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

Refer to NMFS No:
NWR-2011-3197

April 14, 2016

Mark Eberlein
U.S. Department of Homeland Security
FEMA Region X
130 228th Street SW
Bothell, Washington 98021

Re: Endangered Species Act (ESA) Section 7(a)(2) Jeopardy and Adverse Modification of Critical Habitat Biological Opinion, ESA Section 7(a)(2) "Not Likely to Adversely Affect" Determination, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Implementation of the National Flood Insurance Program in the State of Oregon

Dear Mr. Eberlein:

On July 18, 2011, I received your letter requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Federal Emergency Management Agency's (FEMA's) implementation of the National Flood Insurance Program (NFIP) in Oregon. The enclosed document contains a biological opinion (opinion) prepared in response to your request.

As in the draft opinion shared with FEMA on September 6, 2013, in this final opinion, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of Southern green sturgeon or to destroy or adversely modify its designated critical habitat. However, NMFS concludes that the proposed action is likely to jeopardize the continued existence of 16 ESA-listed anadromous fish species and Southern Resident killer whales, and it will result in the destruction or adverse modification of designated or proposed critical habitat for the 16 anadromous fish species. A reasonable and prudent alternative (RPA) is included in this opinion.

Section 7(b)(3)(A) of the ESA requires that if a jeopardy determination is made for the affected species, or if destruction or adverse modification of critical habitat will result, then NMFS must provide an RPA that would not violate ESA section 7(a)(2) and can be implemented by the Federal agency or applicant. In this case, NMFS identified an RPA composed of six elements:

1. Notice, education, and outreach to NFIP participating communities in Oregon regarding the outcome of FEMA's consultation with NMFS on the implementation of the NFIP in Oregon.

2. Interim measures that FEMA and its NFIP participating communities can promptly implement to reduce the impacts of floodplain development on natural floodplain functions needed to support listed species. These interim measures are to be implemented during the 8.5 year time-frame anticipated for FEMA to complete the mapping updates and implement the modifications to the NFIP's minimum criteria and reporting requirements identified in elements 2 through 5 of the RPA.

3. Revised mapping protocols to improve the identification of special hazard areas, including channel migration zones and areas of future risk.

4. Revised floodplain management criteria to provide greater certainty that the impacts of development in areas of high hazard will be avoided, minimized, and mitigated to protect natural floodplain functions.

5. Data collection and reporting requirements needed to accurately track floodplain development impacts and RPA implementation.

6. Compliance and enforcement strategies to ensure that effects of floodplain development pursuant to the NFIP are avoided or reduced throughout the action area.

Implementation of this RPA would avoid jeopardy to 16 ESA-listed anadromous fish species and Southern Resident killer whales and avoid destruction or adverse modification of designated or proposed critical habitat for the 16 anadromous fish species.

We also conclude that the proposed action is not likely to adversely affect 10 ESA-listed marine mammal and turtle species, or designated critical habitat for leatherback sea turtles.

This document also includes our analysis of the action's likely effects on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The analysis assumes implementation of the RPA and includes six EFH conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH (see Section 3.3 of the opinion). Section 305(b)(4)(B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations.

If the response is inconsistent with the EFH conservation recommendations, FEMA must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the proposed action and our recommendations. In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many of the recommendations are adopted. Therefore, we request that in your required reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted by FEMA for implementation.

If you have questions regarding this ESA and MSA consultation, please contact Bonnie Shorin, at bonnie.shorin@noaa.gov.

Sincerely,

William W. Stelle, Jr.
Regional Administrator
NMFS West Coast Region

cc: Amy Weinhouse, FEMA

Endangered Species Act (ESA) Section 7(a)(2) Jeopardy and Destruction or Adverse Modification of Critical Habitat Biological Opinion and Section 7(a)(2) "Not Likely to Adversely Affect" Determination

for the

Implementation of the National Flood Insurance Program in the State of Oregon

NMFS Consultation Number: NWR-2011-3197

Action Agency: Federal Emergency Management Agency

Affected Species and Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Lower Columbia River Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened	Yes	Yes	Yes
Upper Willamette River spring-run Chinook salmon (*O. tshawytscha*)	Threatened	Yes	Yes	Yes
Upper Columbia River spring-run Chinook salmon (*O. tshawytscha*)	Endangered	Yes	Yes	Yes
Snake River spring/summer-run Chinook salmon (*O. tshawytscha*)	Threatened	Yes	Yes	Yes
Snake River fall-run Chinook salmon (*O. tshawytscha*)	Threatened	Yes	Yes	Yes
Columbia River chum salmon (*O. keta*)	Threatened	Yes	Yes	Yes
Lower Columbia River coho salmon (*O. kisutch*)	Threatened	Yes	Yes	Yes
Oregon Coast coho salmon (*O. kisutch*)	Threatened	Yes	Yes	Yes
Southern Oregon/Northern California Coast coho salmon (*O. kisutch*)	Threatened	Yes	Yes	Yes
Snake River sockeye salmon (*O. nerka*)	Threatened	Yes	Yes	Yes
Lower Columbia River steelhead (*O. mykiss*)	Threatened	Yes	Yes	Yes
Upper Willamette River steelhead (*O. mykiss*)	Threatened	Yes	Yes	Yes
Middle Columbia River steelhead (*O. mykiss*)	Threatened	Yes	Yes	Yes
Upper Columbia River steelhead (*O. mykiss*)	Threatened	Yes	Yes	Yes
Snake River Basin steelhead (*O. mykiss*)	Threatened	Yes	Yes	Yes

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Southern green sturgeon (*Acipenser medirostris*)	Threatened	Yes	No	No
Southern eulachon (*Thaleichthys pacificus*)	Threatened	Yes	Yes	Yes
Southern resident killer whale (*Orcinus orca*)	Endangered	Yes	Yes	No
Humpback whales (*Megaptera novaeangliae*)	Endangered	No*	No	NA
Blue whales (*Balaenoptera musculus*)	Endangered	No*	No	NA
Fin whales (*B. physalus*)	Endangered	No*	No	NA
Sei whales (*B. borealis*)	Endangered	No*	No	NA
Sperm whales (*Physeter macrocephalus*)	Endangered	No*	No	NA
North Pacific Right whales (*Eubalaena japonica*)	Endangered	No*	No	NA
Loggerhead sea turtles (*Caretta caretta*)	Threatened	No*	No	NA
Green sea turtles (*Chelonia mydas*)	Endangered	No*	No	NA
Leatherback sea turtles (*Dermochelys coriacea*)	Endangered	No*	No	NA
Olive Ridley sea turtles (*Lepidochelys olivacea*)	Endangered	No*	No	NA

*Please refer to Section 2.12 for the analysis of species or critical habitat that are not likely to be adversely affected.

Fishery Management Plan That Describes EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast salmon	Yes	Yes
Pacific coast groundfish	Yes	Yes
coastal pelagic species	Yes	Yes
highly migratory species	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued by:

William W. Stelle, Jr.
Regional Administrator
NMFS West Coast Region

Date: April 14, 2016

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LIST OF ACRONYMS

A/P	Abundance and Productivity
BA	Biological Assessment
BFE	Base Flood Elevation
BIA	Bureau of Indian Affairs
BLM	US Bureau of Land Management
BMP	Best Management Practice
BOR	Bureau of Reclamation
BPA	Bonneville Power Administration
BRT	Biological Review Team
CAC	Community Assistance Contact
CAP-SSSE	Community Assistance Program – State Support Services Element
CAV	Community Assistance Visit
CFR	Code of Federal Regulations
CHART	Critical Habitat Analytical Review Team
CLOMA	Conditional LOMA
CLOMC	Conditional Letter of Map Change
CLOMR	Conditional LOMR
CLOMR-F	Conditional LOMR-F
CR	Columbia River
CRS	Community Rating System
CWA	Clean Water Act
DDT	dichlorodiphenyltrichloroethane
DFO	Department of Fisheries and Oceans, Canada
DLCD	Oregon Department of Land Conservation and Development
DOGAMI	Oregon Department of Geology and Mineral Industries
DPS	Distinct Population Segment
EFH	Essential Fish Habitat
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FCRPS	Federal Columbia River Hydropower System
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FR	Federal Register
GIS	Geographic Information System
HCP	Habitat Conservation Plan
HUC	Hydraulic Unit Code
IC	Interior Columbia

ITS	Incidental Take Statement
LCDC	Land Conservation and Development Commission, Oregon
LCR	Lower Columbia River
LOMA	Letter of Map Amendment
LOMC	Letter of Map Change
LOMR	Letter of Map Revision
LOMR-F	Letter of Map Revision based on Fill
MCR	Middle Columbia River
MHHW	Mean Higher-High Water
MPG	Major Population Group
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NFIA	National Flood Insurance Act
NFIP	National Flood Insurance Program
NLAA	Not Likely to Adversely Affect
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NWFSC	Northwest Fisheries Science Center
OAR	Oregon Administrative Rules
OC	Oregon Coast
ODFW	Oregon Department of Fish and Wildlife
OHW	Ordinary High Water
OR	Oregon
ORS	Oregon Revised Statutes
PAH	polycyclic aromatic hydrocarbons
PBDE	polybrominated diphenyl ethers
PCB	Polychlorinated Biphenyls
PCE	Primary Constituent Element
PFMC	Pacific Fishery Management Council
PMR	Physical Map Revision
POP	Persistent Organic Pollutants
RBZ	Riparian Buffer Zone
RIP	Rehabilitation and Inspection Program (currently known as the Levee Safety Program's Rehabilitation Program), U.S. Army Corps of Engineers
RPA	Reasonable and Prudent Alternative
RPM	Reasonable and Prudent Measure
SFHA	Special Flood Hazard Area
SONCC	Southern Oregon/Northern California Coasts
SPTH	Site-potential Tree Height
SR	Snake River
SRB	Snake River Basin

SRKW	Southern Resident Killer Whale
SS/D	Spatial Structure and Diversity
SWIF	System-wide Inspection Framework, U.S. Army Corps of Engineers
TRT	Technical Review Team
U.S.C.	United States Code
UCR	Upper Columbia River
USFS	U.S. Forest Service
UWR	Upper Willamette River
VSP	Viable Salmonid Population
WA	Washington
WLC	Willamette-Lower Columbia

1. INTRODUCTION

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

1.1 Background

The subject of this section 7 consultation under the Endangered Species Act (ESA) is the implementation of the Federal Emergency Management Agency's (FEMA's) National Flood Insurance Program (NFIP) in the State of Oregon. The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 *et seq*.), and implementing regulations at 50 CFR 402.

This consultation evaluates FEMA's program and whether it is designed in such a way as to ensure implementation of the program will not appreciably reduce the likelihood of the survival and recovery of ESA-listed species under NMFS' jurisdiction. Our evaluation is limited to those aspects of the proposed action within FEMA's purview and does not consider state or local floodplain management programs that may expand upon FEMA's program and be modified independent of FEMA's program. Furthermore, we evaluated the effects of the NFIP on the basis of the development actions that the program allows to occur and the manner in which they are allowed to be implemented (*e.g.*, what limits and requirements are associated with FEMA's floodplain development standards). In this consultation, we conclude that FEMA's proposed action is not structured in a manner that ensures that the effects of the activities that would be implemented under the program are not likely to jeopardize the continued existence of ESA-listed anadromous species that occur in Oregon and Southern Resident killer whales that prey on those species, or result in the destruction or adverse modification of critical habitat that has been designated or proposed for those anadromous species.

We also completed an essential fish habitat (EFH) consultation on the proposed action, 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.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). A complete record of this consultation is on file at our office in Portland, Oregon.

1.2 Consultation History

The NMFS received a letter and a biological assessment (BA) from FEMA on July 18, 2011, requesting formal consultation under the ESA for the implementation of the NFIP in the State of Oregon. Specifically, formal consultation was requested on three aspects of the NFIP:
(1) floodplain mapping, (2) the regulatory floodplain management criteria, and (3) the Community Rating System.

The BA did not provide individual determinations of effect by species or their associated critical habitats. Instead, the BA provided a general determination for all ESA-listed species and any associated critical habitats. At a program level, FEMA concluded that the implementation of the NFIP may affect, but is not likely to adversely affect ESA-listed species and their designated critical habitat. However, FEMA requested formal consultation for the site-specific effects associated with the issuance of floodplain development permits by NFIP participating communities. At the project scale, FEMA determined that ESA-listed species, and presumably their associated designated critical habitats, would be adversely affected.

In addition, the BA determined that the proposed action would adversely affect essential fish habitat (EFH) designated under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). Consequently, though not specifically included in FEMA's request, NMFS understands that FEMA is seeking EFH consultation on the proposed action.

Formal consultation was initiated on August 15, 2012. A brief chronological summary of relevant consultation events follows:

1. September 2008 - In response to a 2004 Federal court order, FEMA requested ESA consultation with NMFS, and NMFS subsequently issued a jeopardy biological opinion regarding implementation of the NFIP in the Puget Sound region of Washington State.
2. June 2009 - The Audubon Society of Portland, National Wildlife Federation, Northwest Environmental Defense Center, and Association of Northwest Steelheaders brought a lawsuit against FEMA alleging that FEMA violated section 7 of the ESA by not consulting with NMFS on the impacts of the NFIP in Oregon on fifteen species of salmon and steelhead listed under the ESA.
3. July 2010 - The parties in the lawsuit reached a settlement agreement, which required, in part, that FEMA request formal consultation on three aspects of the NFIP: 1) implementation of 42 U.S.C. 4102(c); 2) mapping of the floodplains and revisions thereof under 42 U.S.C. 4101(a)(1); and, the implementation of the Community Rating System pursuant to 42 U.S.C. 4022(b)(1).
4. August 2010 - NMFS received a request from FEMA to initiate informal consultation and to provide a species list, critical habitat list, and information regarding species' use of floodplains.
5. September 2010 - NMFS responded to FEMA's request.
6. July 2011 - FEMA requested formal consultation.
7. August 2011 - NMFS requested additional information prior to initiating formal consultation.
8. October 2011 - FEMA responded to NMFS' additional information request.
9. December 2011 – In an effort to determine if a common understanding of the proposed action existed, NMFS shared a draft proposed action description with FEMA for their review.
10. February 2012 – FEMA responded with comments on the draft proposed action description.

11. February 2012 – NMFS identified three aspects of the proposed action that needed further clarification.[1]
12. March 2012 – FEMA provided additional information that resolved two of the three remaining aspects of the proposed action.[2]
13. April 2012 – NMFS requested FEMA update the Community Rating System section of the proposed action.[3]
14. May 2012 – FEMA published a federal register notice regarding the intent to prepare an EIS on the NFIP as implemented nation-wide, including a preferred alternative to revise regulations to improve ESA compliance.
15. June 2012 – FEMA provided a revised description of the Community Rating System program.[4]
16. July 2012 – NMFS submitted written comments to FEMA regarding FEMA's national EIS offering a series of suggested revisions to the NFIP that would better protect ESA-listed resources.
17. August 2012 - FEMA agreed to provide additional information related to the remaining aspect of the proposed action within 90 days. FEMA and NMFS agreed on initiating formal consultation as of August 15 and to a 6-month extension of the statutory consultation timeline.[5] FEMA also requested a draft biological opinion for review and comment.
18. September 2012 - NMFS notified ten Northwest tribes that NMFS was in formal consultation with FEMA under the ESA regarding the modification of NFIP implementation in the State of Oregon. In the letter, NMFS offered to conduct technical-level meetings which could lead to formal government-to-government consultation under the Secretarial Order of June 5, 1997.[6]
19. December 2012 – NMFS and FEMA met individually with the Confederated Tribes of the Grand Ronde and the Cow Creek Tribe to discuss the proposed action.
20. December 2012 to March 2013 – FEMA provided additional information clarifying their proposed action.
21. March 2013 – FEMA provided text from a "final" biological assessment (March 13).
22. March 2013 – NMFS concluded consultation on March 15 and used the proposed action and data available on that date in drafting the biological opinion.
23. April 2013 – FEMA provided a complete copy of the final biological assessment (April 9).

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[1] E-mail correspondence from Rob Markle (NMFS) to Mark Eberlein (FEMA) regarding clarification of proposed action (February 24, 2012).

[2] E-mail correspondence from Mark Eberlein (FEMA) to Rob Markle (NMFS) regarding clarification of proposed action (March 9, 2012).

[3] Conference call between FEMA (Mark Eberlein, Barry Gall) and NMFS (Rob Markle) regarding the remaining proposed action needs (April 27, 2012).

[4] E-mail correspondence from Mark Riebau (FEMA) to Rob Markle (NMFS) regarding revised CRS program description (June 1, 2012).

[5] E-mail correspondence from Barry Gall (FEMA) to Rob Markle (NMFS) regarding information clarifying the proposed action and an extension of the consultation timeline (August 15, 2012).

[6] Individual written correspondences from Michael Tehan (NMFS) to the Chairs of ten Tribes (September 21, 2012).

24. June 2013 – NMFS requested, and FEMA agreed to, a 2-month extension to complete the draft opinion.
25. August 2013 – NMFS notified FEMA of a 2 week delay in completing the draft opinion.
26. September 2013 – NMFS provided FEMA a draft jeopardy opinion and requested comments within 60 days. On November 5, the agencies agreed to extend the comment period until January 4, 2014.
27. November 2013 – FEMA and NMFS regional managers met to discuss the proposed RPA.
28. January 2014 – By mutual agreement, FEMA and NMFS commenced discussions on the proposed RPA in the draft biological opinion pending formal written response from FEMA. Eight meetings were conducted between January 9 and March 20, 2014.
29. April 2014 – FEMA requested the suspension of interagency meetings.
30. May 2014 – FEMA provided written comments on the proposed RPA in the draft Oregon biological opinion (May 29).
31. June 2014 - FEMA and NMFS managers met to discuss completing the consultation.
32. October 2014 – In litigation against FEMA regarding FEMA's implementation of the NMFS NFIP Biological Opinion and Reasonable and Prudent Alternative for Puget Sound, Washington, the United States District Court for the Western District of Washington ruled in favor of FEMA, finding that the RPA was sufficiently non-specific regarding implementation methods so that plaintiff could not show that FEMA's methods were arbitrary or capricious.
33. December 2014 – Email corresponenence from the Oregon Department of Land Conservation and Development (DLCD).
34. December 2014 – NMFS released a revised draft RPA to FEMA for technical review and also received comments from stakeholders and groups with expertise.
35. January 2015 – NMFS reviewed submitted comments from FEMA, DLCD, ASFPM, and NGOs.
36. March 2015 – NMFS released a review copy of a revised RPA to FEMA.
37. August 2015 – NMFS released a review copy of the RPA to FEMA.
38. September 2015 – FEMA requested additional time to discuss the RPA; NMFS received comments on the RPA from FEMA.
39. December 8, 2015 – FEMA provided a "Proposed RPA Model" to NMFS.
40. January 6, 2016 – NMFS released a review copy of the revised RPA to FEMA.
41. February 12, 2016 – FEMA provided comments on the proposed RPA.
42. February 24, 2016 – Conference call between NMFS WCR and FEMA HQ and Region X.
43. March 7, 2016 – NMFS released a review copy of the revised RPA to FEMA.

