cause lack of LWD contributing to reduced channel complexity, channel instability and redd scour in peak events (p.194).	Yes	(p. 201) Need to address loss of side channels and estuarine loss. Remove dikes to restore side channels (p. 204)
	Quilcene (17)	Jefferson Co 1982, 25	QC	119	14370 (34%)	[59.6%]34%	Poor-Y: Loss of FW floodplain listed as limiting factor in Big. Loss of estuarine habitat due to diking mentioned in Big and Little affecting spawning and migration (p. 137).	Poor - About 50% of Big and Little riparian is deciduous dominated with no riparian forest; future recruitment is poor to moderate (p. 137-8).	Fair? - Low flows of 5-13 CFS in Little threaten spawning; more assessment is needed (p.137).	Poor - Logging roads contribute to sediment problems in Big; banks are hardened with riprap in lower Little; bank armoring and dike construction exacerbates flooding and channel scour in Big; channel instability in both (p.137-8).	Yes	(p. 146) Need to address loss of side channels

ESU/ WRIA	Population/Stock	Community/ Start Date/ Total Yrs	River	Number of Policies	(Total census, FEMA), % Pop Growth by WRIA 1990-2001, PSAT	[% change in County since Start Date, OFM] % change in County by 2025	Watershed Rating/ LF-Floodplain	Watershed Rating/ LF-Riparian	Watershed Rating/ LF-Flows	Watershed Rating/ LF-Bank and Channel	ESU Limiting Factors/ FP, Rip, Flow, B&C	Future threats
	Salmon/ Snow (17)	Jefferson Co 1982, 25	SS	119	14370 (34%)	[59.6%]34%	Poor-Y(sc): Loss of side channels as LF affecting spawning and incubation (p. 103-4).	Poor - Limiting Factor and lost or degraded in both creeks; 75% or more of riparian area is young forest or ag in both creeks (p. 103-4).	Fair - Increases in peak flows a LF and leads to scour of redds in Salmon creek; Increased peak flow and low summer flows LF for spawning and incubation in Snow Creek (p.103-4).	Poor - Fines and aggradation LF in both creeks; re-routing of channel and loss of instream complexity in Snow creek (p. 103-4).	Yes	(p. 116) Need to address loss of side channels
	JimmyCL (17)	Clallam Co 1980, 27	JCL	355	33800 (34%)	[25.9%]16%	Poor-Y(sc): Loss of side channels as LF affecting spawning and incubation (p. 101).	Not rated - LF- mature forest lost to 62% of riparian in young forest, ag, roads and dikes, res. use (p.101-2).	Fair - increased peak flows leads to increased bed scour affecting spawning and incubation (p.101).	Poor - LF include loss of LWD, bank hardening, channel instability, loss of side channels, aggradation , increased bed scour (p. 101).	Yes	

Appendix 2. Credit points awarded for CRS activities

CRS CREDIT POINTS BY ACTIVITY

ACTIVITY	MAXIMUM POSSIBLE POINTS[1]	AVERAGE POINTS EARNED[2]	MAXIMUM POINTS EARNED[3]	PERCENTAGE OF COMMUNITIES CREDITED[4]
300 Public Information Activities				
310 Elevation Certificates	162	69	142	100%
320 Map Information Service	140	138	140	95%
330 Outreach Projects	380	90	290	86%
340 Hazard Disclosure	81	19	81	61%
350 Flood Protection Information	102	24	66	87%
360 Flood Protection Assistance	71	53	71	48%
400 Mapping & Regulatory Activities				
410 Additional Flood Data	1,346	86	521	29%
420 Open Space Preservation	900	191	734	83%
430 Higher Regulatory Standards	2,740	166	1,041	85%
440 Flood Data Maintenance	239	79	218	68%
450 Stormwater Management	670	98	490	74%
500 Flood Damage Reduction Activities				
510 Floodplain Management Planning	359	115	270	20%
520 Acquisition and Relocation	3,200	213	2,084	13%
530 Flood Protection	2,800	93	813	6%
540 Drainage System Maintenance	330	232	330	69%
600 Flood Preparedness Activities				
610 Flood Warning Program	255	93	200	30%
620 Levee Safety	900	198	198	1%
630 Dam Safety	175	66	87	81%