This opinion is based on the best available information, including information presented in the BA, additional information provided by FEMA and the Oregon Department of Land Conservation and Development (DLCD), other informational sources (*e.g.*, Association of State Floodplain Managers), informational meetings, and the relevant scientific literature. Since September 2010, NMFS has participated in numerous informational meetings and conference calls related to the subject action. A summary of those meetings follows:

1. September 7, 2010 – Meeting with FEMA.

2. September 23, 2010 – Meeting with FEMA and Oregon DLCD.
3. October 15, 2010 – Conference call with FEMA, AECOM (FEMA contractor), and Oregon DLCD.
4. November 4, 2010 – Conference call with FEMA, AECOM, and Oregon DLCD.
5. January 3, 2011 – Meeting with Oregon DLCD.
6. February 17, 2011 – Meeting with FEMA, AECOM, and Oregon DLCD.
7. March 17, 2011 – Conference call with FEMA, AECOM, and Oregon DLCD.
8. March 24, 2011 – Meeting with FEMA, Oregon DLCD, Metro, and ODFW.
9. April 29, 2011 – Conference call with FEMA, AECOM, and Oregon DLCD.
10. June 2, 2011 – Meeting with NRCS.
11. June 2, 2011 – Meeting with USFS.
12. July 28, 2011 – Meeting with FEMA and Oregon DLCD.
13. September 6, 2011 – Meeting with Oregon DLCD.
14. September 12, 2011 – Meeting with Oregon Department of Geology and Mineral Industries (DOGAMI).
15. October 12, 2011 – Meeting with Oregon DLCD.
16. November 3, 2011 – Conference call with FEMA, AECOM, and Oregon DLCD.
17. November 9, 2011 – Meeting with Oregon Governor's Office and Oregon DLCD.
18. December 8, 2011 – Meeting with Oregon DLCD.
19. January 25, 2012 – Meeting with USGS.
20. April 27, 2012 – Conference call with FEMA.
21. July 19, 2012 – Conference call with FEMA.
22. July 24, 2012 – Meeting with Oregon DLCD, FEMA, and local representatives.
23. July 31, 2011 – Conference call with FEMA and DLCD.
24. July 24, 2012 – Meeting with Oregon DLCD, FEMA, and local representatives.
25. July 31, 2012 – Conference call with FEMA, and DLCD.
26. October 31, 2012 – Conference call with Confederated Tribes of the Grand Ronde and FEMA.
27. November 9, 2012 – Conference call with Cow Creek Tribe and FEMA.
28. December 6, 2012 – Conference call with FEMA.
29. December 18, 2012 – Conference call with FEMA.
30. January 23, 2013 – Conference call with FEMA.
31. September 27, 2013 – Conference call with FEMA.
32. November 26, 2013 – Meeting with FEMA.
33. January 9, 2014 – Meeting with FEMA.
34. January 22, 2014 – Meeting with FEMA.
35. February 6, 2014 – Conference call with FEMA.
36. February 13, 2014 – Meeting with FEMA.
37. February 20, 2014 – Meeting with FEMA.
38. March 6, 2014 – Meeting with FEMA.
39. March 10, 2014 – Meeting with FEMA.
40. March 20, 2014 – Meeting with FEMA.

41. April 17, 2015 – Meeting with FEMA.
42. June 4, 2014 – Meeting with FEMA.
43. August 12, 2014 – Meeting with DLCD and FEMA.
44. October 3, 2014 – Conference call with Association of State Flood Plain Managers.
45. October 16, 2014 – Meeting with Northwest Regional Floodplain Managers Association. May 12, 2015 – Meeting with FEMA, DLCD and Columbia River Inter-Tribal Fish Commission.
46. June 19, 2015 – Meeting with FEMA and DLCD.
47. July 20-21, 2015 – Meeting with FEMA, DLCD and local governments to discuss RPA in Salem and Pendleton, Oregon.
48. September, 3, 2015– Conference call with FEMA.
49. October 9, 2015 – Conference call NMFS, FEMA, and Council on Environmental Quality.
50. October 26, 2015 – Conference call between NMFS WCR and FEMA HQ and Region X.
51. October 28, 2015 – Conference call between NMFS WCR and FEMA HQ and Region X.
52. November 5, 2015 – Conference call between NMFS WCR and FEMA HQ and Region X.
53. November 12, 2015 – Conference call between NMFS WCR and FEMA HQ and Region X.
54. February 5, 2016 – Conference call between NMFS WCR and FEMA HQ and Region X.
55. March 16, 2016 – Conference Call between NMFS WCR and FEMA HQ and Region X.
56. March 17, 2016 – Meeting with FEMA, NMFS, and CEQ.

In addition to the meetings and conference calls listed above, numerous unscheduled discussions between FEMA, DLCD, and NMFS took place beginning in August 2010. A complete record of this consultation is on file at the Oregon Washington Coastal Area Office in Portland, Oregon.

1.3 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

The proposed action is the implementation of the National Flood Insurance Program (NFIP) in the State of Oregon. The NFIP is administered by the Federal Insurance and Mitigation Administration within FEMA. The DLCD is designated by the Governor as the state's coordinating agency for the NFIP.

This section presents a summary of the action as proposed by FEMA in their BA, as augmented by additional information provided by FEMA during consultation and publicly available information from FEMA. A description of the proposed action provided by FEMA can be found in the BA (Section 2.0).

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). The NFIA was enacted to provide previously unavailable flood insurance protection to property owners. "Under the program, federally funded engineering studies and modeling would be used to assess and map flood hazards. This information would be used to promote better land use and construction decisions, and thereby reduce future flood losses as the vulnerability to inundation diminished over time" (NAS 2015). Mudslide and flood-related erosion insurance protections were added in 1969 (Public Law 91-152) and 1973 (Public Law 93-234), respectively (44 CFR 59.2). In 1994, Congress repealed the findings provision for erosion (Public Law 103-325). Congress did not repeal other portions related to erosion. As related to the NFIP and this consultation, the 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;
- to assure that any Federal assistance provided under the program will be related closely to all flood-related programs and activities of the Federal government;
- to authorize continuing studies of flood hazards in order to provide for a constant reappraisal of the flood insurance program and its effect on land use requirements;
- to require States or local communities, as a condition of future Federal financial assistance, to participate in the flood insurance program and to adopt adequate flood plain ordinances with effective enforcement provisions consistent with Federal standards to reduce and avoid future flood losses; and
- to identify flood risks and provide flood risk information to the public.[7]

In Oregon, there are 32,021 NFIP flood insurance policies in force based on data available as of March 17, 2015.[8] These floodplain policies include $18.9 million in premiums and provide over $3.8 billion in insurance coverage. Residential policies dominate (88%). While varying annually, NFIP participation in Oregon has grown since program inception (Figure 1.3-1). The total number of NFIP insurance policies, including policy holders situated outside of identified floodplains, had an estimated average annual growth rate during the most recent 10-year period (2003-2012) of 2%.[9] Since 1978, there have been 5,283 flood damage losses and over $92 million paid out under the NFIP in Oregon.[10]

[7] 42 U.S.C. 4001-02.

[8] National Flood Insurance Program, BureauNet (http://bsa.nfipstat.fema.gov/reports/reports.html). Policies by Occupancy Type/Zone. Accessed on March 17, 2015.

[9] Data provided via e-mail from Sheila Marks (BureauNet) in response to a request from Rob Markle (NMFS) (March 4, 2013).

[10] National Flood Insurance Program, BureauNet (http://bsa.nfipstat.fema.gov/reports/reports.html). Claims by Occupancy Type/State, as of January 31, 2013. Accessed on March 17, 2015.

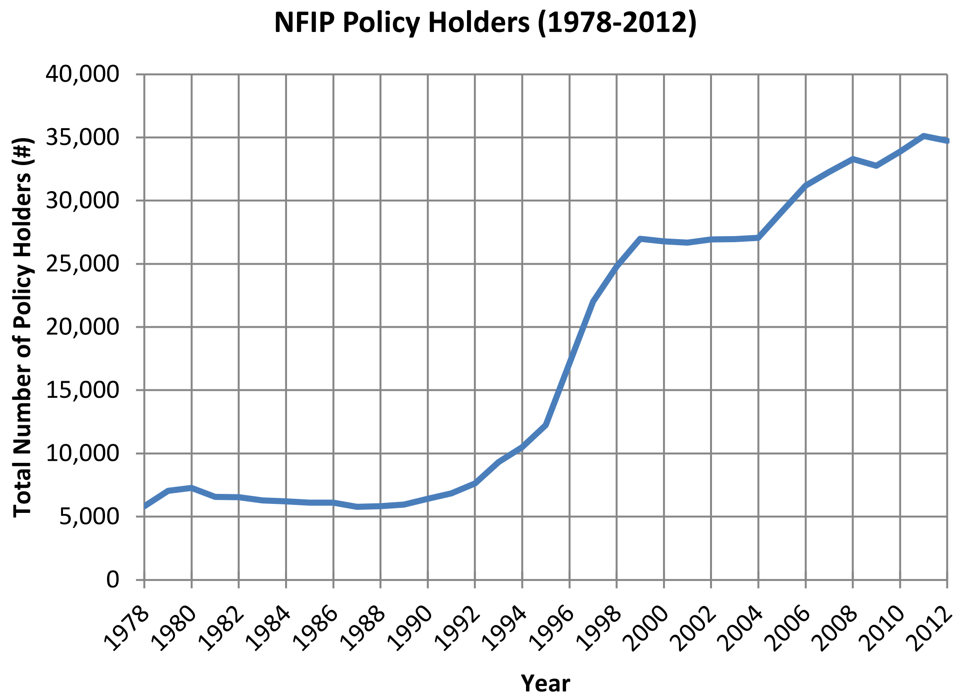

Figure 1.3-1. The total number of NFIP flood insurance policy holders in Oregon by year, 1978-2012.[11]

The NFIP is intended to reduce Federal expenditures for flood losses and disaster assistance by providing flood insurance at reasonable rates within communities[12] that choose to participate in the program and by requiring, as a condition of participation, that communities adopt effective land use and control measures to reduce or avoid future flood losses. The NFIA directs FEMA to develop, and revise from time to time, comprehensive criteria for land management and use, which, to the maximum extent feasible, will:

1. constrict the development of land which is exposed to flood damage;
2. guide development of proposed construction away from locations threatened by flood hazards;
3. assist in reducing flood damage; and
4. otherwise improve the long-range land management and use of flood-prone areas (42 U.S.C. 4102(c)).

In order to qualify for the program, communities must adopt land use controls at least as restrictive as the criteria established by FEMA.[13] FEMA has progumlgated regulations containing the federal criteria at 44 CFR Part 60, which we refer to in this opinion as FEMA's regulatory floodplain management criteria.

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[11] Data provided via e-mail from Sheila Marks (BureauNet) in response to a request from Rob Markle (NMFS) (March 4, 2013).

[12] A "community" is a governmental body with the statutory authority to enact and enforce zoning regulations, building codes, subdivision and other land use control measures.

[13] See 44 CFR Part 60, 42 U.S.C. 4012(c), and 42 U.S.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.

Participation in the NFIP is a voluntary agreement between communities and the Federal government. If a community adopts and enforces a floodplain management ordinance consistent with (or stricter than) FEMA's regulatory floodplain management criteria to reduce future flood risks within the regulatory floodplain, the Federal government will make flood insurance available to property owners in that community as a financial protection against flood losses. Participating communities must adopt and enforce minimum floodplain management criteria and apply the criteria uniformly to all privately and publicly owned land within the designated floodplain. In some instances, community officials may have access to information or knowledge of conditions that require higher standards than FEMA's regulatory floodplain management criteria. Therefore, any floodplain management regulations adopted by a State or a community which are more restrictive than FEMA's regulatory floodplain management criteria are encouraged and take precedence (44 CFR Part 60.1(d)).[14]

While the NFIP is a voluntary program, Goal 7 of Oregon's Statewide Planning Program requires communities to address flood hazards and specifies that participation in the NFIP constitutes compliance with this requirement. Goal 7 does not make NFIP participation compulsory. Nevertheless, nearly all of Oregon's communities (99%) participate in the NFIP. Of the 262 identified communities in Oregon, 260 communities participate in the NFIP, including communities with limited areas that are prone to flooding (31 communities) or no identified regulatory floodplains (9 communities).[15] In addition, three Indian tribes also participate: Confederated Tribes of the Umatilla Reservation, Confederated Tribes of the Warm Springs Reservation of Oregon, and Burns Paiute Tribe.

Currently, two Oregon communities do not participate in the NFIP (Appendix A of BA). These communities reportedly have extremely small flood hazard areas that, for other reasons, cannot be developed.

FEMA makes available flood insurance to all property owners in a participating community regardless of whether the property is in the floodplain or not. Therefore, through a community's participation in the NFIP, property owners in upland areas and in the forty communities with minimal or no identified flood risk are eligible to purchase flood insurance under the program.

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[14] FEMA comments on a draft proposed action description provided by NMFS for FEMA review on December 16, 2011. The response was provided by FEMA on February 15, 2012, and included edits within the document and additional information relevant to the consultation.

[15] Originally based on Appendix A of BA, but The National Flood Insurance Program Community Status Book was updated on September 11, 2014. Current versions are posted at *http://www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-community-status-book.*

The NFIP has three basic components: flood hazard mapping, floodplain insurance, and floodplain management. According to FEMA, flood insurance provides an alternative to publicly funded disaster assistance that reduces the ever escalating costs of repairing damage to buildings and their contents caused by floods. FEMA reports that costs to taxpayers for flood damages are reduced by over $1 billion a year nationally through communities implementing minimum floodplain management requirements and property owners purchasing flood insurance.[16] "Newer buildings constructed in compliance with floodplain regulations suffer approximately 80% less damage annually than those not built to current standards."[17]

> Another NFIP analysis showed that only 2% of NFIP claims examined were for new buildings constructed after communities received their flood maps and adopted their flood damage prevention ordinances, *i.e.*, 98% of the losses were to buildings that pre-dated community based floodplain management. Other studies have shown that the majority of new residential and other development is now directed away from areas subject to flood hazard areas thereby protecting life and property. [DLCD][18]

In its BA, FEMA proposes two elements associated with implementation of the NFIP in the State of Oregon: (1) ongoing existing NFIP aspects, and (2) proposed ESA-revisions specific to Oregon. Ongoing aspects are those that would remain unchanged from current implementation and are the same FEMA activities applied nationwide. Revised aspects are new implementation measures intended to address ESA and MSA concerns in Oregon.

According to FEMA, the agency lacks discretion over several elements of the NFIP. These elements include:

- Issuing flood insurance – 42 U.S.C. 4012(c).
- Handling flood insurance claims – 42 U.S.C. 4019.
- The requirement to establish regulatory floodplain management criteria for NFIP communities, although the specific criteria are discretionary – 42 U.S.C. 4102(c).
- Denying flood insurance coverage – 42 U.S.C. 4012(c) and 42 U.S.C. 4022(a)(1).
- Identifying and mapping flood-prone areas – 42 U.S.C. 4101.
- Revising Special Flood Hazard Area (SFHA) maps when requested by a State or local government to recognize map errors, revisions from physical changes, and revisions based on improved data, although FEMA retains discretion to also determine whether revisions are necessary based on an analysis of *all natural hazards affecting flood risks* – 42 U.S.C. 4101(f).
- Revision of flood hazards as a result of appeal or protest – 42 U.S.C. 4104(c).
- Identification of mudslide hazards – 42 U.S.C. 4101(b).

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[16] FEMA comments on a draft proposed action description provided by NMFS for FEMA review on December 16, 2011. The response was provided by FEMA on February 15, 2012, and included edits within the document and additional information relevant to the consultation.

[17] Oregon Department of Land Conservation and Development, Natural Hazards webpage. Available at: *http://www.oregon.gov/LCD/HAZ/floods.shtml*. Accessed on February 21, 2012.

[18] *Id.*

- Review and issuance of Letters of Map Amendment (LOMA) and Letters of Map Revision (LOMR) – 42 U.S.C. 4101(f) and (h).
- Notification of flood map changes – 42 U.S.C. 4101(h).
- Compendia of flood map changes – 42 U.S.C. 4101(i).
- Use of 1% annual-chance flood as the base flood standard.

FEMA identified other elements of the NFIP that are discretionary. Those elements fit within the three components of the NFIP that are the subject of this consultation: (1) floodplain mapping, (2) regulatory floodplain management criteria, and (3) the Community Rating System. Each of these program areas is comprised of a number of different activities. These components are the subject of this consultation.

By regulation, FEMA is required to avoid adverse impacts of floodplain development, restore and preserve the natural and beneficial values served by floodplains, and seek to attain the widest range of beneficial uses of the environment without degradation or risk to health and safety (44 CFR 9.2). In administering the NFIP, most of what is done by FEMA is performed on a program-wide basis (44 CFR 9.5(f)). As such, FEMA is required to apply an "8-step decision-making process" for "all regulations, procedures, or other issuances making or amending NFIP policy" (44 CFR 9.5(f)(1)). Under step 5 of that process, FEMA must "minimize the potential adverse impacts" of floodplain and wetland development, "restore and preserve the natural and beneficial values served by floodplains, and preserve and enhance the natural and beneficial values served by wetlands" (44 CFR 9.6(b)). Therefore, by our interpretation, when establishing NFIP standards and criteria (*i.e.*, when establishing criteria to carry forward the discretionary elements of the NFIP), FEMA is required to: (1) minimize the impacts of floodplain development, and (2) restore and preserve the natural and beneficial values served by floodplains, including those values that benefit NMFS' trust resources (44 CFR 9.5(f) and 44 CFR 9.6(b)).

1.3.1 Ongoing Actions

1.3.1.1 Floodplain Mapping

Under the NFIP, FEMA maps all areas of a community that have potential for growth and potential flood risks.[19] However, some areas may be designated as an undetermined flood risk (D-Zone). Mapping of flood hazards provides the data necessary to administer floodplain management regulations, rate flood insurance policies, and implement the mandatory flood insurance purchase requirement and the prohibition on Federal assistance.

FEMA delineates the regulatory floodplain as the land within a community subject to a 1% or greater chance of flooding in any given year. FEMA refers to this area as the Special Flood Hazard Area (SFHA), which is also commonly referred to as the 100-year floodplain. While not a statutory requirement of the NFIA, the SFHA is defined in FEMA's regulations as "land within

[19] FEMA comments on a draft proposed action description provided by NMFS for FEMA review on December 16, 2011. The response was provided by FEMA on February 15, 2012, and included edits within the document and additional information relevant to the consultation.

a community with a 1% chance or greater of flooding in any given year" (44 CFR 59.1). The Presidential Excutive Order 11988 defines the floodplain as "the lowland and relatively flat areas adjoining inland and coastal waters including floodprone areas of offshore islands, including *at a minimum*, that area subject to a 1% or greater chance of flooding in any given year" (emphasis added). Recently, FEMA has been mapping the 0.2% annual-chance flood area (500-year floodplain), although FEMA has not promulgated floodplain management regulations specific to this area. FEMA also has not acknowledged that mapping the 500-year floodplain constitutes a change in the regulatory floodplain or its jurisdictional area.

The 1% annual-chance flood represents a flood with the magnitude and frequency with a statistical probability of being equaled or exceeded once every 100 years. The statistical probability of flooding due to inundation is a function of location and time (Table 1.3-1). One way to describe it is that during a typical 30-year mortgage for a structure in the SFHA, there is a greater than one in four chance (26%) of a flood event impacting that structure. If the structure is located in the 50-year floodplain that probability would increase to 45% or greater, depending on its elevation. Another way to describe it is to use the average life expectancy in the United States.[20] Over an 80-year period, a person residing in the SFHA has a greater than 55% probability of experiencing a 1% chance flood, and if that person lived at the 50-year flood elevation the probability would be 80%.

Table 1.3-1. The statistical probability of flooding due to inundation is a function of location and time. The probability increases in a higher recurrence interval floodplain and an increased period of time.

Floodplain Recurrence Interval (year)	Exposure Time Period (years)									
	10	20	30	40	50	60	70	80	90	100
2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
5	89%	99%	100%	100%	100%	100%	100%	100%	100%	100%
10	65%	88%	96%	99%	99%	100%	100%	100%	100%	100%
25	34%	56%	71%	80%	87%	91%	94%	96%	97%	98%
50	18%	33%	45%	55%	64%	70%	76%	80%	84%	87%
100	10%	18%	26%	33%	39%	45%	51%	55%	60%	63%
500	2%	4%	6%	8%	10%	11%	13%	15%	16%	18%

Flood Insurance Study (FIS). A FIS is a report prepared by FEMA that summarizes flood hazards in a community. The analyses used to prepare the FIS are also used to prepare the Flood Insurance Rate Map (FIRM), which is the map that shows the flood hazard areas in the community. The FIRM is the basis for floodplain management, mitigation, and insurance activities in the NFIP. The FIS provides information to supplement the FIRM.

[20] The World Bank indicates the average life expectancy in the United States as of 2009 is 78.1 years. Available at: http://data.worldbank.org/country/united-states. Accessed on February 21, 2012.

The FIS may identify a community's principal flood problems (*e.g.*, causes of major floods, past major floods, historical flood data, gauge station locations) and flood protection measures (*e.g.*, channelization projects, levees, dams, local and state ordinances, open space easements in the floodplain). The FIS explains the engineering methods used in the study, including a hydrologic and hydraulic analyses. Hydrologic analyses are studies of the amount of water flowing in a stream during flood events (*e.g.,* peak discharges in cubic feet per second for the 10-, 2-, 1-, and 0.2% annual-chance floods[21]). For coastal areas, hydrologic analyses include storm surge analyses and parameters, astronomic tide effects, joint probability analysis, still-water elevation determination, wave setup analysis, and episodic erosion. Hydraulic analyses are studies that determine the water-surface elevations on streams, particularly the 100-year water-surface elevation, also referred to as the base flood elevation (BFE).

The hydrologic and hydraulic analyses are used to determine the base flood elevation and delineate floodplain boundaries, flood insurance risk zones, and regulatory floodways.

- The BFE is the water surface elevation of a flood having a 1% chance of being equaled or exceeded in any given year (44 CFR 63.4). The BFE includes backwater effects from other streams.
- The flood insurance risk zones are the zones used to determine flood insurance premium rates for properties in the community. The risk zones include SFHAs (*i.e.,* Zones A and V) and areas outside SFHAs (*i.e.,* Zones B, C, X, D, E and M).
- Pursuant to FEMA's regulations, a floodway is the channel of a river or other watercourse and the adjacent land areas that must be reserved to discharge the 1% annual-chance flood (base flood) without cumulatively increasing the water-surface elevation more than a designated height (per FEMA's regulations, 1 foot in height). Per FEMA's regulations, the floodway is not static or necessarily tied to geographic points and may be relocated if development occurs within the previously delineated area. Furthermore, floodways are not designated for areas that do not provide conveyance for the 1% annual-chance flood, for example, coastal zones (V-zones) or riverine areas that are influenced by tides. The computation of regulatory floodways on riverine flooding sources in coastal floodplains is based on the base flood discharge and elevations of the riverine flooding source only. The regulatory floodway must be terminated at the boundary of the V1-30, VE, or V Zone, or where the mean high tide exceeds the 1% annual-chance riverine flood elevation, whichever occurs further upstream. FEMA 2009, p. C-47.[22]

In some instances, FEMA has completed an FIS, but has not designated a floodway. Where a regulatory floodway has not been designated and designation is possible (*i.e.*, upstream of a V-Zone or where the mean high tide exceeds the 1% annual-chance riverine flood elevation), NFIP regulations condition development. In these cases, no new construction, substantial

[21] The 10%, 2%, 1%, and 0.2% annual-chance floods correspond to what are commonly referred to as the 10-, 50-, 100-, and 500-year floods, respectively.

[22] On March 20, 2014, FEMA informed NMFS that new mapping standards had been issued as of August 22, 2013 (FP 204-078-1). However, it is NMFS understanding that the new standards do not alter the substantive points referenced here.

improvements,[23] or other development (including fill) is permitted in Zones A1-30 and AE on the community's FIRM, unless it is demonstrated 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 1 foot at any point within the community (44 CFR 60.3(c)(10)).

FEMA may use approximate or detailed study methods in completing an FIS. Approximate study methods use resources such as topographic maps, aerial photographs, any available flood information, and rudimentary hydrologic and hydraulic analyses. This type of analysis allows FEMA to determine the general boundaries of the SFHA but is not sufficiently rigorous to determine BFEs and floodways.

Detailed study methods use comprehensive hydrologic and hydraulic analyses including engineering models. At a minimum, this type of analysis allows the determination of SFHAs and BFEs or flood depths to display on the FIRM. A detailed study will result in the publication of flood elevations and a flood profile. This requires local floodplain administrators to adopt those flood elevations, or higher elevations if better data is available, in their local floodplain management ordinances.

The level of study used by FEMA is discretionary, because the level of detail on a given flooding source is directly related to the available funding and the flood risk associated with an area. FEMA's intent in using this approach is to prioritize the use of funding in areas that have a greater flood risk to public safety and development. The FEMA lead, in conjunction with the Flood Map Project Management Team, decides which flooding source(s) within the community will be studied using detailed hydraulic analyses (FEMA 2009).[24] The Flood Map Project Management Team may be comprised of several "Mapping Partners," including:

- FEMA representatives, including Regional Project Officer, Assistance Officer, Project Officer, Project Engineer, Contracting Officer, and other Regional Office and Headquarter staff;
- Cooperating Technical Partner or other community representative;
- Flood Map Production Coordination Contractor representative;
- Study Contractor representative (optional); and
- State NFIP Coordinator or other State representative (optional).

The Mapping Partner performing the hydraulic analysis determines flood elevations for the 10%, 2%, 1%, and 0.2% annual-chance floods (10-, 50-, 100-, and 500-year floods), unless otherwise instructed by the FEMA lead.

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[23] A "substantial improvement" is defined by NFIP regulations as any repair, reconstruction, or improvement of a structure for which the cost equals or exceeds 50 percent of the market value of the structure either: (1) Before the improvement or repair started, or (2) if the structure has been damaged and is being restored, before the damage occurred.

[24] On March 20, 2014, FEMA informed NMFS that new mapping standards had been issued as of August 22, 2013 (FP 204-078-1). However, it is NMFS understanding that the new standards do not alter the substantive point referenced here.

FEMA conducts FISs for each community where flooding is perceived to be a risk and issues FIRMs that show the area subject to the 1% annual-chance flood. The main components of any study used to develop flood hazard data are topographic data, survey methodology, and flood hazard identification techniques (modeling and mapping). FISs often provide floodplain cross sections and flood profiles of the flood elevations along the stream centerline. Flood profiles may include elevations of the 10%, 2%, 1%, and 0.2% annual-chance floods.

Flood Maps. Accurate flood maps are a fundamental part of the NFIP. The level of flood risk varies in a community. Flood maps provide a means of displaying the flood risks determined by the FIS in an easily interpreted spatial context.

In Oregon, FIRMs are the flood maps currently in use by all communities. A FIRM is the insurance and floodplain management map produced by FEMA that identifies, based on the FIS, the areas subject to flooding during a 1% annual-chance (100-year) flood event in a community.[25] The FIRM also identifies the flood insurance risk zones. The SFHA is displayed as either V- or A-zones. V-zones (V, VE, V1-30) are high hazard zones in coastal areas that are subject to high velocity wave impacts. A-zones (A, AE, A1-30, AH, AO) include coastal floodplains that are less hazardous than V-zones, floodplains along rivers and streams, and areas susceptible to other flooding sources. The zone designations correlate directly to the level of study that has been performed in that area (Table 1.3-2).

For some areas in mapped communities, the flood hazards remain undetermined and are unmapped. These unmapped areas are labeled Zone D. The designation of Zone D can also be used for rating when a community incorporates portions of another community's area where no map has been prepared.

Areas landward of (behind) levees may be designated as in the SFHA or not. Areas behind FEMA accredited levees are designated as a Zone X (shaded). FEMA accredits levees that are determined to provide protection from the base flood (*i.e.*, 1% annual-chance flood). To be accredited, a levee must first be certified by a registered professional engineer that the structure meets the requirements of 44 CFR 65.10. Under 44 CFR 65.10, a Federal agency with responsibility for levee design (*e.g.*, U.S. Army Corps of Engineers) may certify the levee in lieu of a professional engineer. Accreditation also requires confirmation by FEMA that the adopted operations and maintenance plans are adequate (44 CFR 65.10(d)).[26]

Areas behind non-accredited levees are designated as SFHA or Zone D, depending on the level of protection provided by the levee. Under FEMA's new levee policy, FEMA proposes to designate SFHAs (*e.g.*, Zone A) if the hazard-reduction capability of the non-accredited levee is such that some portion of the 1% annual-chance flood can still reach the area behind the levee (FEMA 2013b). For areas behind non-accredited levees that are found to be otherwise "sound" or do not meet the freeboard[27] requirement (*i.e.*, freeboard deficient), FEMA will represent the

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[25] FISs and FIRMs are available online at: *www.fema.gov/hazard/map/flood.shtm*.

[26] FEMA Factsheet: Levee Certification vs. Accreditation. October 2012.

[27] For NFIP purposes, freeboard refers to the vertical distance between the top of the levee and the water level that can be expected during the 1% annual-chance flood.

uncertainty of the associated flood hazard using the Zone D designation (FEMA 2013b). Only areas in the SFHA are subject to the mandatory flood insurance requirement. Therefore, under the NFIP, properties in areas designated as Zone X or Zone D are not required to purchase flood insurance or adhere to FEMA's regulatory floodplain management criteria.

Table 1.3-2. Zone designations as they appear on FIRMS (44 CFR 64.3(a)(1)) and which zones have a mandatory flood insurance requirement (44 CFR 64.3(b)). Designations beginning with "A" or "V" are considered part of the SFHA (44 CFR 59.1) for riverine and coastal areas, respectively. The corresponding type of analysis performed to determine the SFHA designations is also noted where known.

Zone Designation	Insurance Required	Definition	Type of Analysis
SFHA Designations			
A	Yes	SFHA with no BFEs or floodway determined	Approximate
AE	Yes	SFHA with BFEs determined and in some cases floodway determined	Detailed
A1-A30	Yes	SFHA with BFEs determined and in some cases floodway determined (old format, not used on newer FIRMs)	Detailed
AH	Yes	SFHA with flood depths of 1 to 3 ft (usually areas of ponding); BFEs determined	Detailed
AO	Yes	SFHA with flood depths of 1 to 3 ft (usually sheetflow on sloping terrain or ponding); average depths determined	Detailed
A99	Yes	SFHA with no BFEs determined, area to be structural protected (dike, dam, levee) from flooding in future	
AR	Yes	Decertified SFHA in process of restoring structural flood protection	
V	Yes	Coastal flood zone with velocity hazard (wave action); no BFE determined	Approximate
VE	Yes	Coastal flood zone with velocity hazard (wave action); BFE determined	Detailed
V1-V30	Yes	Coastal flood zone with velocity hazard (wave action); BFE determined (old format, not used on newer FIRMS)	Detailed
VO	Yes	Coastal flood zone with shallow flooding and/or unpredictable flow paths between 1 and 3 feet and with velocity	
Other Designations			
B, X (shaded)	No	Moderate flood hazard, including area of 0.2% annual-chance flood, 1% annual-chance flood with shallow flooding (<1-ft), or protected by levee from 1% annual-chance flood; or area of future-conditions flood hazard	
C, X (unshaded)	No	Minimal hazard, usually above 0.2% annual-chance flood	
D	No	Undetermined, but possible, flood hazard; may include areas behind non-accredited levees	None
M	Yes	Special mudslide hazard	
N	No	Moderate mudslide hazard	
P	No	Undetermined, but possible, mudslide hazard	

Zone Designation	Insurance Required	Definition	Type of Analysis
E	Yes	Special flood-related erosion hazard	

In areas studied by detailed analyses, FIRMs show BFEs. For many communities, when detailed analyses are performed, the FIRMs also show areas inundated by 0.2% annual-chance (500-year) flood and regulatory floodway areas. This is the case for many newer FIRMs where recent FISs have been completed.
The mapping of flood hazards provides the data necessary to administer community floodplain management regulations, rate flood insurance policies, and implement the mandatory flood insurance purchase requirement and the prohibition on Federal assistance. The FIRMs also increase awareness of the flood hazards and are used by states and communities for emergency management and by Federal agencies in implementing Executive Order 11988, Floodplain Management. Most flood maps cover only one community. Recently, FEMA has produced countywide flood maps that show flood information for all of the geographic areas of a county, including towns and cities.

Flood Insurance Study and Map Revision. The FIS reports and FIRMs are prepared according to specific technical standards. However, FEMA recognizes that changes to the reports and maps may be necessary. The reasons for these changes are due to the availability of more or new technical data, changes in the physical conditions either natural or man-made within the floodplain or watershed, and improvements in the techniques used in assessing flood risk.

There is no set schedule for updating FIRMs. FEMA updates maps as needed and as resources allow.[28] For example, FEMA had about 1 million dollars of discretionary funding in 2012 for all of Region 10 (Alaska, Washington, Idaho, Oregon), which would fund approximately 1 ½ watersheds. FEMA indicated that it conducts studies by watershed, not community.[29] Additionally, FEMA revises FIRMs whenever a participating community provides information to reflect updated conditions through the Letter of Map Change (LOMC) process.

An SFHA may be revised even when there is no change in the base flood elevation (44 CFR 65.5). Although FEMA states that it uses the most accurate information available, many NFIP methods were developed decades ago and do not take full advantage of modern technological and analysis capabilities (NAS 2015). Studies indicate that flood mapping undertaken by FEMA often underestimates actual flood risk. “Calculation of theoretical flood levels is a complex process that involves a statistical analysis of historical flood records that incorporates several assumptions (see Klemes, 2000). For example, river discharges are presumed to conform to a “Log Pearson Type III” distribution, and even more importantly, population stationarity is assumed (USGS, 1981). Note that official calculations clearly assume that the character of the flood population has not changed over time (USGS, 1981, p. 6), when available evidence

[28] FEMA comments on a draft proposed action description provided by NMFS for FEMA review on December 16, 2011. The response was provided by FEMA on February 15, 2012, and included edits within the document and additional information relevant to the consultation.

[29] *Id.*

suggests otherwise….It is easy to demonstrate that the official levels predicted for regulatory "100-year," etc., flood events are typically incorrect." (Criss 2016, in press). Limitations of scale or topographic definition of the source maps used to prepare the FIRM may cause areas that are at or above the base flood elevation to be inadvertently shown within the SFHA boundaries. Also, the placement of fill may elevate areas within the SFHA boundaries to an elevation at or above the BFE. However, the placement of materials that do not change the elevation of a site is not considered fill. For example, where existing materials (*e.g.*, vegetation and top soil) are removed and backfilled with non-native material (*e.g.*, structural material) to the existing grade elevation, FEMA does not consider the structural material as fill.
Changes to the FIS or FIRMs can be initiated by either the community or FEMA. The NFIP regulations direct FEMA to revise and amend FIS reports and FIRMs as warranted, or after it receives requests from community officials or individual property owners. To help FEMA ensure that the reports and maps present information that accurately reflects existing flood risks, the NFIP regulations require that each community inform FEMA of any physical changes that affect BFEs in the community and, within 6 months of the date that such data are available, submit those data showing the effects of the changes.

FEMA revises maps in three ways: (1) by conducting a new or revised flood insurance study; (2) through a physical map revision (PMR), or (3) with a letter of map change (LOMC) (Table 1.3-3). Development of a new or revised FIS was previously described. A PMR involves the revision of one or more flood map (FIRM) panels that will then be reprinted and published with a new effective date. Changes to the regulatory floodplain (SFHA) that do not include publication of the entire map panel include several types of LOMCs (Table 1.3-3). The specific method used depends on the exact situation or cause for revision.

Table 1.3-3. FEMA can revise maps by conducting a new or revised FIS or through a Physical Map Revision (PMR) or a Letter of Map Change (LOMC).

Process	Acronym	Purpose
Physical Map Revision	PMR	FEMA provides a reprinted FIRM incorporating changes to the limits of floodplains and/or floodways, corporate limits, or flood hazard risk zones.
Letters of Map Change		
Letter of Map Amendment	LOMA	Provides an administrative procedure for FEMA to review information submitted by a property owner who believes the property has been inadvertently included in a designated SFHA. Does not physically revise the FIRM.
Letter of Map Revision	LOMR	Officially revises the current FIRM to show changes in the limits of floodplains, floodways, corporate limits, or flood hazard risk zones. Physically revises a portion of the FIRM but does not reissue the map panel.
Conditional LOMR	CLOMR	FEMA's comment on a proposed project that would, upon construction, affect the hydrologic or hydraulic characteristics of a flooding source and thus result in the modification of the existing regulatory floodway, the effective base flood elevations, or the SFHA. Does not physically revise the FIRM.
Letter of Map Revision-Fill	LOMR-F	Officially revises the current FIRM to show that a particular structure/property has been elevated by fill, and removed from

		being located in a designated SFHA. Does not physically revise the FIRM but provides documentation as to the change.
Conditional LOMR-F	CLOMR-F	FEMA's comment on a proposed project concerning the placement of fill for structures and legally described parcels of undeveloped land. Outcomes can include conditional exclusion from the SFHA or not. Does not physically revise the FIRM.

A PMR is an official republication of a map to effect changes to flood insurance zones, floodplain delineations, flood elevations, floodways, and planimetric features. There may be several reasons that a PMR is undertaken. For example, a significant number of LOMCs have been issued for the map panel, recent flood events changed the topography, the accuracy of the SFHA delineation is called into question, new data is available, and/or there has been an improvement in the techniques used in assessing flood risk. Recently, technological advances in base elevation data, such as light detection and ranging (lidar) information, have greatly improved the mapping resolution. This is particularly true for flat areas, such as floodplains, and has contributed to map revisions. As improved base elevation data are incorporated into the flood mapping process, flood map accuracy has improved. In Oregon, significant areas have lidar available with more areas being covered every year. In some cases, the lidar data was obtained with FEMA funding.

In Oregon, FEMA Region 10 prioritizes flood insurance studies based on the following factors: (1) assessment of risk, (2) evaluation of the need to update data, (3) available terrain data, and (4) local contribution of data. FEMA Region 10 also includes geographic information system (GIS) data pertaining to the ESA-listed species and their habitat, as well as input from the states regarding factors such as climate change, floodplain development pressure, growth, land use changes, and areas without digitized FIRMs. In the BA, FEMA identified prioritization factors and components, but did not identify how the process considers the information in order to make a decision on which flood insurance study to develop. National guidance places a strong emphasis on coastal work and prioritization of riverine areas based on assessment of risk (45%), evaluation of need to update data (45%), and available terrain data (10%).

A letter of map amendment (LOMA) is a clarification based on better or more detailed topographic data that provides a greater level of accuracy than the current flood map. The LOMA process corrects inadvertent inclusions of structures or property that have incorrectly been included in a designated SFHA. If the LOMA process determines a structure or property is not located in a SFHA, the "Mandatory Flood Insurance Purchase Requirement" is removed. No physical change to the floodplain has occurred and no fill has been placed in the floodplain.

The letter of map revision (LOMR) process is an administrative process by which a community can submit technical data to revise the FIS and FIRM. The result is a letter from FEMA to the Chief Executive Officer of the community officially revising the current effective FIRM and FIS. Along with providing the community official a letter stating the changes to the floodplains, floodways, or flood elevations, FEMA provides revised portions of the FIS and FIRM, as appropriate. LOMRs are based on physical changes that have affected the SFHA, in contrast to LOMAs, which are a clarification of maps based on more precise data – not a change on the ground.