[1] *The maximum possible points are based on the 2006* ***CRS Coordinator's Manual.***

[2] *The average points earned are based on communities' scores as of May 1, 2005, and do not include growth adjustments or the new credits provided in the 2006* ***CRS Coordinator's Manual***

.[3] *The maximum points earned are the highest scores attained by a community as of May 1, 2005 and do not include growth adjustments. In some cases many communities have attained the maximum points listed.*

[4] *The percentage of communities credited is as of May 1, 2005.*

CRS RANKING BY COMMUNITY

COMMUNITY NUMBER	COMMUNITY NAME	CRS ENTRY DATE	CURRENT EFFECTIVE DATE	CURRENT CLASS
	Washington			
530073	Auburn, City of	10/1/92	05/1/02	7
530074	Bellevue, City of	10/1/92	05/1/06	5
530153	Burlington, City of	10/1/94	04/1/99	6
530103	Centralia, City of	10/1/94	10/1/99	7
530104	Chehalis, City of	10/1/94	05/1/04	6
530024	Clark County	10/1/04	10/1/04	7
530051	Ephrata, City of	10/1/00	10/1/00	8
530200	Everson, City of	10/1/94	10/1/99	8
530140	Fife, City of	05/1/06	05/1/06	7
530166	Index, Town of	04/1/98	04/1/98	8
530079	Issaquah, City of	10/1/92	10/1/02	5
530071	King County	10/1/91	10/1/05	2
530156	La Conner, Town of	10/1/96	10/1/97	8
530102	Lewis County	10/1/94	10/1/99	7
530316	Lower Elwha Klallam Tribe	10/1/00	05/1/05	7
530169	Monroe, City of	10/1/91	05/1/06	5
530158	Mount Vernon, City of	05/1/97	10/1/02	6
530085	North Bend, City of	10/1/95	05/1/06	6
530138	Pierce County	10/1/95	04/1/00	3
530088	Renton, City of	10/1/94	10/1/99	7
530151	Skagit County	04/1/98	10/1/03	6
535534	Snohomish County	05/1/06	05/1/06	5
530090	Snoqualmie, City of	10/1/92	05/1/02	5
530173	Sultan, City of	10/1/03	10/1/03	8
530204	Sumas, City of	10/1/93	04/1/98	7
530188	Thurston County	10/1/00	10/1/00	5
530198	Whatcom County	10/1/96	10/1/01	7

(Rankings provided Pers. Com. Dan Sokol, 9/3/08)

APPENDIX 3

Tier One and Tier Two Salmon Populations and Associated NFIP Communities

APPENDIX 3

Tier One and Tier Two Salmon Populations and Associated NFIP Communities

NMFS provides the following priority for implementation, which is based on an evaluation of population characteristics contributing to the ESU or DPS overall viability. "Tier One" populations must be restored to a low extinction risk status, because their contribution to the abundance, diversity, spatial structure and productivity of the ESU or DPS are critical to ESU or DPS viability. The loss of any of these populations would significantly weaken prospects for the restoration of the ESU or DPS to a viable status, diminishing the likelihood of survival and recovery of the entire ESU or DPS. Categorization of a population as Tier One means that steps must be taken more immediately to reduce its risk of extirpation.

"Tier Two" populations may also have traits that are important for ESU or DPS viability, but their contribution to ESU or DPS abundance, diversity, spatial structure and productivity is less important than Tier One populations. Steps taken to afford stability and recovery of Tier Two populations improve the likelihood of survival and recovery of the ESU or DPS, but are not as vital and time-sensitive as changes to safeguard Tier One populations.