A letter of map revision-fill (LOMR-F) is submitted for properties where fill has been placed to raise the structure or lot to or above the base flood elevation. Issuance of the LOMR-F removes a structure from the SFHA and the “Mandatory Flood Insurance Purchase Requirement.” To issue a LOMR-F, NFIP regulations require that the lowest adjacent grade[30] of the structure be at or above the base flood elevation. The participating community must also determine that the land and any existing or proposed structures to be removed from the SFHA are "reasonably safe from flooding." To remove the entire lot and structure, both the lowest point on the lot and the lowest adjacent grade of the structure must be at or above the BFE. A LOMR-F is not required for all local land use decisions that result in fill in the SFHA. It is only required if the land owner wishes to have the affected area mapped as no longer in the SFHA, thus removing the requirement for flood insurance. Therefore, not all fill activities in participating communities require FEMA approval. LOMR-Fs do not physically revise the map but provide letter documentation of the outcome.

LOMRs, including LOMR-Fs, officially revise the flood maps based on the existing conditions, such as an “as-built” project. In most cases, they are a result of human activities, but could also be driven by naturally occurring events such as avulsions or channel migrations. In all cases, the action occurred in the past. Since LOMRs only reflect past actions, FEMA considers them as nondiscretionary actions.

Conditional LOMRs (CLOMRs) and conditional LOMR-Fs (CLOMR-Fs) are advisory and do not revise or amend the flood maps. The intent is to ensure that FEMA’s constituents, including states and communities, are aware of the impact that a proposed development in the SFHA would have on the mapped flood hazard and associated flood risk. While a community may request a conditional letter for any proposed project, FEMA only requires a CLOMR or CLOMR-F when someone proposes an encroachment in the SFHA that would increase the BFE by 1-foot or more, an encroachment in the floodway that would result in any increase in the BFE (>0.0 foot), or to change the floodway location. For those development actions that require CLOMRs, the underlying project may not proceed without FEMA’s prior approval (44 CFR 60.3(c)(13), (d)(4), 65.12).The conditional letter process provides a way for FEMA to review a proposed project for floodplain mapping purposes before a community or developer begins construction. Following project review, FEMA will issue a letter that states whether the proposed project would meet the regulatory floodplain management criteria of the NFIP and, if so, what revisions would be made to the community's flood maps if the project is built as proposed. The letter provides assurance to the applicant that their action, if constructed as proposed, would be compliant with NFIP regulations. FEMA does not interpret the letter as an approval to proceed with physical construction, but rather as “a comment on confidence level for changing the map” if a LOMR is later submitted.[31] Issuance of a conditional letter does not change the flood map. A LOMR is still required after construction to remove the property from the SFHA.

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[30] Any fill placed on site before the first flood map is considered to be the “natural grade.”

[31] FEMA comments on a draft proposed action description provided by NMFS for FEMA review on December 16, 2011. The response was provided by FEMA on February 15, 2012, and included edits within the document and additional information relevant to the consultation.

Procedure Memorandum 64[32] (PM 64) summarizes FEMA's approach to ESA compliance associated with requests for LOMCs (FEMA 2010a) (Table 1.3-4). The memorandum reflects FEMA's perspective that communities are responsible for ensuring that any ESA requirements are met. FEMA states this is consistent with FEMA's regulations at 44 CFR 60.3(a)(2), which require a community to review proposed development to assure that all necessary permits have been received from those governmental agencies from which approval is required by law. Previously, FEMA recognized CLOMRs and CLOMR-Fs as discretionary actions with a Federal nexus that could require ESA section 7 consultation between FEMA and NMFS in order to identify any potential effects on threatened or endangered species before any construction or physical change in the floodplain would occur. To the extent PM 64 was ambiguous as to FEMA's view of its role in assuring that CLOMRs are ESA-compliant, FEMA clarified its position in a memorandum issued in October 2015. The new memorandum states that "FEMA will no longer act as a facilitator for a requester in dealing with the Services under the ESA for any CLOMR or CLMOR-F." (FEMA, "Endangered Species Act and Review/Processing of CLOMR-Fs and CLOMRs," Oct. 19, 2015, p. 2.) Per the 2015 memorandum, FEMA now requires that the requester document to FEMA that ESA "take" will not occur to threatened or endangered species as a result of the project, and FEMA will not process the CLOMR request until FEMA has received such documentation.

[32] On March 20, 2014, FEMA informed NMFS that new mapping standards had been issued as of August 22, 2013 (FP 204-078-01) and that Procedure Memorandum 64 had been incorporated into the new standards (communicated during inter-agency meeting in Lacey, Washington). On March 27, 2014, FEMA clarified that FEMA had not changed its procedures with regard to Procedure Memorandum 64 (E-mail correspondence from David Ratté (FEMA) to Robert Markle (NMFS) regarding the 2013 mapping standards (FP 204-078-1, adopted August 22, 2013)).

Table 1.3-4. Procedure Memorandum 64 summarizes FEMA's approach to ESA compliance associated with requests for LOMCs (FEMA 2010a).[33]

Request	ESA-related Action	ESA Requirement Related to FEMA Process
Conditional LOMC Requests		
CLOMA	No physical modification to floodplain is proposed.	ESA compliance is required independently of FEMA's process. The community needs to ensure that permits are obtained per requirement under Section 60.3(a)(2) of FEMA's regulations.
CLOMR-F	Proposed placement of fill in the floodplain.	ESA compliance must be documented to FEMA prior to issuance of CLOMR-F. FEMA must receive confirmation of ESA compliance from the Services.
CLOMR	Proposed modifications of floodplains, floodways, or flood elevations based on physical and/or structural changes.	ESA compliance must be documented to FEMA prior to issuance of CLOMR. FEMA must receive confirmation of ESA compliance from the Services.
LOMC Requests		
LOMA	No physical modification to floodplain has occurred.	ESA compliance is required independently of FEMA's process. The community needs to ensure that permits are obtained per requirement under Section 60.3(a)(2) of FEMA's regulations.
LOMR-F	Placement of fill in floodplain has occurred.	ESA compliance is required independently of FEMA's process. The community needs to ensure that permits are obtained per requirement under Section 60.3(a)(2) of FEMA's regulations.
LOMR	Modifications of floodplains, floodways, or flood elevations have occurred based on physical and/or structural changes.	ESA compliance is required independently of FEMA's process. The community needs to ensure that permits are obtained per requirement under Section 60.3(a)(2) of FEMA's regulations.

Since 1990, when many of the Pacific salmon and steelhead species were listed under the ESA, FEMA has issued numerous letters of map change of various types in Oregon (Table 1.3-5). The most numerous types are LOMAs and LOMR-Fs with almost 3,500 and 410 letters issued, respectively. There have been 110 conditional letters of map revision (*i.e.*, CLOMRs and CLOMR-Fs) issued.

Table 1.3-5. Since 1990, FEMA has issued numerous letters of map change of various types in Oregon.

	Letter of Map Change Type					
	CLOMAs	**LOMAs**	**CLOMRs**	**LOMRs**	**CLOMR-Fs**	**LOMR-Fs**
Number Issued	11	3,491	55	287	55	408
Yearly Average	0.5	151.8	2.4	12.5	2.4	17.7

[33] *Id.*

Mapping Areas Behind Levees. FEMA develops flood maps based on available information of historical flows, current topographic conditions, and risk. Levees may reduce the risk associated with flooding. However, the risk is not totally removed, and flooding potential remains. When considering the flooding risk of areas behind levees, FEMA distinguishes between accredited and non-accredited levees.

FEMA identified five accredited and six provisionally accredited levees[34] in Oregon (Table 1.3-6). While other accredited levees exist in Oregon, FEMA does not know how many.[35] FEMA has only maintained a list of accredited levees since the 1980s.

FEMA recognizes areas protected by accredited levees (44 CFR 65.10) and provisionally accredited levees as not being in the SFHA and identifies them as a moderate flood risk, which are displayed on FIRMs as a shaded Zone X. Once FEMA receives a levee certification package from a levee owner or sponsor, FEMA performs a completeness review and accredits the levee based on whether or not the levee sponsor has documented that the levee system provides protection from the estimated 1% annual-chance flood.

[34] "Provisionally accredited levees" are levees FEMA has previously accredited and for which FEMA is awaiting data or documentation that will show the levee's compliance with NFIP regulations.

[35] Comment made by David Ratté (FEMA) during a meeting with NMFS on March 10. 2014.

Table 1.3-6. FEMA accredited and provisionally accredited levee systems in Oregon as of February 2012.[36] Note: List does not include levee on the Walla Walla River in the community of Milton-Freewater, which FEMA recognized after providing the information on accredited levees. "RIP" denotes levees in the Corps' Rehabilitation and Inspection Program (RIP).

Community	County	Levee Owner	Comments
Accredited Levees			
Multnomah County	Multnomah	Sauvie Island Drainage Improvement Company	17.8 miles RIP
Multnomah County	Multnomah	Peninsula Drainage District No. 1	5.0 miles RIP
Multnomah County	Multnomah	Multnomah County Drainage District No. 1	14.8 miles RIP
Multnomah County	Multnomah	Sandy Drainage Improvement Company	3.3 miles RIP
Portland	Multnomah	Peninsula Drainage District No. 2	6.0 miles RIP
Provisionally Accredited Levees			
Columbia County	Columbia		De-accreditation remapping on hold.
Rainier	Columbia	Rainier Water Improvement Company	De-accreditation remapping on hold.
Reedsport	Douglas	City of Reedsport	De-accreditation remapping on hold.
Scappoose	Columbia	Scappoose Drainage Improvement Company	De-accreditation remapping on hold.

There are also numerous non-accredited levees in Oregon. FEMA has not compiled a comprehensive list of non-accredited levees.[37] However, including accredited levees, the U.S. Army Corps of Engineers' (Corps') National Levee Database indicates 219 levee systems (333 miles) exist in Oregon. Though the database is recognized as being incomplete, the identified systems reflect over 333 miles of levees that protect to varying degrees over 400 square miles (256,779 acres) of land from some degree of flooding.

During recent remapping efforts, FEMA mapped areas behind non-accredited levees as if the levees were not present. This is often termed the "without-levee" procedure. In February 2011, in response to stakeholder concerns with the procedure, several members of the U.S. Congress requested that FEMA revise the practice. As a result, FEMA has:

- developed a new mapping process for non-accredited levees that is intended to provide more precise scientific and technical data when evaluating the level of protection that the levee may provide surrounding communities;
- introduced a series of targeted modeling approaches to replace the previous "without levee" approach, which did not recognize a levee as providing any level of protection to

[36] FEMA comments on a draft proposed action description provided by NMFS for FEMA review on December 16, 2011. The response was provided by FEMA on February 15, 2012, and included edits within the document and additional information relevant to the consultation.

[37] *Id.*

surrounding communities if the communities could not demonstrate that the levee was certified as providing protection against the 1% annual-chance of flooding;
- withheld Letters of Final Determination for communities who do not meet accreditation requirements and would "benefit" from new approaches (*e.g.*, Tillamook County); and
- sought public comment on the new mapping methodology.

FEMA originally requested that the mapping of areas behind non-accredited levees not be part of the proposed action under consultation. However, since that time, FEMA has finalized the new mapping approach (FEMA 2013b). Furthermore, in so much as this is a consultation on the discretionary aspects of the NFIP, we do not believe the action can be parsed to wholly exclude areas behind non-accredited levees. Therefore, we include the effects from such areas as part of the proposed action based on FEMA's new approach to mapping flood risk behind non-accredited levee systems (FEMA 2013b).

Because non-accredited levee systems may provide a measure of flood risk reduction, FEMA has developed a suite of procedures to aid in mapping flood risk in areas behind these levees. The procedures allow levee systems to be evaluated by segments. Prior to determining the appropriate procedure to identify the areas of potential flood risk landward of non-accredited levees, FEMA will contact communities and seek local input. Once determined, the flood risk will be identified on FIRMs as either being in the SFHA (*e.g.*, Zone A or an area of possible flood hazard (*i.e.*, Zone D).

1.3.1.2 Regulatory Floodplain Management Criteria

State and local governments, through their planning, zoning, and building codes, make the determination of how a property, including property in the floodplain, may be developed. As a part of the National Flood Insurance Act (1968), Congress prohibited the issuance of flood insurance to property owners within a community that had not adopted and implemented floodplain management criteria at least as strict as the federal standards; FEMA has been delegated authority to establish the minimum floodplain management criteria and to revise them from time to time. FEMA's regulations place certain requirements as a condition of community participation in the NFIP. In part, these include:
- If a local floodplain ordinance is not in place, or if that ordinance does not meet the regulatory floodplain management criteria, a community cannot be eligible for the NFIP (44 CFR 59.2(b)).
- If a community fails to maintain a floodplain ordinance or adopts an ordinance that does not meet FEMA's regulatory floodplain management criteria, FEMA may suspend that community from the NFIP (44 CFR 59.24).
- A participating community must require permits for all development in the SFHA (44 CFR 60.3). "Development," as defined by FEMA, means 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 or storage of equipment or materials (44 CFR 59.1).

To assist local communities in the development of their floodplain management programs, Oregon DLCD provides a model floodplain ordinance as a baseline template (based on FEMA's regulatory floodplain management criteria). The existing model ordinance is currently in revision, but neither the existing nor proposed ordinances provide measures specific to ESA-listed species including anadromous fish.

The regulatory floodplain management criteria apply to properties located in identified SFHAs that are mapped on a community's FIRM. Per the NFIA, FEMA's criteria are supposed to discourage development within the SFHA, prevent new development from increasing the flood threat, and protect both new (post-FIRM) and existing (pre-FIRM) buildings from anticipated flood events. All new development within the floodplain must meet FEMA's regulatory floodplain management criteria. It is the responsibility of the community to ensure that all new and substantially improved structures built in the SFHA meet the requirements of the local floodplain management ordinance. Methods and materials designed to minimize future flood damage must be used, while not increasing the flood risk to other existing development in the floodplain.

Existing buildings that pre-date the FIRM must be brought into compliance with FEMA's regulatory floodplain management criteria only when the building is "substantially damaged" or "substantially improved." FEMA defines substantial damage/improvement as meaning that the cost to repair or the cost to improve the existing building equals or exceeds 50% of the structure's pre-damaged market value. In these cases, FEMA's regulatory floodplain management criteria require bringing the pre-FIRM building into compliance with the same requirements that apply to new construction in the SFHA. These requirements may include state and local criteria that exceed FEMA's regulatory floodplain management criteria. Similarly, when a community's BFE has increased in elevation, post-FIRM buildings that have been substantially damaged or are proposed for a substantial improvement must comply with construction requirements that reflect the new BFE.

FEMA ensures compliance with the established NFIP regulations by reviewing community ordinances and maintaining a dialogue with the community. FEMA, and DLCD on behalf of FEMA, oversees community activities and monitors program implementation through Community Assistance Visits (CAVs) and Community Assistance Contacts. During the 2002-2006 period, FEMA and DLCD completed an average of 9.9 CAVs per year. Of these, 63% (44 communities) had not had a CAV in more than 10 years.[38] Based on those communities visited since 1986, communities have had on average 2.9 CAVs (ranging from 1 to 6 CAVs) in the intervening 27 years. Based on available information, 67 Oregon communities have not had a CAV in more than 25 years, of which 59 have never had a CAV.[39] If FEMA identifies program deficiencies or violations, FEMA has the option to place the community on formal probation. After notifying and providing a community time to address any issues, if a community fails to address the issues, FEMA will place the community on probation for a minimum of 1 year. During probation, new policies can be sold and existing policies renewed, but policyholders are surcharged a $50 fee. If during probation the community continues not to address FEMA's concerns, the community can be suspended from the NFIP. During suspension, existing policies

[38] Data provided by Chris Shirley (DLCD) via e-mail to Robert Markle (NMFS) (March 5, 2013). During the 2003-2012 period staff resources were reallocated to completing the Map Modernization process. Annual average during that period was 6 CAVs per year.

[39] Data provided by Chris Shirley (DLCD) via e-mail to Robert Markle (NMFS) (March 5, 2013).

cannot be renewed and new policies cannot be sold. The possibility of losing insurance coverage creates an incentive for local communities to adhere to FEMA's minimum eligibility requirements. Additionally, if a community is suspended, it will need to engage DLCD to ensure it is meeting its Statewide Goal 7 requirements.

The applicable floodplain management criteria vary depending on the level of floodplain analysis performed within the community. For each additional level of detail provided in the FIS, additional regulatory requirements for community floodplain management ordinances are imposed. For example, given the following determinations, the associated criteria are applicable:

- SFHA has not been delineated, but flooding occurs – 44 CFR 60.3(a) applies.
- SFHA has been delineated – 44 CFR 60.3(b) applies.
- SFHA has been delineated and BFE has been determined – 44 CFR 60.3(c) applies.
- SFHA and floodway have been delineated and BFE has been determined – 44 CFR 60.3(d) applies.
- Coastal zone – 44 CFR 60.3(e) applies.
- Flood protection restoration areas – 44 CFR 60.3(f) applies.

The regulatory requirements associated with each level of flood hazard analysis are outlined in 44 CFR 60.3, and the State of Oregon implements these requirements through ORS 227.215 and ORS 215.416. FEMA's regulatory floodplain management criteria establish different requirements for properties in A-zones and V-zones, but specific elevation and structural performance requirements are included for all buildings in the SFHA. The primary elements of FEMA's criteria are that structures be floodproofed, and, where BFEs have been identified, that structures be elevated to or above the BFE. FEMA's criteria, combined with FEMA's mapping regulations, incentivize elevation on fill by allowing filled properties to be "mapped out" of the SFHA. Once a property is mapped out, the property owner does not need to purchase flood insurance or comply with the regulatory floodplain management criteria.

These requirements form the foundation of floodplain management in a community. The State of Oregon and some individual Oregon communities have adopted more restrictive floodplain management requirements.

State of Oregon Requirements. Oregon has a Statewide Planning Program for land use that consists of 19 planning goals with broad policy statements and guidelines. More specific goal requirements are codified in the Oregon Revised Statues (ORS) and Oregon Administrative Rules (OAR).

The primary implementation mechanism is contained in Goal 2 (Land Use Planning), which requires local governments to develop comprehensive plans and implementing measures that are consistent with the statewide goals. Initial plans required Land Conservation and Development Commission (LCDC) approval. A public process is required to amend the goals or administrative rules. DLCD, which serves as staff to the Land Conservation and Development Commission, makes recommendations for statewide goal amendments or rule changes. Local governments have 3 to 5 years (more for Goal 5, Natural Resources) to come into compliance with the new requirements.

The primary statewide planning goal associated with flood hazards is Goal 7 (Natural Hazard Planning). The goal requires local governments to conduct natural hazard inventories and to adopt policies within their comprehensive plans and implementing measures to reduce the risks of hazards to people and property. Goal 7 also requires governments to update their comprehensive plans and implementing measures within 3 years if DLCD notifies them of new information regarding natural hazards. As mentioned previously, Goal 7 specifically states that participation in the NFIP constitutes compliance with Goal 7 with respect to coastal and riverine flood hazards. In addition, the goal has several non-binding guidelines encouraging communities to adopt standards that exceed FEMA's regulatory floodplain management criteria, such as by limiting placement of fill in floodplains, prohibiting the storage of hazardous materials in floodplains, requiring structures to be elevated to a level higher than that required by the NFIP or the State Building Code, and participating in the Community Rating System.

To comply with Goal 7, local governments must adopt measures to reduce the risk of flood hazards. This may be satisfied by the model ordinance provided by DLCD, or communities may enact stricter ordinances or codes. Changes to local ordinances or codes implemented pursuant to the Statewide Planning Goals require DLCD approval.

Planning Goal 5 relates to natural resources, including riparian habitat. Local governments are required under this goal to conduct inventories of natural resources, including riparian corridors, wetlands, and wildlife habitat, and to adopt measures for the protection of those resources. State administrative rules outline inventory procedures (OAR 660-023). As an alternative to the standard inventory process, local governments can take a "safe harbor" course of action, allowing them to apply predetermined setback distances from riparian corridors ranging from 50 to 75 feet, or to the edge of any significant wetland within the riparian corridor. There is a safe harbor for the inventory of significant riparian resources and a safe harbor for developing a program to protect the resource. Even when both safe harbors are applied, significant development is still allowed in the riparian area.

The Goal 5 process and standards do not apply when local governments adopt restrictions on development in riparian areas to comply with Goal 7. In addition, the requirements of Goals 15, 16, 17, and 18 supersede Goal 5 requirements. FEMA indicated in the BA that the state's ability to enforce implementation of Goal 5 is minimal.

Other Statewide Planning Goals that affect floodplain development include:

- Goal 15 (Willamette River Greenway), which emphasizes natural resource conservation and the prioritization of water-dependent uses,[40] is the basis for a Willamette River Greenway program. The program establishes the greenway boundary (150 feet from ordinary low water elevation) and development review criteria for each city and county.
- Goal 16 (Estuarine Resources) requires comprehensive management programs for estuaries. The goal prioritizes uses that protect the integrity of the estuary ecosystem as well as water-dependent uses.

[40] Water-dependent uses related to the Statewide Planning Goals are defined differently from the water-dependent uses used by FEMA in this consultation. See "functionally-dependent use" definition used by FEMA in Section 1.3.2 of this opinion.

- Goal 17 (Coastal Shorelands) relates to the use of coastal shorelands and prioritizes uses that maintain the integrity of estuaries and coastal waters as well as water-dependent uses. Coastal shorelands include lands subject to ocean flooding. Local communities must develop their comprehensive plans in such a way as to exceed the minimum requirements of the NFIP.
- Goal 18 (Beaches and Dunes) requires plans and policies to regulate the use of beach and dune areas. The goal includes a provision that communities and the State prohibit residential, commercial, and industrial development on beaches, dunes subject to ocean overtopping or undercutting, and interdunal areas subject to ocean flooding. Other development is allowed if the developer can demonstrate that it is adequately protected from hazards, including flooding.

Under its implementation regulations, FEMA encourages more restrictive State and community floodplain management ordinances (44 CFR 60.1(d)). However, FEMA has stated that they have no authority to require a community to modify its local ordinances to provide floodplain management requirements beyond FEMA's regulatory floodplain management criteria. If the State and local communities fail to enforce the more restrictive ordinances FEMA cannot enforce compliance beyond the NFIP minimum requirements.

Furthermore, while more restrictive State and local requirements may be shaped by FEMA's minimum requirements, they are not reliant on the NFIP for their justification and have independent utility from the NFIP. Lastly, the State and local communities may unilaterally revise the requirements. Consequently, under the ESA, they are not part of the proposed action, or interdependent or interrelated actions.

1.3.1.3 Community Rating System

In 1990, FEMA established the Community Rating System (CRS). Congress codified the program in the National Flood Insurance Reform Act of 1994. The program provides reductions in insurance premiums based on the extent to which a community's floodplain management practices exceed the minimum NFIP requirements and provide for other flood damage reduction activities.

Until March 2013, FEMA was using the 2007 CRS Coordinator's Manual (FEMA 2007), but the CRS program has recently been revised and a new manual became effective April 1, 2013 (FEMA 2013a).[41] In this section, information relevant to the previous and current programs is presented.

In general, the goals of the 2013 CRS are as follows:

- reduce flood damage to insurable property;
- strengthen and support the insurance aspects of the NFIP; and

[41] In August 2014, NMFS learned that the Office of Management and Budget (OMB) extended the effectiveness of the 2013 CRS Coordinator's Manual until December 31, 2016.

- encourage a comprehensive approach to floodplain management, including the preservation and restoration of natural functions and resources of floodplains and coastal areas.

Section 116.a of the 2013 CRS identifies nine activities that promote natural floodplain functions. Each section identifies where CRS credit can be provided to communities that implement these practices. FEMA's current manual is valid over the period 2013-2016.[42]

Using a criteria-based scoring system described in the 2013 CRS Coordinator's Manual (FEMA 2013a), FEMA ranks communities based on 19 activities[43] grouped in four categories or series. Within each of the 19 activities, there are specific "elements" for which communities can receive CRS credits.

The criteria and rating system included in the CRS are largely discretionary. The 2013 CRS Coordinator's Manual describes the scoring system in detail (FEMA 2013a). A total of 12,304 possible points are available.[44] Four of the 19 activities (420, 430, 520, and 530) account for 61% of the eligible points (Appendix C of the BA).

Through an application process, local communities demonstrate which criteria are being met and how. Supporting information and documentation must be provided to FEMA to verify the implementation of the criteria. In reviewing applications, FEMA uses a five-step process to determine the number of credits given to a community:

1. Element Credit Points - The determination of whether the community's program includes the elements associated with a particular creditable activity.
2. Impact Adjustment - For each element, the effectiveness/size of the activity is determined to measure the expected impact/improvement (using impact ratios).
3. Credit Calculation - Points are multiplied by impact ratios and summed to determine the amount of credit received for each activity.
4. Community Growth Adjustment - A multiplier for the Mapping and Regulations activities (Series 400) is applied to reflect the community's growth rate (the higher the rate, the larger the multiplier).
5. Community Classification - Points for all of the activities are totaled to determine the community's overall score.

The total points achieved by a community determine which CRS class a community receives based upon ten different classes (Table 1.3-7). The credits required to obtain a particular class rating and the resulting discount on insurance premiums vary. In general, each class has a credit point range of 500 points, and class advancement results in a corresponding 5% premium reduction for all policyholders in the SFHA in that community (Table 1.3-7). Policyholders outside of the SFHA also receive a premium reduction.

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[42] "CRS Credit for Habitat Protection" is available via the FEMA Region X website at: *www.fema.gov/about/regions/regionx/nfipesa.shtm*.

[43] The 2007 CRS program was based on 18 activities.

[44] E-mail correspondence between John Graves (FEMA) and Robert Markle (NMFS) regarding the maximum possible points under the proposed 2013 CRS program (January 30, 2013).

All participating NFIP communities begin as Class 10 communities. As actions satisfying the criteria associated with the 19 activities are demonstrated, the community moves into a new class. Class 1 represents the highest possible rating. A community with a Class 1 rating earns a premium reduction of 45% to SFHA policyholders in that community. In Oregon, 28 communities participated in the CRS as of April 2015.[45] The City of Portland holds the highest class rating in the state, Class 5 (Table 1.3-7, Appendix 1.3-A). A community's class may change following a CRS compliance visit called a "cycle visit," or if a community is between cycle visits they can request a modification if they take on a new activity.[46] The class may also change if the community is no longer complying with the minimum NFIP requirements. Similar to probation or suspension, CRS "retrograde" is a tool for FEMA to use in order to encourage compliance with the NFIP.

Table 1.3-7. Oregon communities active in the CRS program provided policyholders a 5 to 25% discount in flood insurance in the SFHA, as of April 2015.[47]

CRS Class	Credit Points Required	Flood Insurance Premium Reduction (%)		Communities in Class (#)*
		In SFHA	Outside SFHA	
1	4,500+	45	10	0
2	4,000 - 4,499	40	10	0
3	3,500 - 3,999	35	10	0
4	3,000 - 3,499	30	10	0
5	2,500 - 2,999	25	10	1
6	2,000 - 2,499	20	10	8
7	1,500 - 1,999	15	5	11
8	1,000 - 1,499	10	5	9
9	500 - 999	5	5	2
10	0 - 499	0	0	0
Total				31

* Source: NFIP Flood Insurance Manual, April 2015 (*http://www.fema.gov/flood-insurance-manual*).

In addition to the credit points required for a class, there are also prerequisites that communities must meet to achieve Class 1, Class 4, and Class 6. For Class 1 and Class 4, prerequisites include a minimum number of points for natural floodplain function.[48] Thirteen elements and sub-elements are identified as contributing to the prerequisite natural floodplain functions points (Table 1.3-8).

[45] NFIP Flood Insurance Manual, April 1, 2015 (*http://www.fema.gov/flood-insurance-manual*).

[46] FEMA comments on a draft proposed action description provided by NMFS for FEMA review on December 16, 2011. The response was provided by FEMA on February 15, 2012, and included edits within the document and additional information relevant to the consultation.

[47] E-mail from Barry Gall (FEMA) to Robert Markle (NMFS) regarding a revised language for the proposed CRS program (January 25, 2013).

[48] The 2013 CRS Coordinator's Manual (p. 120-6) defines natural floodplain functions as: "The functions associated with the natural or relatively undisturbed floodplain that moderate flooding, retain flood waters, reduce erosion and sedimentation, and mitigate the effects of waves and store surges from storms" and "other significant beneficial functions include maintenance of water quality, recharge of ground water, and provision of fish and wildlife habitat."

The Class 1 and Class 4 prerequisite points are 150 and 100 points, respectively, of the maximum possible 1,309 natural floodplain functions points (Table 1.3-8). Consequently, a community needs to have approximately 3% of their total points from the specified natural floodplain functions elements or sub-elements in order to meet the Class 1 or 4 prerequisite. For example, in order for the City of Portland to move from a Class 5 to a Class 4 community, it would need to have 100 natural floodplain function points of the minimum 3,000 points necessary to qualify for the Class 4 rating and its associated 30% insurance premium discount.

Table 1.3-8. Elements, sub-elements, and the maximum possible points for use in satisfying the Class 1 (150 points) and 4 (100 points) natural floodplain function prerequisites.

Activity	Element - Sub-element (CRS acronym)	Maximum Possible Points
Activity 420	Natural Functions Open Space (NFOS)	350 points
	Natural Shoreline Protection (NSP)	120 points
Activity 430	Prohibition of Fill or Requiring Compensatory Storage (DL 1)	280 points
Activity 440	Additional Map Data - natural functions layer (AMD 12)	14 points
Activity 450	Stormwater Management Regulations - design storms (SMR-DS)	225 points
	Stormwater Management Regulations - low impact development (SMR-LID)	25 points
	Watershed Master Plan - peak flow and volume management (WMP 3)	55 points
	Watershed Master Plan - wetlands & natural open spaces preservation (WMP 5)	30 points
	Watershed Master Plan - natural channel protection (WMP 6)	25 points
	Watershed Master Plan - soft bank protection (WMP 7)	25 points
	Erosion and Sediment Control Regulations (ESC)	40 points
	Water Quality Regulations (WQ)	20 points
Activity 510	Floodplain Management Planning – natural floodplain functions plan (NFP)	100 points
	Total	1,309 points

1.3.2 ESA-Specific Revisions for Oregon

FEMA's proposed action for this consultation includes the implementation of conservation measures intended to protect ESA-listed fish in the State of Oregon. Some of the proposed conservation measures were developed to be implemented in the Puget Sound area of Washington State by the 2008 Biological Opinion and RPA for the implementation of the NFIP in Puget Sound (NMFS 2008c). FEMA proposes to carry over portions of those measures to Oregon (Table 1.3-9).

Table 1.3-9. FEMA proposes to carry over portions of the Reasonable and Prudent Alternative from the Puget Sound NFIP consultation to Oregon.

Puget Sound RPA	Oregon proposed action
Mapping	
Letters of Map Change	Same, except applied nationally under Procedure Memorandum 64[1] and as modified by FEMA's 2015 Memorandum.[49]
Prioritize mapping with consideration to ESA-listed species	Same
Provide modeling guidance: Two dimensional	Same, plus unsteady state modeling guidance
Floodplain Management Criteria	
Prohibit development in floodway, riparian zone, and channel migration zone or	Not proposed [2]
No adverse effects[50] in floodway, riparian zone and channel migration zone	Same, except channel migration zone not proposed
Prohibit development in 100-year floodplain or	Not proposed [2]
All adverse effects in floodplain mitigated (no net adverse effects)[3]	Same
Improvements/repairs to existing structures resulting in greater than 10% footprint increase will mitigate adverse effects	Same, except utilities are included in allowed activities
Community Rating System	
Elements A-I	Same
Levee Vegetation	
Use and encourage Flood Mitigation Assistance Program and Hazard Mitigation Grant program to reduce risk and benefit salmon	Not proposed
Floodplain Mitigation	
Mitigation for interim period	Same

[49] FEMA, "Endangered Species Act and Review/Processing of CLOMR-Fs and CLOMRs," Oct. 19, 2015.

[50] During consultation, at a meeting between NMFS and FEMA held February 13, 2014, FEMA provided a list of activities that would be considered to have "no adverse effect," as follows: (A) repairs or remodels of an existing structure provided that the repair/remodel are not a substantial improvement or a repair of substantial damage; (B) expansion of an existing structure that is no greater than 10% beyond its existing footprint provided the pairs or remodeling are not a substantial improvement or repair of substantial damage; also, if the structure is in the floodway, there shall be no change in the dimensions perpendicular to flow without a floodway analysis; (C) activities the sole purpose of which is to create, restore, or enhance natural floodplain functions, provided the activities do not include structures, grading, fill, or impervious surfaces; (D) development of open space and recreational facilities, such as parks, trails, and hunting grounds, that do not include structures, fill impervious surfaces, or removal of more than 5% of native vegetation on that portion of the property within the SFHA; and (E) repair to on-site septic systems, so long as ground disturbance is kept to the minimum necessary.

Puget Sound RPA	Oregon proposed action
Monitoring and Adaptive Management	
Annual progress reporting to NMFS	Same
	Incorporate FEMA into Corps' Joint Permit Applications process
	Prioritization of monitoring based on fill activities, Joint Permit Applications, and repetitive loss activities

[1] On March 20, 2014, FEMA informed NMFS that new mapping standards had been issued as of August 22, 2013 (FP 204-078-01) and that Procedure Memorandum 64 had been incorporated into the new standards (communicated during inter-agency meeting in Lacey, Washington). On March 27, 2014, FEMA clarified that FEMA had not changed their procedures with regard to Procedure Memorandum 64 (E-mail correspondence from David Ratté (FEMA) to Robert Markle (NMFS) regarding the 2013 mapping standards (FP 204-078-1, adopted August 22, 2013)).
[2] In its comments on the draft proposed action description (February 15, 2012), FEMA asserts that it does not have the authority to prohibit development.
[3] "No net adverse effects" means any adverse effects must be fully mitigated and result in no reduction in the value of habitat functions at the reach scale.

Extensive discussion has occurred over recent years between FEMA, NMFS, and other government agencies about the potential changes to existing habitat functions and processes due to natural, ongoing lateral channel migrations in some stream channel reaches, especially in relatively shallow gradient alluvial river systems. Estimating the spatial extent of possible lateral channel changes in future decades within an estimated channel migration zone can provide communities very valuable data regarding possible impacts to instream and riparian habitat functions, as well as information regarding the relative 1% annual flood risk to infrastructure and public safety for proposed land development actions within the channel migration zone. The extent of the estimated channel migration zone is largely based on observed changes over previous decades using historic aerial imagery and other data, and field observations of geomorphic features. In some cases, past land development actions may have limited or constricted a river system's ability to react to variations in hydrologic or sediment regimes through natural lateral adjustments in channel location and geometry.

FEMA proposes to require that communities use the best available science in assessing current baseline conditions and analyzing the effects of proposed development on ESA-listed species and their designated critical habitats. If a community has information or mapping regarding the channel migration zone, that information is expected to be used as best available science. If the information is available in a digital format and provided to FEMA, FEMA will make the information available to the jurisdiction as an informational data layer in the risk database accompanying the digital FIRM dataset.

1.3.2.1 Floodplain Mapping

Flood Insurance Study and Map Revision. In 2010, FEMA distributed "Regional Guidance for Hydrologic and Hydraulic Studies in support of the Model Ordinance for

Floodplain Management and the Endangered Species Act."[51] Specifically, the guidance responds to three elements identified in the Puget Sound NFIP Biological Opinion: (1) use foreseeable future land use changes to establish future base flood elevations; (2) use unsteady one-dimensional or two-dimensional hydraulic models to analyze complex riverine systems, when applicable; and (3) include the channel migration zone as part of the regulatory floodplain (FEMA 2010b, p. 2). Regarding the channel migration zone, the hydrologic and hydraulic aspects of mapping the area are addressed. The Regional Guidance does not supersede the technical requirements for applying a specific model provided in the 2009 Guidance for Riverine Flooding Analyses and Mapping (FEMA 2009).[52] The intent is to supplement the national guidance to better fit regional conditions, particularly special ESA provisions for the State of Washington. Communities in Washington are not required to use the guidance. However, communities that do follow this guidance will meet the modeling requirements included in the Puget Sound NFIP consultation, and have a more effective program to reduce the dangers and damage caused by floods and migrating stream channels.

FEMA's BA indicated that FEMA proposes to make similar guidance available to Oregon communities. FEMA has not indicated what aspects of the Regional Guidance are proposed for implementation in Oregon, and as of August 2013 had not provided further information with respect to Oregon. However, FEMA Region 10 has stated that it proposes to provide guidance on the use of flood mapping models, such as unsteady state models and two-dimensional mapping models that can provide additional considerations for habitat features. Steady state step-backwater models only address the carrying capacity of a floodplain, whereas unsteady state models have the ability to calculate the impact of loss of storage within the floodplain due to development or other physical changes. Two-dimensional models calculate direction of overbank flow. In the absence of more specific guidance, NMFS will use the Regional Guidance (FEMA 2010b) as part of the proposed action. Based on the 2010 Regional Guidance, FEMA's proposed changes would include guidance on the use of unsteady state and multidimensional models. However, steady state modeling remains an acceptable approach where flows are assumed to only travel downstream (FEMA 2010b, pages 10 and 11). Additionally, the proposed guidance will explore the integration of FEMA Region 10 flood modeling data with other habitat models currently in use by ecologists, fisheries scientists, and other similar disciplines.

In their proposed action for Oregon, FEMA Region 10 proposes to incorporate ESA species and critical habitat information early in the map sequencing process. Currently, FEMA takes 47 distinct steps to issue a new floodplain map. FEMA Region 10 will incorporate species information and habitat at Step 2 of the sequence process. Appendix D (Sequencing Game) of the BA provides an outline of the sequencing steps. The consideration of species at Step 2 will provide equal emphasis with needs, data, and risk factors that currently drive the sequencing. The proposal would not necessarily eliminate those communities without ESA species/habitat from the priority list for mapping, as their needs or risks may outweigh the lack of species or critical habitat presence. However, if two communities with equal need, data, and risk factors

[51] Regional Guidance for Hydrologic and Hydraulic Studies (January 2010 draft) is available at: *www.fema.gov/about/regions/regionx/nfipesa.shtm.*

[52] On March 20, 2014, FEMA informed NMFS that new mapping standards had been issued as of August 22, 2013 (FP 204-078-1). However, it is NMFS understanding that the new standards do not alter the substantive point referenced here.

were selected as high priority for mapping updates, the proposed sequencing would select the community with listed species/habitat over the community without species/habitat present.

FEMA Region 10 is proposing to implement a screening process to flag LOMR-Fs issued to communities for prioritization in follow-up monitoring and enforcement actions. FEMA Region 10 evaluates all LOMR-Fs once they are issued and gives consideration to those communities with LOMR-Fs for conducting CAVs and Community Assistance Contacts.