The following communities influence Tier 1 Puget Sound Chinook populations:

- Whatcom County and all NFIP communities adjacent to the North and South Forks of the Nooksack River (Bellingham, Everson, Ferndale, Lummi Nation, Lynden, Nooksack).,
- Skagit County and all NFIP communities, adjacent to the Skagit River, the Sauk River, and the Suiattle Rivers (Burlington, Hamilton, LaConner, Lyman, Mount Vernon, and Sedro-Wooley).
- Pierce County and all NFIP communities adjacent to the White River (Buckley, Fife, Puyallup, Sumner, Tacoma).
- Clallam County and all NFIP communities adjacent to the Elwha and Dungeness Rivers (Lower Elwha Tribe, Sequim).
- Island County and all NFIP communities affecting estuarine floodplains (Coupeville, Langley, Oak Harbor).
- Thurston County and all NFIP communities affecting the Nisqually River (Yelm).
- Jefferson County and all NFIP communities affecting estuarine areas (Port Townsend), and affecting the Hamma Hamma, Duckabush, and Dosewallips Rivers.

- King County and all NFIP communities affecting the White River (Enumclaw, Milton, Pacific).

- Snohomish County and all NFIP communities affecting Sauk River (Darrington).

The following communities influence Tier 1 Hood Canal summer-run chum populations:

- Jefferson County and all NFIP communities adjacent to the Big and Little Quilcene, Hamma Hamma, Duckabush, and Dosewallips Rivers.

- Clallam County and all NFIP communities adjacent to Snow and Salmon Creeks, and Jimmycomelately Creek.

- Mason County and all NFIP communities adjacent to Union and Lilliwaup Rivers.

Adopting revised floodplain ordinances as soon as possible in these Tier One areas is necessary to prevent jeopardy, and adverse modification of critical habitat, and enable recovery of Puget Sound Chinook and Hood Canal chum. These salmon populations are already at high risk of extirpation, with critically low population numbers. Development activities in these locations affect Tier 1 populations that must be recovered to a low extinction risk status for the Puget Sound Chinook and Hood Canal summer chum salmon ESUs to be considered viable and eventually warranting delisting under the ESA

The following communities influence Puget Sound Chinook Tier two populations:

- Skagit County and all NFIP communities adjacent to the Lower Sauk River (Concrete).

- Snohomish County and all NFIP communities adjacent to the North Fork and South Fork of the Stillaguamish River and Sauk River (Arlington, Everett, Gold Bar, Granite Falls, Index, Monroe, Snohomish, Stanwood, Sultan).

- King and Snohomish Counties, and all NFIP communities adjacent to Skykomish and Snoqualmie Rivers (Auburn, Burien, Carnation, Duvall, Kent, North Bend, Seattle, Skykomish, Snoqualmie, Tukwila, Woodinville).

- Pierce and King Counties, and all NFIP communities adjacent to the Puyallup River and the Green River (Orting, South Prairie, Wilkeson).

- Pierce and Thurston Counties, and all NFIP communities adjacent to the Nisqually River.

- Kitsap County - Bainbridge Island, Bremerton, Port Orchard, Poulsbo.

The following communities support Hood Canal chum Tier two populations:

- Jefferson County and all NFIP participating communities adjacent to Chimicum Creek.

- Kitsap County, and all NFIP communities adjacent to Big Beef and Anderson Creeks.

- Mason County and all NFIP communities adjacent to Tahuya, Dewatto, and Skokomish Rivers, and Finch Creek (Skokomish Tribe).

All other Puget Sound NFIP communities are a third priority for implementing RPA elements 2-6.

Specific population level information, and their priority for supporting the Puget Sound steelhead DPS is currently unavailable. Lacking this information, NMFS takes the position that NFIP revisions required by the RPA and implemented in a sequence to avoid jeopardy to, and adverse modification of critical habitat of Puget Sound Chinook, and Hood Canal summer-run chum will afford similar protections to the Puget Sound steelhead DPS, and avoid jeopardy to the DPS. Critical habitat is currently not designated for this species, but implementation of the RPA will avoid destruction or adverse modification to such critical habitat after such designation is effective.