1.3.2.2 Regulatory Floodplain Management Criteria

As part of the proposed action, FEMA proposes that it will advise communities with ESA-listed species and critical habitat present within the floodplain to update their existing ordinances[53] or enforceable procedures so that the conservation measures[54] described below are incorporated.[55] FEMA proposes to have communities implement these "ESA measures" under 44 CFR 60.3(a)(2), FEMA's "all necessary permits" regulation.[56]

1. All new development, and substantial improvements, as defined by FEMA's regulations, will not adversely affect ESA-listed species or critical habitat within any designated floodway or Riparian Buffer Zone (RBZ) as described below. Collectively, the floodway, when delineated, and the RBZ are considered a management area within which a limited amount of activity may occur.[57] This allows for some level of development as long as guidelines are followed to retain those existing natural functions and processes that floodplain habitats provide to aquatic communities. The only adverse effects allowed in the conservation zone[58] are those developments with short-term impacts associated with: (1) functionally dependent uses, (2) habitat restoration activities, or (3) activities that result in a beneficial gain for the species or habitat. Short-term impacts are temporary changes occurring during or immediately following an action and that do not persist. FEMA proposes to define short-term adverse effects as those that occur during or

[53] ORS 227.215 and ORS 215.416, for cities and counties, respectively, authorize cities and counties to adopt ordinances for activities that may be undertaken only in compliance with the terms of a development permit. The term "permit" does not include approval or denial of an application designed to regulate the physical characteristics of a use permitted outright (ORS 197.015). Development in the SFHA may not be an outright permitted use because 44 CFR Part 60.3(a)(1) requires cities to adopt ordinances that require a permit for all development in the SFHA. In general, permits should tie to specific standards or criteria required to grant the permit, otherwise granting the permit would require a public hearing (ORS 197.763). For this reason, cities where fish-bearing streams occur should adopt local ordinances that specifically call out the need to evaluate floodplain development for compliance with ESA in accordance with specific performance standards or criteria.

[54] FEMA presented these as "performance measures" in the biological assessment. NMFS recognizes effective performance measures as quantitative metrics that are easily monitored and identify specific thresholds that initiate an adaptive management component. Since FEMA's measures do not appear to meet those standards and instead are intended to conserve resources, herein we have characterized them as "conservation measures."

[55] FEMA provided revised measures on December 20, 2012 via e-mail from Barry Gall (FEMA) to Robert Markle (NMFS).

[56] Clarification of the proposed action provided by John Graves (FEMA) to Robert Markle (NMFS) during a telephone call discussing FEMA's proposed enforcement procedures for the Oregon standards (February 26, 2013).

[57] NMFS edited the description to include the floodway to be consistent with our understanding of FEMA's intent.

[58] NMFS termed the combined floodway and RBZ as the "conservation zone."

immediately following an action, and usually only persist for a few days for most habitat functions and processes (*e.g.*, temporary increases in turbidity), but never more than one year (*e.g.*, temporary degradation of in-stream or riparian habitat characteristics).[59] All adverse effects associated with functionally dependent uses will be avoided, minimized, or rectified so that the long-term outcome will be neutral or beneficial for ESA-listed species and their critical habitats.

A functionally-dependent use as defined by FEMA is a use that cannot perform its intended purpose unless located or carried out in proximity to water (*e.g.*, pier, bridges). For NFIP insurable structures, "[t]he term includes only docking facilities, port facilities that are necessary for the loading and unloading of cargo or passengers, and ship building and ship repair facilities, but does not include long-term storage or related manufacturing facilities" (44 CFR Part 59.1). For structures other than NFIP insurable buildings (*e.g.*, utility crossings, bridges), the locational dependence is determined by two tests (Interagency Task Force on Floodplain Management, 1984):[60] (1) Is the purpose of the activity involved directly in the business of inserting and extracting goods into and out of waterborne vessels or inserting and extracting the vehicles themselves to and from the water, or to provide public access and use of the shoreline for recreation? (2) For an industry classified as functionally-dependent under the first question, is an individual structure vital to day-to-day production?

2. The outer boundary of the RBZ is measured from the ordinary high water line (OHW) of a fresh waterbody (lake; pond; ephemeral, intermittent, or perennial stream[61]) or mean higher-high water line (MHHW) of a marine shoreline or tidally influenced river reach to 170 feet horizontally on each side of the stream. In this context, the RBZ includes the area between the outer boundaries on each side of the stream, including the stream channel.[62] For incorporated cities and designated urban unincorporated communities[63] outside the urban growth boundary (Appendix F of the BA and repeated in Appendix 1.3-

[59] Short-term effects defined in revised measures provided by Barry Gall (FEMA) to Robert Markle (NMFS) on December 20, 2012.

[60] FEMA comments on a draft proposed action description provided by NMFS for FEMA review on December 16, 2011. The response was provided by FEMA on February 15, 2012, and included edits within the document and additional information relevant to the consultation. FEMA provided further clarification on this point on March 9, 2012.

[61] Perennial Stream: A stream that flows year round, even during periods of no rainfall. Intermittent Stream: A stream that flows only during certain times of the year, including ephemeral streams.

[62] FEMA comments on a draft proposed action description provided by NMFS for FEMA review on December 16, 2011. The response was provided by FEMA on February 15, 2012, and included edits within the document and additional information relevant to the consultation.

[63] Oregon Administrative Code 660-022-0010 defines an 'Urban Unincorporated Community' as "an unincorporated community which has the following characteristics: (a) Include at least 150 permanent residential dwellings units; (b) Contains a mixture of land uses, including three or more public, commercial or industrial land uses; (c) Includes areas served by a community sewer system; and (d) Includes areas served by a community water system." (http://arcweb.sos.state.or.us/pages/rules/oars_600/oar_660/660_022.html).

B of this opinion), the types of development in the RBZ can be modified to account for the "built out" environment by complying with either A or B.[64]

A. Conducting a "programmatic habitat assessment"[65] that is scientifically based (Best Available Science) and demonstrates that the modified development within the RBZ will result in an improved overall conservation, protection, and appropriate restoration of riparian habitat within the spatial scale of the assessment.
   i. The assessment can be conducted for the whole community, or individual urban watershed or sub-watershed, while maintaining the standards in conservation measure #1 for the non-assessed areas of the community; and
   ii. As a minimum, modified development within the RBZ shall not be allowed within 50 feet of the OHW or MHHW lines.

B. Adhering to the criteria and standards for allowing site specific development modifications within the RBZ as described in Appendix E of the BA and repeated in Appendix 1.3-C of this opinion.[66]

3. For SFHA development outside the floodway or RBZ, all adverse effects on existing floodplain functions that support fish and their habitat will be mitigated so that no net loss or a net beneficial gain is achieved.

Under FEMA's proposal, these conservation measures would not apply to any improvements or repairs to existing structures or utilities that do not increase the structure's existing footprint by more than 10%, based on the footprint on the date of this opinion.[67] Additionally, any development proposal that has received prior approval through an ESA section 4(d), 7, or 10 process would be considered by FEMA to satisfy all ESA requirements and deemed compliant with the NFIP for purposes of 44 CFR 60.3(a)(2) if:

1. all elements of the proposed development in the floodplain were addressed in the previously approved ESA process, including all interrelated and interdependent actions; and
2. no new information has been revealed subsequent to that approval to cause a change in the effects of the proposed development (*e.g.*, a listing of new species or critical habitat, new data previously not available, substantial changes in the landscape).[68]

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[64] RBZ modification standards were provided by Barry Gall (FEMA) to Robert Markle (NMFS) on December 20, 2012.

[65] An adequate assessment will conform to the latest FEMA Region X Floodplain Habitat Assessment and Mitigation Guide available online (*http://www.fema.gov/national-flood-insurance-program-endangered-species-act*).

[66] Clarification on conservation measure #2 included in draft text of FEMA's Final Biological Assessment provided by Barry Gall (FEMA) to Robert Markle (NMFS) on March 13, 2013.

[67] FEMA comments on a draft proposed action description provided by NMFS for FEMA review on December 16, 2011. The response was provided by FEMA on February 15, 2012, and included edits within the document and additional information relevant to the consultation.

[68] Clarification on acceptable ESA documentation included in draft text of FEMA's Final Biological Assessment provided by Barry Gall (FEMA) to Robert Markle (NMFS) on March 13, 2013.

While FEMA proposes these conservation measures, it does not appear that FEMA is incorporating them as enforceable components of their minimum criteria, thus it is unclear how FEMA is requiring communities to incorporate them. This topic is addressed further in the Effects Section of this opinion.

1.3.2.3 Habitat Mitigation Activities[69]

FEMA proposes to instruct local communities to record floodplain development activities, assess impacts using the current tools available, and mitigate for any identified adverse effects to habitat functions. FEMA expects habitat mitigation will be achieved on a project by project basis (*i.e.*, at the time of local permitting and at the local level). Since the community officials of many jurisdictions have limited experience with ESA consultations, FEMA proposes to help community officials understand how to develop and review habitat assessments and make ESA "effects determinations." We interpret this to mean that FEMA intends to educate community officials in how to evaluate the effects of proposed development projects on ESA-listed species and their habitats.

FEMA proposes to provide technical assistance to communities and has funded DLCD to perform outreach. FEMA proposes to offer public workshops in Oregon, contingent upon available funding, to help local community officials understand and make "effects determinations." The workshops are intended to provide local communities with detailed information on how to conduct and/or interpret habitat assessments that are provided to them for permitting. FEMA also proposes to develop and provide regional guidance documents on an internet site to assist communities, including "Floodplain Habitat and Mitigation" guidance for Oregon. We note that this aspect is modeled after FEMA's implementation of the NFIP RPA for the Puget Sound Region.

A Floodplain Habitat Assessment and Mitigation guidance document has not yet been completed for Oregon, but is intended to assist communities with documenting ESA compliance by completing supportable "programmatic habitat assessments." The guidance would include a description of the general content needed for a habitat assessment, examples of possible formats to use, and links to other resources that could assist communities in the preparation of assessments. Also included would be a list and description of the key habitat functions and processes that may be impacted by some land development actions. Habitat assessments would need to describe current baseline conditions relative to these functions and how the proposed action would affect each function in order to adequately assess possible impacts to ESA-listed species and designated critical habitats.

1.3.2.4 Enforcement

FEMA proposes to use available reports, LOMR-F approvals, repetitive loss statistics, potential violations, ESA-listed species presence, and other factors to influence the community selection process for conducting CAVs and Community Assistance Contacts.

[69] Clarification of FEMA's proposed efforts to assist communities was included in draft text of FEMA's Final Biological Assessment provided by Barry Gall (FEMA) to Robert Markle (NMFS) on March 13, 2013.

FEMA proposes to engage with the Corps and the Oregon Department of State Lands for the opportunity to be included in the Joint Permit Application review process as a means of sampling and reconciling floodplain activities for conducting compliance activities with communities. The approach would be to add FEMA to the distribution of Joint Permit Application applications. FEMA would track activity and location information to use in community compliance monitoring conducted during CAVs. At this time, FEMA has not yet reached out to the subject agencies regarding this proposal.

In addition, FEMA provides financial assistance to DLCD to help monitor community compliance with the NFIP under the Assistance Program – State Support Services Element grant program. FEMA proposes to change its State Support Services Element funding guidelines to require DLCD to assist FEMA with its monitoring of communities for ESA compliance.

FEMA proposes that communities that fail to implement the requirements of 44 CFR Part 60.3(a)(2) (*i.e.*, compliance with ESA before issuing a floodplain development permit) will be subject to FEMA enforcement actions. Enforcement would fall under the criteria of "failure to enforce the local floodplain ordinance" and result in a CAV to determine the circumstances and identify corrections for violations. FEMA proposes to provide NMFS a copy of any CAV report where a potential violation of the proposed conservation measures has been observed when the report is submitted to the community for redress.[70] The report would include the nature of the potential violation, any actions required to remedy the potential violation, and the actions taken by the community for compliance. FEMA relies on this same construct in Washington State, where 7 years of RPA implementation for the NFIP participating communities in the Puget Sound reveals that FEMA has engaged in technical assistance with some communities that failed to comply with RPA standards, but no probation or suspension has resulted. NMFS staff in Washington does attend some CAVs at FEMA's invitation.

FEMA proposes to proceed with NFIP enforcement under 44 CFR 59.24 when a community fails to adequately enforce the floodplain management regulations, including the "necessary permits" regulation (44 CFR 60.3(a)(2)). A significant flaw in this aspect of FEMA's proposed action is the reliance on local entities "complying with the ESA" prior to issuing a floodplain development permit. The ESA is primarily designed to ensure that Federal actions, not local actions, avoid jeopardizing species and adversely modifying critical habitat, and no consultation requirement or process exists for local entities to make such a demonstration of compliance. While FEMA indicates that ESA section 10(a)(1)(B) permits are that vehicle, they misunderstand how that section of the ESA operates – ESA section 10 permits are not a required permit. The services' regulations at 50 CFR 222.301 state "any person who desires to obtain permit priveleges" for take incidental to an otherwise lawful activity must apply for that permit in accordance with applicable regulatory provisions. In other words, section 10 permits are elective, not required, and therefore do not appear to fall within the purview of 44 CFR 60.3(a)(2).

[70] FEMA comments on a draft proposed action description provided by NMFS for FEMA review on December 16, 2011. The response was provided by FEMA on February 15, 2012, and included edits within the document and additional information relevant to the consultation.

FEMA proposes to notify NMFS of violations that result in the loss of habitat or potential take of an ESA-listed species.[71] This approach assumes that local record-keeping and reporting will be sufficient for FEMA to discern local violations of FEMA's proposed action. Finally, when non-compliance with 44 CFR 60.3(a)(2) is associated with a failure to comply with the ESA, FEMA proposes to require that NMFS demonstrate that harm occurred to ESA-listed species (*i.e.*, through loss of habitat or take of species) as a prerequisite to FEMA continuing enforcement action for non-compliance with the discretionary conservation measures proposed by FEMA, shfting FEMA's ESA section 7(a)(2) obligation to NMFS as a section 9 enforcement burden. After the passage of time reveals that technical assistance has failed to correct a community's noncompliance with the ESA protocols of the FEMA proposed action, a community will be removed from the Community Rating System (if enrolled, but most in Oregon are not); if the community still fails to correct its performance, it would be placed on probation. Upon placing a community on probation, FEMA will further notify NMFS of all actions taken by FEMA to correct program deficiencies and violations. If the community does not make corrections during probation, a jurisdiction will be suspended from the NFIP. However, FEMA's record of CAVs and probation of Oregon communities for failing to comply with the existing regulatory minimum criteria is very low, with only one community placed on probation and no suspensions in the last 30 years.[72] FEMA's current compliance monitoring includes approximately 12 CAV per year with, an average of 10 years between community reviews. Approximately 23% of communities have never been monitored.

FEMA proposed several reporting measures to be incorporated in program implementation in Oregon (Table 1.3-10).

Table 1.3-10. FEMA proposes to incorporate reporting measures in program implementation in Oregon in order to achieve specific desired outcomes.

Activity/Objective	Desired Outcome	Specific Indicator
Mapping		
Provide modeling guidance	Communities/individuals are aware of mapping models that help capture habitat features for evaluating impacts	1. Number of downloads on website 2. Number of requests for information 3. Percent of communities with awareness of guidance document
Map sequencing for flood studies	Listed species/habitat given consideration in decision for funding future studies	4. Process formalized by the Region 5. Percent of flood studies with listed species/habitat
Flag LOMR-Fs for monitoring	Communities are addressing fill impacts to species before permitting	6. Number of LOMR-Fs reviewed by FEMA for impacts 7. Number of issued permits with omissions for addressing fill impacts

[71] Clarification of FEMA's proposed action relative to "enforcement" was provided by Barry Gall (FEMA) to Robert Markle (NMFS) via e-mail (March 1, 2013) and followed a telephone conversation on the same topic that included John Graves (FEMA), (February 26, 2013).

[72] Pers Comm. Christine Shirley, DLCD, March 11, 2015.

Activity/Objective	Desired Outcome	Specific Indicator
Regulation		
Communities update existing ordinances	No adverse effects occur in the floodway or riparian zone (limited short-term adverse effects associated with functionally dependent uses, habitat restoration, and projects with resultant beneficial gain are possible)[1] No net loss or beneficial gain for rest of floodplain (long-term adverse effects are possible at the site scale, but are mitigated in the reach/area scale so that the total outcome is no net loss or beneficial gain)[1]	8. Number of communities with adopted ordinances
Floodplain Mitigation Activities		
Mitigate impacts at local level	All impacts to species/habitat from floodplain development are avoided or mitigated	9. Percent of permits (from sampling) that address mitigation of impacts to species/habitat
Conduct workshops and technical assistance	Increased awareness of the value and benefit to mitigating impacts to species/habitat	10. Percent of communities participating in workshops/receiving technical assistance
Monitoring/Adaptive Management		
Conduct Community Assistance Visit/Community Assistance Contacts in communities with highly vulnerable ESU populations	Greater success in implementation at the local level	11. Number and percent of Community Assistance Visit/Community Assistance Contact per highly vulnerable ESU population
Receive Joint Permit Application for monitoring	Utilizing available data for evaluating and prioritizing Community Assistance Visit/Community Assistance Contacts	12. Establishment of process with US Army Corps of Engineers for receiving Joint Permit Applications by FY2014
Violation reporting	Visibility by NMFS on potential issues with implementation	13. Number and percent of Community Assistance Visits submitted to NMFS

[1] Clarification provided by FEMA in comments on a draft proposed action description, February 15, 2012.

1.3.2.5 Implementation Schedule

FEMA proposes the following schedule for establishing the revised program in Oregon. FEMA expects the revised program will be fully implemented 4 years from issuance of this biological opinion. During this period, FEMA intends to focus on the internal agency changes and assisting local communities.

Several of the internal FEMA changes (*e.g.,* mapping priorities, modeling, CRS) are already implemented on a national scale or by FEMA Region X in response to the Puget Sound NFIP consultation. The changes unique to Oregon will be instituted in coordination with DLCD during the 4-year implementation period.

Local community changes would occur in two focused phases: first outreach, and then compliance. During the first 2 years, FEMA will focus on education and outreach to inform the communities about the program changes and how to make the appropriate changes to their local regulations. The remaining 2 years would focus on complying with state-required processes for amending ordinances, along with continued outreach and technical assistance by FEMA, NMFS, and DLCD. FEMA's expectation is that communities would come into compliance on various schedules, and the timeline will not be a strict sequential process.

FEMA proposes to establish, with assistance from NMFS, the priorities for bringing individual communities into compliance based upon fish recovery efforts or most vulnerable populations. FEMA, with assistance from DLCD, will then focus efforts on those communities first.

Communities have previously been notified by FEMA of their responsibility to comply with the ESA via the standards set forth in 44 CFR 60.3(a)(2). FEMA's direction requires communities either: (1) prohibit all NFIP-related actions in the SFHA during the establishment of the revised program, or (2) determine the presence of ESA-listed fish species or designated critical habitat and assess permit applications for potential impacts to the species or their habitat. FEMA expects adherence to 44 CFR 60.3(a)(2) means that communities will require any actions with potential adverse effects to be fully mitigated and result in no net loss of habitat function.

At this time, FEMA has not proposed a specific reporting requirement for the establishment period.

1.4 Action Area

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

For this consultation, the action area consists of all the areas where listed species covered by this opinion may be affected by FEMA's implementation of the NFIP in the State of Oregon related to floodplain mapping, application of the regulatory floodplain management criteria, and the CRS program. This includes the flood-prone areas adjacent to rivers and streams throughout Oregon, as well as adjacent estuarine and marine areas (Figures 1.4-1 and 1.4-2).

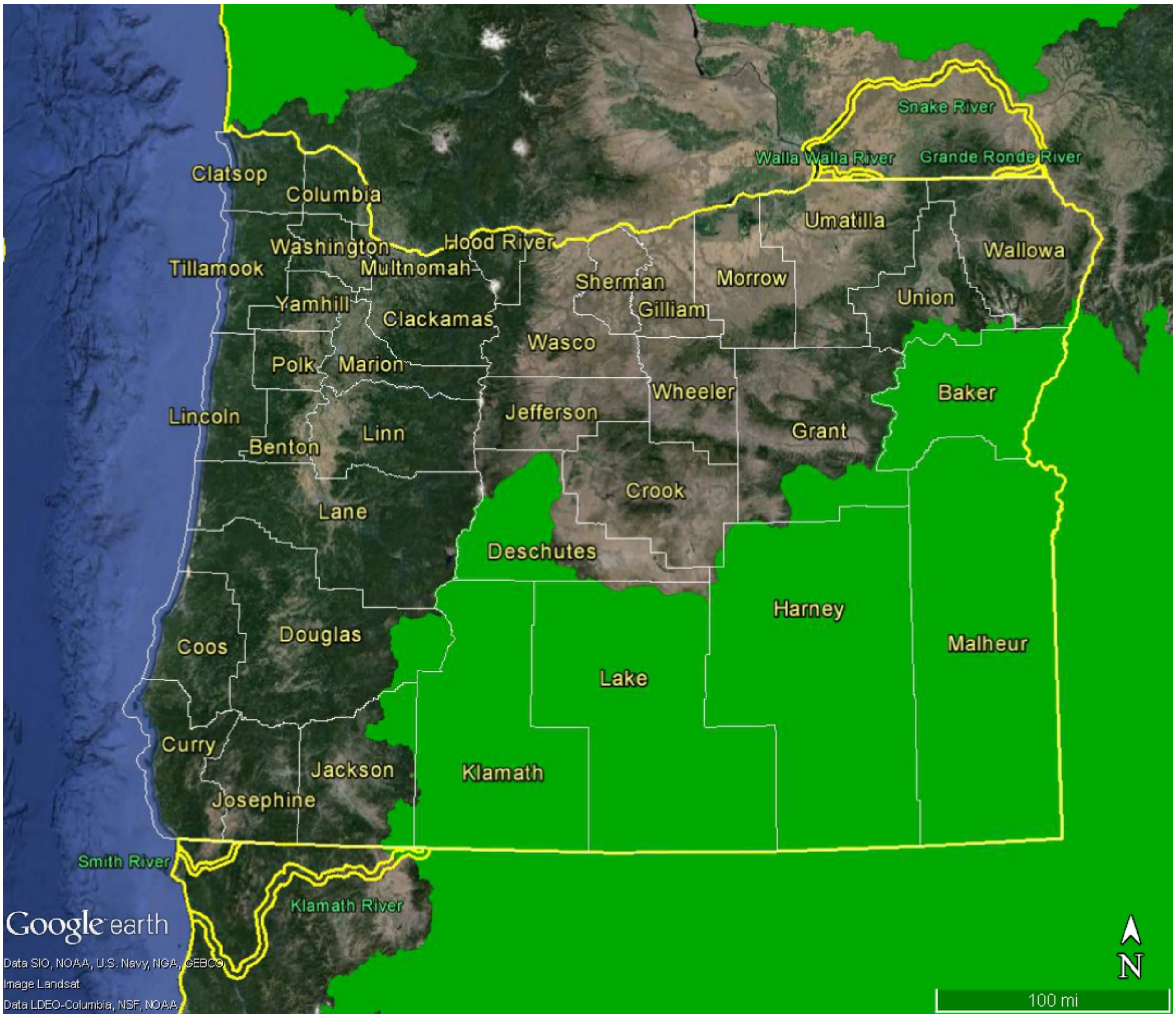

Figure 1.4-1. The State of Oregon portion of the action area. The yellow outline indicates the action area, including major mainstem rivers located downstream. The green field indicates areas without ESA-listed species under NMFS jurisdiction. White lines and labels indicate counties in Oregon. Green labels indicate major mainstem rivers downstream of Oregon.

We excluded five river basins in Oregon because they are endorheic basins[73] or, while technically they may have contained anadromous fish in the past, these exorheic basins now have natural or artificial barriers that preclude anadromous fish migration, thus making them inaccessible to species considered in this opinion: Goose and Summer Lakes (endorheic), Harney (endorheic), Owyhee, Malheur, and Powder Rivers. Furthermore, the exhorheic basins in question are: (1) largely in Federal ownership where the NFIP does not apply; (2) in terrain that

[73] An endorheic basin is a closed drainage basin that retains water and allows no outflow to other rivers or oceans.

is unlikely to contain significant floodplains; (3) spatially separated from anadromous fish distribution by substantial distances (*e.g.*, more than 50 miles upstream of Hells Canyon Dam); and (4) associated with water impoundments that are reasonably certain to sufficiently amerliorate hydrologic or water quality effects where listed fish occur downstream. Thus, implementation of the NFIP in these basins is expected to be disconnected from, or of insufficient magnitude to transmit any adverse effects downstream where anadromous fish occur.

In addition to the five river basins that we identified as not containing ESA-listed anadromous fish, or where adverse effects are unlikely, excluding the Klamath River basin is also appropriate because the Oregon portion of the Klamath River basin (approximately 5,090 square miles) including the communities (i.e., Klamath Falls, Altamont, Chiloquin, Chemult, Bonanza, Malin, Bly, and other small communities predominately within Klamath County) is above Iron Gate Dam (approximately 20 miles downstream of the Oregon border) which prevents upstream passage of SONCC coho salmon. Historically, SONCC coho salmon occurred in Klamath River in Oregon up to Spencer Creek, which currently enters the Klamath River at John C. Boyle Reservoir. While containing substantial floodplains, the majority of the basin in Oregon occurs above several dams and Upper Klamath Lake. The reservoirs and lake will sufficiently limit the magnitude of any resultant hydrologic or water quality effects associated with implementation of the NFIP in the Oregon portion of the basin to prevent adverse effects to occur below Iron Gate Dam. Consequently, we expect that any adverse effects associated with floodplain development on non-Federal lands in those Oregon areas of the Klamath River basin are unlikely to impact listed species where they occur downstream in the Klamath River mainstem.

Figure 1.4-2. The marine portion of the action area is indicated by the light shading. Source: Wiles (2004).

To assess the effects of the proposed action on the Southern Resident killer whales (SRKW) (*Orcinus orca*), we considered the overlap in the marine distribution of anadromous salmonids affected by the action and the coastal range of SRKW. Anadromous salmonids that originate from Oregon will disperse both north, to the coastal waters of Washington and the west coast of Vancouver Island, and south off the coast of California (Weitkamp 2010). Therefore, the action area also encompasses the whales' entire coastal range from California to Vancouver, British Columbia where the marine ranges of SRKW and affected anadromous salmonids overlap (Figure 1.4-2). This analysis considers the indirect effects of the NFIP causing a reduction in available prey for SRKW. The coastal range of SRKW is not designated as critical habitat.

An overlap exists between the areas affected by the NFIP and the range of ESA-listed species (18) and designated (16) or proposed (1) critical habitats that occur in Oregon (Figure 1.4-1). This includes 13 of the 18 river basins that occur in Oregon: North Coast, Mid Coast, Umpqua, South Coast, Rogue, Klamath, Willamette, Sandy, Hood, Deschutes, John Day, Umatilla (including part of the Walla Walla River), and Grande Ronde. The Klamath Basin is excluded, as only a small portion in southern Jackson County contains an ESA-listed species, (Southern Oregon/Northern California Coasts coho salmon), and the majority of those lands are in Federal ownership where the NFIP does not apply.

The action area also contains EFH designated for coastal pelagic species (PFMC 1998), Pacific Coast salmon (PFMC 1999), highly migratory species (PFMC 2003), and Pacific Coast groundfish (PFMC 2005), or is in an area where environmental effects of the proposed action may adversely affect designated EFH for those species.

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

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

2.1 Approach to the Analysis

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

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

This opinion relies on the definition of "destruction or adverse modification", which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features” (81 FR 7414).

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

- Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed action. Section 2.2 describes the current status of each listed species and its critical habitat relative to the conditions needed for recovery. For listed salmon and steelhead, NMFS has developed specific guidance for analyzing the status of the listed species’ component populations in a “viable salmonid populations” paper (VSP; McElhany *et al*. 2000). The VSP approach considers the abundance, productivity, spatial structure, and diversity of each population as part of the overall review of a species’ status. For listed salmon and steelhead, the VSP criteria therefore encompass the species’ “reproduction, numbers, or distribution” (50 CFR 402.02). In describing the rangewide status of listed species, we rely on viability assessments and criteria in technical recovery team documents and recovery plans, where available, that describe how VSP criteria are applied to specific populations, major population groups, and species. We determine the rangewide status of critical habitat by examining the condition of its physical or biological features (also called “primary constituent elements” or PCEs in some designations) which were identified when the critical habitat was designated.
- Describe the environmental baseline in the action area. Section 2.3 includes the past and present impacts of Federal, state, or private actions and other human activities in the action area. It includes the anticipated impacts of proposed Federal projects that have already undergone formal or early section 7 consultation and the impacts of state or private actions that are contemporaneous with the consultation in process.
- Analyze the effects of the proposed action on both species and their habitat. In this step (Section 2.4), we consider how the proposed action would affect the species’ reproduction, numbers, and distribution or, in the case of salmon and steelhead, their VSP parameters. We also evaluate the proposed action’s effects on critical habitat features.
- Describe any cumulative effects in the action area. Cumulative effects (Section 2.5), as defined in our implementing regulations (50 CFR 402.02), are the effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area. Future Federal actions that are unrelated to the proposed action are not considered because they require separate section 7 consultation.
- Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat. In this step (Section 2.6), we add the effects of the action (Section 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5) to assess whether the action could reasonably be expected to: (1) reduce appreciably the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the conservation value of designated or proposed critical habitat. These assessments are made in full consideration of the status of the species and critical habitat (Section 2.2).
- Reach jeopardy and adverse modification conclusions. In this step (Section2.7) we state our conclusions regarding jeopardy and the destruction or adverse modification of critical habitat are presented in Section 2.7. These conclusions flow from the logic and rationale presented in Section 2.6 (Integration and Synthesis).

- If necessary, define a reasonable and prudent alternative to the proposed action. If, in completing the last step in the analysis, we determine that the action under consultation is likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat, we must identify an RPA to the action in Section 2.8. The RPA must not be likely to jeopardize the continued existence of listed species nor adversely modify their designated critical habitat and it must meet other regulatory requirements.

In this opinion, NMFS concludes that the proposed action is not likely to adversely affect (NLAA) the following ESA-listed species present in the action area or designated critical habitat for leatherback sea turtle (see Section 2.12 for details).

- Humpback whales
- Blue whales
- Fin whales
- Sei whales
- Sperm whales
- North Pacific Right whales
- Loggerhead sea turtles
- Green sea turtles
- Leatherback sea turtles
- Olive Ridley sea turtles

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be affected by the proposed action. The status is the level of risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. The species status section helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitats throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated areas, and discusses the current function of the essential physical and biological features that help to form that conservation value.

One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large, is climate change. Climate change is likely to play an increasingly important role in determining the abundance of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. Areas with elevations high enough to maintain temperatures well below freezing for most of the winter and early-spring will be less affected. Low-elevation areas are likely to be more affected. By 2100, riverine flood depths and flood areas are predicted to increase by over 100% in some areas of the Pacific Northwest (AECOM 2013, p. 6-1). Nationally, estimated flood increases were attributed to human population growth (30%) and climate change (70%) (AECOM 2013, p. ES-6).

During the last century, average regional air temperatures increased by 1.5°F, and increased up to 4°F in some areas. Warming is likely to continue during the next century as average temperatures increase another 3 to 10°F. Overall, about one-third of the current cold-water fish habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (USGCRP 2009).

Precipitation trends during the next century are less certain than for temperature, but more precipitation is likely to occur during October through March and less during summer months, and more of the winter precipitation is likely to fall as rain rather than snow (ISAB 2007; USGCRP 2009). Where snow occurs, a warmer climate will cause earlier runoff so stream flows in late spring, summer, and fall will be lower and water temperatures will be warmer (ISAB 2007; USGCRP 2009).

Higher winter stream flows increase the risk that winter floods in sensitive watersheds will damage spawning redds and wash away incubating eggs. Earlier peak stream flows will also flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and the risk of predation. Lower stream flows and warmer water temperatures during summer will degrade summer rearing conditions, in part by increasing the prevalence and virulence of fish diseases and parasites (USGCRP 2009). Other adverse effects are likely to include altered migration patterns, accelerated embryo development, premature emergence of fry, variation in quality and quantity of tributary rearing habitat, and increased competition and predation risk from warm-water, non-native species (ISAB 2007).

The earth's oceans are also warming, with considerable interannual and inter-decadal variability superimposed on the longer-term trend (Bindoff *et al*. 2007). Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances (Scheuerell and Williams 2005; USGCRP 2009; Zabel *et al*. 2006). Ocean conditions adverse to salmon and steelhead may be more likely under a warming climate (Zabel *et al*. 2006). Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. Marine fish species have exhibited negative responses to ocean acidification conditions that include changes in growth, survivorship, and behavior. Marine phytoplankton, which are the base of the food web for many oceanic species, have shown varied responses to ocean acidification that include changes in growth rate and calcification (Feely *et al*. 2012).

The Status of Species and Critical Habitat sections below are organized by recovery domains (Table 2.2-2) to better integrate into this consultation information in final and draft recovery plans on the conservation status of the ESA-listed species and their critical habitats. Recovery domains are the geographically-based areas within which NMFS prepares recovery plans.

2.2.1 Status of the Species

For Pacific salmon, steelhead, and certain other species, NMFS commonly uses the four "viable salmonid population" (VSP) criteria (McElhany *et al*. 2000) to assess the viability of the populations that, together, constitute the species. These four criteria (spatial structure, diversity, abundance, and productivity) encompass the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. When these parameters are collectively at appropriate levels, they maintain a population's capacity to adapt to various environmental conditions and allow it to sustain itself in the natural environment.

For species with multiple populations, once the biological status of a species' populations has been determined, NMFS assesses the status of the entire species using criteria for groups of populations, as described in recovery plans and guidance documents from technical recovery teams. Considerations for species viability include having multiple populations that are viable, ensuring that populations with unique life histories and phenotypes are viable, and that some viable populations are both widespread to avoid concurrent extinctions from mass catastrophes and spatially close to allow functioning as metapopulations (McElhany *et al*. 2000).

The summaries that follow describe the status of the 18 ESA-listed species, and their designated critical habitats, that occur within the geographic area of this proposed action and are considered in this opinion. More detailed information on the status and trends of these listed resources, and their biology and ecology, are in the listing regulations and critical habitat designations published in the Federal Register (Table 2.2-1).

Table 2.2-1. Listing status, status of critical habitat designations and protective regulations, and relevant Federal Register (FR) decision notices for ESA-listed species considered in this opinion. Listing status: "T" means listed as threatened under the ESA; "E" means listed as endangered; "P" means proposed for listing or designation

Species	Listing Status	Critical Habitat	Protective Regulations
Marine and Anadromous Fish			
Chinook salmon *(Oncorhynchus tshawytscha)*			
Lower Columbia River	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Willamette River spring-run	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Columbia River spring-run	E 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	ESA section 9 applies
Snake River spring/summer-run	T 6/28/05; 70 FR 37160	10/25/99; 64 FR 57399	6/28/05; 70 FR 37160
Snake River fall-run	T 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543	6/28/05; 70 FR 37160
Chum salmon *(O. keta)*			
Columbia River	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Coho salmon *(O. kisutch)*			
Lower Columbia River	T 6/28/05; 70 FR 37160	2/24/16; 81 FR 9252	6/28/05; 70 FR 37160
Oregon Coast	T 6/20/11; 76 FR 35755	2/11/08; 73 FR 7816	2/11/08; 73 FR 7816
Southern Oregon/Northern California Coasts	T 6/28/05, 70 FR 37160	5/5/99; 64 FR 24049	6/28/05; 70 FR 37160
Sockeye salmon *(O. nerka)*			
Snake River	E 8/15/11; 70 FR 37160	12/28/93; 58 FR 68543	ESA section 9 applies
Steelhead (*O. mykiss*)			
Lower Columbia River	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Willamette River	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Middle Columbia River	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Columbia River	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	2/1/06; 71 FR 5178
Snake River Basin	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Green sturgeon (*Acipenser medirostris*)			
Southern DPS	T 4/07/06; 71 FR 17757	10/09/09; 74 FR 52300	6/2/10; 75 FR 30714
Eulachon *(Thaleichthys pacificus)*			
Southern DPS	T 3/18/10; 75 FR 13012	10/20/11; 76 FR 65324	Not applicable
Marine Mammals			
Killer Whale (*Orcinus orca*)			
Southern Resident DPS	E 11/18/05; 70 FR 69903	11/29/06; 71 FR 69054	ESA section 9 applies

The Status of Species and Critical Habitat Sections below are organized by recovery domains (Table 2.2-2) to better integrate into this consultation information in final and draft recovery plans on the conservation status of the ESA-listed species and their critical habitats. Recovery domains are the geographically-based areas within which NMFS prepares recovery plans.

Table 2.2-2. Recovery planning domains identified by NMFS and their ESA-listed salmon and steelhead species.

Recovery Domain	Species
Willamette-Lower Columbia (WLC) 107 populations	LCR Chinook salmon UWR Chinook salmon CR chum salmon LCR coho salmon LCR steelhead UWR steelhead
Interior Columbia (IC) 80 populations	UCR spring-run Chinook salmon SR spring/summer-run Chinook salmon SR fall-run Chinook salmon SR sockeye salmon UCR steelhead MCR steelhead SRB steelhead
Oregon Coast (OC) 56 populations	OC coho salmon
Southern Oregon/Northern California Coasts (SONCC) 40 populations (of which 13 populations occur in Oregon)	SONCC coho salmon

For each recovery domain, a technical review team (TRT) appointed by NMFS has developed, or is developing, criteria necessary to identify independent populations within each species, recommended viability criteria for those species, and descriptions of factors that limit species survival. Viability criteria are prescriptions of the biological conditions for populations, biogeographic strata, and evolutionarily significant units (ESUs) and distinct population segments (DPSs) that, if met, would indicate that an ESU or DPS will have a negligible risk of extinction over a 100-year time frame.[74]

Although the TRTs operated from the common set of biological principals described in McElhany *et al.* (2000), they worked semi-independently from each other and developed criteria suitable to the species and conditions found in their specific recovery domains. All of the criteria have qualitative as well as quantitative aspects. The diversity of salmonid species and populations makes it impossible to set narrow quantitative guidelines that will fit all populations in all situations. For this and other reasons, viability criteria vary among species, mainly in the number and type of metrics and the scales at which the metrics apply (*i.e.*, population, major population group (MPG), or ESU/DPS) (Busch *et al.* 2008).

[74] For Pacific salmon, NMFS uses its 1991 ESU policy, which states that a population or group of populations will be considered a Distinct Population Segment if it is an Evolutionarily Significant Unit. An ESU represents a distinct population segment of Pacific salmon under the Endangered Species Act that: (1) is substantially reproductively isolated from conspecific populations, and (2) represents an important component of the evolutionary legacy of the species. The species *O. mykiss* is under the joint jurisdiction of NMFS and the Fish and Wildlife Service, so in making its January 2006 listing determinations NMFS elected to use the 1996 joint FWS-NMFS DPS policy for this species.