Final Supplement Table 1. Puget Sound Chinook Populations and Risk Status for ESU Viability

	Chinook Populations	Need to be at Low Risk For ESU viability
Strait of Georgia	North Fork Nooksack South Fork Nooksack	North Fork Nooksack South Fork Nooksack
Strait of Juan de Fuca	Elwha Dungeness	Elwha Dungeness
Hood Canal	Skokomish Mid-Hood Canal	Skokomish Mid-Hood Canal
Whidbey Basin	Skykomish (late) Snoqualmie (late) NF Stillaguamish (early) SF Stillaguamish (moderately early) Upper Skagit (moderately early) Lower Skagit (late) Upper Sauk (early) Lower Sauk (moderately early) Suiattle (very early) Cascade (moderately early)	Suiattle (very early) and 1 each of the early, moderately early, and late forms
Central/South Sound	Samammish (late) Cedar (late) Green/Duwamish (late) Puyallup (late) White (early) Nisqually (late)	White (early) and Nisqually or 1 of the other late forms[3]

APPENDIX 4

Minimum Criteria

Appendix 4: Minimum Criteria

It is the purpose of the following criteria to maintain streams and floodplains in their natural state to the maximum extent possible so they support healthy biological ecosystems, by: 1) assuring that flood loss reduction measures under the NFIP protect natural floodplain functions and riparian habitat, and the natural processes that create and maintain fish habitat, and 2) preventing or minimizing loss of hydraulic, geomorphic, and ecological functions of freshwater and estuarine floodplains and stream channels.

In all 100-year floodplain areas (SFHAs) the following criteria apply:

1. Restrict Development in the Riparian Buffer Zone for all watercourses including off channel areas (areas outside this zone but within the Special Flood Hazard Area) to provide necessary protection to the RBZ. The RBZ is the greater of the following:

- 150 feet measured perpendicularly from ordinary high water for Type S (Shorelines of the State) and F (fish-bearing)streams; 100 feet for N (nonsalmonid-bearing) streams, lakes and marine shorelines, and 50 feet for U (untyped) streams,
- the Channel Migration Zone[22] plus 50 feet; and
- the mapped Floodway.

The Riparian Buffer Zone is an overlay zone that encompasses lands as defined above on either side of all streams, and for all other watercourses including off channel areas. The RBZ is a no-disturbance zone, other than for activities that will not adversely affect habitat function. Any property or portion thereof that lies within the RBZ is subject to the restrictions of the RBZ, as well as any zoning restrictions that apply to the parcel in the underlying zone. Restrictions in this area apply to all development, per the definition of development.[23] Uses that are not

[22] The lateral extent of likely movement along a stream reach during the next one hundred years with evidence of active stream channel movement over the past one hundred years. Evidence of active movement can be provided from aerial photos or specific channel and valley bottom characteristics. A time frame of one hundred years was chosen because aerial photos and field evidence can be used to evaluate movement in this time frame. Also, this time span typically represents the time it takes to grow mature trees that can provide functional large woody debris to most streams. In large meandering rivers a more detailed analysis can be conducted to relate bank erosion processes and the time required to grow trees that function as stable large woody debris.

With the exception of shorelands in or meeting the criteria for the "natural" and "rural conservancy" environments, areas separated from the active channel by legally existing artificial channel constraints that limit bank erosion and channel avulsion without hydraulic connections shall not be considered within the CMZ. All areas, including areas within the "natural" and "rural conservancy" environments, separated from the natural channel by legally existing structures designed to withstand the 100-year flood shall not be considered within the CMZ. A tributary stream or other hydraulic connection allowing listed species fish passage draining through a dike or other constricting structure shall be considered part of the CMZ.

[23] Development. Any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations, storage of equipment or materials, or any other activity which results in the removal of substantial amounts of vegetation or in the alteration of natural site characteristics located within the area of special flood hazard.

permitted unless shown not to adversely affect water quality, water quantity, flood volumes, flood velocities, spawning substrate, and/or floodplain refugia for listed salmon, include the following: new buildings, including accessory buildings; new impervious surfaces; removal of native vegetation; new clearing, grading, filling, land-disturbing activity or other “development” (see definition), other than for the purpose of replacing non-native vegetation with native vegetation, and for other approved restoration work; septic tanks and drain fields, dumping of any materials, hazardous or sanitary waste landfills; receiving areas for toxic or hazardous waste or other contaminants; and, stream relocations, unless the primary function of the action is to restore natural ecological function.

In the RMZ the following uses are allowed: [1] repair or remodel of an existing building in its existing footprint, including buildings damaged by fire or other casualties; [2] removal of noxious weeds; [3] replacement of non-native vegetation with native vegetation; [4] ongoing activities such as lawn and garden maintenance; [5] removal of hazard trees; [6] normal maintenance of public utilities and facilities; and [7] restoration or enhancement of floodplains, riparian areas and streams that meets Federal and State standards

2. Protect fish habitat and flood storage in the remaining 100-year floodplain (outside the RMZ) by either:

a.) Prohibiting development in the 100-year floodplain, OR

b.) Providing compensation for any effects to floodwater storage and fish habitat function within the 100-year floodplain.

Any development in the 100-year floodplain must be compensated, for example, through the creation of an equivalent area and volume of floodwater storage and fish habitat through a balanced cut and fill program. The new flood storage/habitat area must be graded and vegetated to allow fish refugia during flood events and return to the main channel as floodwaters recede without creating stranding risks. In addition, equivalent area, if not located on site, must be located in priority floodplain restoration areas identified in the ESU Recovery Plan for listed species.

3. Mitigate for all indirect effects of development in the floodplain (effects to stormwater, riparian vegetation, bank stability, channel migration, hyporheic zones, wetlands, LWD, etc.) such that equivalent or better salmon habitat protection is provided.

Stormwater. Reduce flood volumes and stormwater runoff from new development by ensuring that increased volumes of stormwater reach the river at the same frequency, timing, and duration as historical runoff. Low Impact Development (LID) methods are required to treat and infiltrate runoff as described in PSAT 2002. These methods generally include various practices for infiltrating stormwater to provide water quality treatment, match historical runoff durations, and preserve base flows.

Riparian vegetation: Maintain or replace riparian function by providing equivalent area, diversity, and function of riparian vegetation as currently exists on the site (per WDFW riparian management recommendations (Knutson and Naef 1997).

Bank Stability: Bank stabilization measures along salmonid-bearing streams, channel migration zones, and along estuarine and marine shorelines must be minimized to the maximum extent possible. If bank stabilization measures are necessary, bioengineered armoring of streambanks and shorlines must be used (per the Integrated Streambank Protection Guidelines 2003 (for riverine shorelines) or the State Shorelines Guidelines on bank stabilization (2003) (for estuarine and marine shorelines).

Channel migration. No activity is allowed that limits the natural meandering pattern of the channel migration zone, however, natural channel migration patterns may be enhanced or restored (see Rapp and Abbe 2003, for delineating channel migration zones).

Hyporheic zones. No activity is allowed that interferes with the natural exchange of flow between surface water, groundwater and the hyporheic zone, however, natural hyporheic exchange may be enhanced or restored (see Bolton and Shelberg. 2001 for hyporheic zone issues).

Wetlands. Wetland function must be maintained or replaced by providing equivalent function per Washington State Department of Ecology (McMillan 1998) regulations.

LWD. Any LWD removed from the floodplain must be replaced in kind, replicating or improving the quantity, size, and species of the existing LWD (per WDFW Aquatic Habitat guidelines).

In the 100-year floodplain outside the Riparian Buffer Zone the following apply:

1) For buildable lots partially in the floodplain, require structures to be located on the portion of the lot outside of the mapped floodplain. Where a buildable lot is fully in the floodplain, structures must be sited in the location that has the least impact on listed salmon, e.g., located as far from the stream or river as possible on the lot, placing structures on the highest land on the lot, orienting structures parallel to flow rather than perpendicular, and avoiding disruption of active hyporheic exchange on a site.

2) Require zoning to maintain a low density (e.g., 5-acre lots or greater) of floodplain development to reduce the damage potential within the floodplain to both property and habitat, and help maintain flood storage and conveyance capacity.

3) All structures must be set back at least 15 feet from the RBZ and shall be sited as close to the 100-year floodplain boundary as possible.

4) In an effort to site structures as far away from the watercourse and RBZ as possible, the applicant will be apprised of the elevations of the 10-year and 50-year floods in detailed study

areas at the same time that the (city, county) provides the 100-year elevation as a part of the permit review. The applicant, in addition to plotting the 100-year elevation near the building site, will also plot the 10 and 50-year elevations on the land. The purpose is to show the applicant the significantly lower risk of placing the structure further away from the watercourse.

5) Structures built using post, pier, piling or stemwall construction may require less mitigation than structures built on earth fill, but must provide equivalent mitigation for lost fish habitat and indirect effects from development.

6) Creation of new impervious surfaces[24] shall not exceed 10 percent of the surface area of the portion of the lot in the floodplain unless mitigation is provided.

7) Removal of native vegetation must leave 65 percent of the surface area of the portion of the lot in the floodplain in an undeveloped state; the 65 percent pertains to the entire portion of the lot in the floodplain, including that area in the RBZ, where removal of native vegetation is generally prohibited.

8) The proposed action must be designed and located so that it will not require new structural flood protection (e.g., levees).

9) During the floodplain permit review process, applicants shall be notified that their property contains land within the Riparian Buffer Zone and/or 100-year floodplain, and that the applicant is required to record a Notice on Title on the property before a permit may be issued. Applicants shall be further notified that development in the RBZ and 100-year floodplain can only occur according to the above criteria.

10) New road crossings over streams are prohibited.

11) Concepts of cluster development, density transfer, credits and bonuses, planned unit development, and transfer of development rights shall be employed wherever possible.

12) Any flood information that is more restrictive or detailed than the FEMA data can be used for flood loss reduction and/or fisheries habitat management purposes, including data on channel migration, more restrictive floodways, maps showing future build-out and global climate change conditions, specific maps from watershed or related studies that show riparian habitat areas, or similar maps.

In the RBZ and the floodplain the following re-development criteria apply:

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[24] Any material or land alteration (i.e. clearing, grading, etc.) which reduces or prevents absorption of storm water into the ground. That hard surface area which either prevents or retards the entry of water into the soil, water that had entered under natural conditions prior to development; and/or that hard surface area that causes water to run off the surface in greater quantities or at an increased rate of flow from that present under natural conditions prior to development. Common impervious surfaces include, but are not limited to: roof tops, walkways, patios, driveways, parking lots or storage areas, concrete or asphalt paving, gravel roads, and packed earthen materials.

1) Require that expansion to existing buildings in the floodplain be limited to no more than 10 percent of the existing footprint (i.e., when building and other structures such as garages are substantially damaged or expanded in the floodplain), unless mitigation for any adverse effects to floodplain habitat is provided, as described above .

4. Communities choosing to implement the mitigation option (2.b. above) must track the projects for which they issue floodplain development permits, including effects to flood storage, fish habitat, and all indirect direct of development. The expected development effects, the equivalent mitigation provided, and the success of the mitigation in replacing the affected fish habitat and flood storage functions shall be reported to FEMA on a semi-annual basis (according to the monitoring requirements in RPA element 3.D)