Most TRTs included in their viability criteria a combined risk rating for abundance and productivity (A/P), and an integrated spatial structure and diversity (SS/D) risk rating (*e.g.*, Interior Columbia TRT) or separate risk ratings for spatial structure and diversity (*e.g.*, Willamette/Lower Columbia TRT).

The boundaries of each population were defined using a combination of genetic information, geography, life-history traits, morphological traits, and population dynamics that indicate the extent of reproductive isolation among spawning groups. The overall viability of a species is a function of the VSP attributes of its constituent populations. Until a viability analysis of a species is completed, the VSP guidelines recommend that all populations should be managed to retain the potential to achieve viable status to ensure a rapid start along the road to recovery, and that no significant parts of the species are lost before a full recovery plan is implemented (McElhany *et al*. 2000).

The size and distribution of the populations considered in this opinion generally have declined over the last few decades due to natural phenomena and human activity, including climate change (as described in Section 2.2), the operation of hydropower systems, over-harvest, effects of hatcheries, and habitat degradation. Enlarged populations of terns, seals, California sea lions, and other aquatic predators in the Pacific Northwest may be limiting the productivity of some Pacific salmon and steelhead populations (Ford 2011).

Viability status or probability or population persistence is described below for each of the populations considered in this opinion. Although Southern DPS green sturgeon (Southern green sturgeon) and Southern DPS eulachon (Southern eulachon) are part of more than one recovery domain structure, they are presented below as part of the WLC recovery domain.

2.2.1.1 Willamette-Lower Columbia Recovery Domain

Species in the Willamette-Lower Columbia (WLC) recovery domain include LCR Chinook salmon, UWR Chinook salmon, CR chum salmon, LCR coho salmon, LCR steelhead, UWR steelhead, Southern green sturgeon, and eulachon. The WLC Technical Recovery Team (WLC-TRT) identified 107 demographically independent populations of Pacific salmon and steelhead (Table 2.2-3). These populations were further aggregated into strata or major population groups (MPGs), groupings above the population level that are connected by some degree of migration, based on ecological subregions. All 107 populations use parts of the mainstem of the Columbia River and the Columbia River estuary for migration, rearing, and smoltification.

Table 2.2-3. Populations in the WLC recovery domain. Combined extinction risks for salmon and steelhead based on an analysis of Oregon populations.

Species	Populations
LCR Chinook salmon	32
UWR Chinook salmon	7
CR chum salmon	17
LCR coho salmon	24
LCR steelhead	23
UWR steelhead	4
Domain Total	107

Persistence probabilities, which are provided here for Lower Columbia River salmon and steelhead, are the complement of a population's extinction risk (i.e., persistence probability = 1 – extinction risk) (NMFS 2013a). Overall viability risk scores (high to low) and population persistence scores for species in this domain are based on combined ratings for the A/P and SS/D metrics (Table 2.2-4) (McElhany *et al.* 2006).

Table 2.2-4. Population persistence categories and probabilities from McElhany *et al.* (2006). A low or negligible risk of extinction is considered "viable" (Ford 2011). For population persistence categories, 4 = very low (VL), 3 = low (L), 2 = moderate (M), 1 = high (H), and 0 = very high (VH) in Oregon populations, and "extirpated or nearly so" (E) in Washington populations (Ford 2011).

Population Persistence Category	Probability of population persistence in 100 years	Probability of population extinction in 100 years	Description
0	0-40%	60-100%	Either extinct or "high" risk of extinction
1	40-75%	25-60%	Relatively "high" risk of extinction in 100 years
2	75-95%	5-25%	"Moderate" risk of extinction in 100 years
3	95-99%	1-5%	"Low" (negligible) risk of extinction in 100 years
4	>99%	<1%	"Very low" risk of extinction in 100 years

Status of LCR Chinook Salmon. Recovery plan targets for this species are tailored for each life history type, and within each type, specific population targets are identified (NMFS 2013a). For spring Chinook salmon, all populations are affected by aspects of habitat loss and degradation. Four of the nine populations require significant reductions in every threat category. Protection and improvement of tributary and estuarine habitat are specifically noted.

For fall Chinook salmon, recovery requires restoration of the Coast and Cascade strata to high probability of persistence, to be achieved primarily by ensuring habitat protection and restoration. Very large improvements are needed for most fall Chinook salmon populations to improve their probability of persistence.

For late fall Chinook salmon, recovery requires maintenance of the North Fork Lewis and Sandy populations which are comparatively healthy, together with improving the probability of persistence of the Sandy population from its current status of "high" to "very high." Improving the status of the Sandy population is largely dependent on harvest and hatchery changes, and habitat improvements to estuarine and tributary conditions designed for the fall life history will benefit the late fall life history as well.

***Spatial Structure and Diversity*.** This species includes all naturally-spawned populations of Chinook salmon originating fromthe Columbia River and its tributaries downstream of a transitional point east of the Hood and White Salmon Rivers, and any such fish originating from the Willamette River and its tributaries below Willamette Falls. Not included in this DPS are: (1) spring-run Chinook salmon originating from the Clackamas River; (2) fall-run Chinook salmon originating from Upper Columbia River bright hatchery stocks, that spawn in the mainstem Columbia River below Bonneville Dam, and in other tributaries upstream from the Sandy River to the Hood and White Salmon Rivers; (3) spring-run Chinook salmon originating from the Round Butte Hatchery (Deschutes River, Oregon) and spawning in the Hood River; (4) spring-run Chinook salmon originating from the Carson National Fish Hatchery and spawning in the Wind River; and (5) naturally spawning Chinook salmon originating from the Rogue River Fall Chinook Program.; and progeny of 15 artificial propagation programs.[75] LCR Chinook populations exhibit three different life history types base on return timing and other features: fall-run (a.k.a. "tules"), late-fall-run (a.k.a. "brights"), and spring-run. The WLC-TRT identified 32 historical populations of LCR Chinook salmon – seven in the coastal subregion, six in the Columbia Gorge, and 19 in the Cascade Range (Table 2.2-5). Spatial structure has been substantially reduced in several populations. Low abundance, past broodstock transfers and other legacy hatchery effects, and ongoing hatchery straying may have reduced genetic diversity within and among LCR Chinook salmon populations. Hatchery-origin fish spawning naturally may also have reduced population productivity (Lower Columbia Fish Recovery Board 2010; ODFW 2010). Out of the 32 populations that make up this ESU, only the two late-fall runs – the North Fork Lewis and Sandy – are considered viable. Most populations (26 out of 32) have a very low probability of persistence over the next 100 years (and some are extirpated or nearly so) (Ford 2011; Lower Columbia Fish Recovery Board 2010; ODFW 2010). Five of the six strata fall significantly short of the WLC-TRT criteria for viability; one stratum, Cascade late-fall, meets the WLC TRT criteria (NMFS 2013a).

[75] In 2014, NMFS removed the Elochoman tule fall Chinook salmon program from the ESU and added four new fall Chinook salmon programs to the ESU (79 FR 20802, April 14, 2014).

Table 2.2-5. LCR Chinook salmon strata, ecological subregions, run timing, populations, and scores for the key elements (A/P, spatial structure, and diversity) used to determine overall net persistence probability of the population (NMFS 2013a). Persistence probability ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH). Shading indicates population originates[76] in the action area.

Stratum		Spawning Population (Watershed)	A/P	Spatial Structure	Diversity	Overall Persistence Probability
Ecological Subregion	**Run Timing**					
Cascade Range	Spring	Upper Cowlitz River (WA)	VL	L	M	VL
		Cispus River (WA)	VL	L	M	VL
		Tilton River (WA)	VL	VL	VL	VL
		Toutle River (WA)	VL	H	L	VL
		Kalama River (WA)	VL	H	L	VL
		North Fork Lewis (WA)	VL	L	M	VL
		Sandy River (OR)	M	M	M	M
	Fall	Lower Cowlitz River (WA)	VL	H	M	VL
		Upper Cowlitz River (WA)	VL	VL	M	VL
		Toutle River (WA)	VL	H	M	VL
		Coweeman River (WA)	L	H	H	L
		Kalama River (WA)	VL	H	M	VL
		Lewis River (WA)	VL	H	H	VL
		Salmon Creek (WA)	VL	H	M	VL
		Clackamas River (OR)	VL	VH	L	VL
		Sandy River (OR)	VL	M	L	VL
		Washougal River (WA)	VL	H	M	VL
	Late Fall	North Fork Lewis (WA)	VH	H	H	VH
		Sandy River (OR)	VH	M	M	VH
Columbia Gorge	Spring	White Salmon River (WA)	VL	VL	VL	VL
		Hood River (OR)	VL	VH	VL	VL
	Fall	Lower Gorge (WA & OR)	VL	M	L	VL
		Upper Gorge (WA & OR)	VL	M	L	VL
		White Salmon River (WA)	VL	L	L	VL
		Hood River (OR)	VL	VH	L	VL
Coast Range	Fall	Young Bay (OR)	L	VH	L	L
		Grays/Chinook rivers (WA)	VL	H	VL	VL
		Big Creek (OR)	VL	H	L	VL
		Elochoman/Skamokawa creeks (WA)	VL	H	L	VL
		Clatskanie River (OR)	VL	VH	L	VL
		Mill, Germany, and Abernathy creeks (WA)	VL	H	L	VL
		Scappoose River (OR)	L	H	L	L

[76] Population origin refers to the spatial area used by the species for spawning.

Abundance and Productivity. A/P ratings for LCR Chinook salmon populations are currently "low" to "very low" for most populations, except for spring Chinook salmon in the Sandy River, which are "moderate," and late-fall Chinook salmon in North Fork Lewis River and Sandy River, which are "very high" (NMFS 2013a). Low abundance of natural-origin spawners (100 fish or fewer) has increased genetic and demographic risks. Other LCR Chinook salmon populations have higher total abundance, but several of these also have high proportions of hatchery-origin spawners. Particularly for tule fall Chinook salmon populations, poor data quality prevents precise quantification of population abundance and productivity; data quality has been poor because of inadequate spawning surveys and the presence of unmarked hatchery-origin spawners (Ford 2011).

***Limiting Factors*.** Limiting factors are defined as "physical, biological, or chemical features (*e.g.*, inadequate spawning habitat, high water temperature, insufficient prey resources) experienced by the fish at the population, intermediate (*e.g.*, stratum or major population grouping), or ESU levels that result in reductions in viable salmonid population (VSP) parameters (abundance, productivity, spatial structure, and diversity)" (NMFS 1997a, as cited by Stout *et al*. 2012, p. 53). The limiting factors for LCR Chinook salmon include (NMFS 2013a; NOAA Fisheries 2011):

- Degraded estuarine and near-shore marine habitat resulting from cumulative impacts of land use and flow management by the Columbia River hydropower system.
- Degraded freshwater habitat: floodplain connectivity and function, channel structure and complexity, riparian areas, stream substrate, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development.
- Reduced access to spawning and rearing habitat mainly as a result of tributary hydropower projects.
- Hatchery-related effects.
- Harvest-related effects on fall Chinook salmon.
- An altered flow regime and Columbia River plume has altered the temperature regime and estuarine food web, and has reduced ocean productivity.
- Reduced access to off-channel rearing habitat in the lower Columbia River.
- Reduced productivity resulting from sediment and nutrient-related changes in the estuary.
- Juvenile fish strandings that result from ship wakes.
- Contaminants affecting fish health and reproduction.

Status of UWR Chinook Salmon. A recovery plan is available for this species (ODFW and NMFS 2011). Broad recovery goals for UWR Chinook salmon is to reduce extinction risk in all populations to "very low."

***Spatial Structure and Diversity*.** This species includes all naturally spawned populations of spring-run Chinook salmon in the Clackamas River; in the Willamette River and its tributaries above Willamette Falls, Oregon; and progeny of six artificial propagation programs (79 FR 20802, 4/14/2014). All seven historical populations of UWR Chinook salmon identified by the WLC-TRT occur within the action area and are contained within a single ecological subregion, the western Cascade Range (Table 2.2-6). The McKenzie River population currently characterized as at a "low" risk of extinction and the Clackamas population has a "moderate" risk (Ford 2011). Consideration of data collected since 2005 has confirmed the high fraction of hatchery origin fish in all of the populations of this species (even the Clackamas and McKenzie rivers have hatchery fractions above WLC-TRT viability thresholds). All of the UWR Chinook salmon populations have "moderate" or "high" risk ratings for diversity. Clackamas River Chinook salmon have a "low" risk rating for spatial structure (Ford 2011).

Table 2.2-6. Scores for the key elements (A/P, diversity, and spatial structure) used to determine current overall viability risk for UWR Chinook salmon (ODFW and NMFS 2011). All populations are in the Western Cascade Range ecological subregion. Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH). All populations originate in the action area.

Population (Watershed)	A/P	Diversity	Spatial Structure	Overall Extinction Risk
Clackamas River	M	M	L	M
Molalla River	VH	H	H	VH
North Santiam River	VH	H	H	VH
South Santiam River	VH	M	M	VH
Calapooia River	VH	H	VH	VH
McKenzie River	VL	M	M	L
Middle Fork Willamette River	VH	H	H	VH

***Abundance and Productivity*.** The Clackamas and McKenzie river populations currently have the best risk ratings for A/P, spatial structure, and diversity. Data collected since the biological review team (BRT) status update in 2005 highlighted the substantial risks associated with pre-spawning mortality. A recovery plan was finalized for this species on August 5, 2011. Although recovery plans are targeting key limiting factors for future actions, there have been no significant on-the-ground-actions since the 2011 status review to resolve the lack of access to historical habitat above dams nor have there been substantial actions removing hatchery fish from the spawning grounds. In the 2011 review for the UWR Chinook salmon we concluded the species should maintain its threatened listing classification (Ford 2011).

***Limiting Factors*.** Limiting factors include (NOAA Fisheries 2011; ODFW and NMFS 2011):

- Significantly reduced access to spawning and rearing habitat because of tributary dams.
- Degraded freshwater habitat, especially floodplain connectivity and function, channel structure and complexity, and riparian areas and large wood recruitment as a result of cumulative impacts of agriculture, forestry, and development.
- Degraded water quality and altered temperature as a result of both tributary dams and the cumulative impacts of agriculture, forestry, and urban development.
- Hatchery-related effects.
- Anthropogenic introductions of non-native species and out-of-ESU races of salmon or steelhead have increased predation on, and competition with, native UWR Chinook salmon.
- Ocean harvest rates of approximately 30%.

<u>Status of CR Chum Salmon</u>. Columbia River chum salmon are included in the lower Columbia River recovery plan (NMFS 2013a). Recovery targets for this species focus on improving tributary and estuarine habitat conditions, and re-establishing populations where they may have been extirpated, in order to increase all four viability parameters. Specific recovery goals are to restore Coast and Cascade chum salmon strata to high probability of persistence, and to improve persistence probability of the two Gorge populations by protecting and restoring spawning habitat, side channel, and off channel habitats alcoves, wetlands, floodplains, *etc.*

***Spatial Structure and Diversity*.** This species includes all naturally-spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon, and progeny of two artificial propagation programs (79 FR 20802, 4/14/2014). The WLC-TRT identified 17 historical populations of CR chum salmon and aggregated these into four strata (Myers *et al*. 2006) (Table 2.2-7). CR chum salmon spawning aggregations identified in the mainstem Columbia River were included in the population associated with the nearest river basin.

The very low persistence probabilities or possible extirpations of most chum salmon populations are due to low abundance, productivity, spatial structure, and diversity. Although, hatchery production of chum salmon has been limited and hatchery effects on diversity are thought to have been relatively small, diversity has been greatly reduced at the ESU level because of presumed extirpations and the low abundance in the remaining populations (fewer than 100 spawners per year for most populations) (Lower Columbia Fish Recovery Board 2010; NMFS 2013a). The Lower Gorge population meets abundance and productivity criteria for very high levels of viability, but the distribution of spawning habitat (*i.e.*, spatial structure) for the population has been significantly reduced (Lower Columbia Fish Recovery Board 2010); spatial structure may need to be improved, at least in part, through better performance from the Oregon portion of the population (NMFS 2013a).

Table 2.2-7. CR chum salmon strata, ecological subregions, run timing, populations, and scores for the key elements (A/P, spatial structure, and diversity) used to determine current overall net persistence probability of the population (NMFS 2013a). Persistence probability ratings are very low (VL), low (L), moderate (M), high (H), to very high (VH). Shading indicates populations that originate in the action area.

Stratum		Spawning Population (Watershed)	A/P	Diversity	Spatial Structure	Overall Persistence Probability
Ecological Subregion	**Run Timing**					
Coast Range	Fall	Young's Bay (OR)	*	*	*	VL
		Grays/Chinook rivers (WA)	VH	M	H	M
		Big Creek (OR)	*	*	*	VL
		Elochoman/Skamokawa rivers (WA)	VL	H	L	VL
		Clatskanie River (OR)	*	*	*	VL
		Mill, Abernathy and Germany creeks (WA)	VL	H	L	VL
		Scappoose Creek (OR)	*	*	*	VL
Cascade Range	Summer	Cowlitz River (WA)	VL	L	L	VL
	Fall	Cowlitz River (WA)	VL	H	L	VL
		Kalama River (WA)	VL	H	L	VL
		Lewis River (WA)	VL	H	L	VL
		Salmon Creek (WA)	VL	L	L	VL
		Clackamas River (OR)	*	*	*	VL
		Sandy River (OR)	*	*	*	VL
		Washougal River (WA)	VL	H	L	VL
Columbia Gorge	Fall	Lower Gorge (WA & OR)	VH	H	VH	H
		Upper Gorge (WA & OR)	VL	L	L	VL

* No data are available to make a quantitative assessment.

Abundance and Productivity. Of the 17 populations that historically made up this ESU, 15 of them (six in Oregon and nine in Washington) are so depleted that either their baseline probability of persistence is very low or they are extirpated or nearly so (Ford 2011; Lower Columbia Fish Recovery Board 2010; NMFS 2013a; ODFW 2010). All three strata in the ESU fall significantly short of the WLC-TRT criteria for viability. Currently almost all natural production occurs in just two populations: the Grays/Chinook and the Lower Gorge. The Grays/Chinook population has a moderate persistence probability, and the Lower Gorge population has a high probability of persistence (Lower Columbia Fish Recovery Board 2010; NMFS 2013a).

Limiting Factors. Limiting factors include (NMFS 2013a; NOAA Fisheries 2011):

- Degraded estuarine and nearshore marine habitat resulting from cumulative impacts of land use and flow management by the Columbia River hydropower system.

- Degraded freshwater habitat, in particular of floodplain connectivity and function, channel structure and complexity, stream substrate, and riparian areas and large wood recruitment as a result of cumulative impacts of agriculture, forestry, and development.
- Degraded stream flow as a result of hydropower and water supply operations.
- Loss of access and loss of some habitat types as a result of passage barriers such as roads and railroads.
- Reduced water quality.
- Current or potential predation from hatchery-origin salmonids, including coho salmon.
- An altered flow regime and Columbia River plume has altered the temperature regime and estuarine food web, and has reduced ocean productivity.
- Reduced access to off-channel rearing habitat in the lower Columbia River.
- Reduced productivity resulting from sediment and nutrient-related changes in the estuary.
- Juvenile fish strandings that result from ship wakes.
- Contaminants affecting fish health and reproduction.

Status of LCR Coho Salmon. This species is included in the Lower Columbia River recovery plan (NMFS 2013a). Specific recovery goals are to improve all four viability parameters to the point that the Coast, Cascade, and Gorge strata achieve high probability of persistence. Protection of existing high functioning habitat and restoration of tributary habitat are noted needs, along with reduction of hatchery and harvest impacts. Large improvements are needed in the persistence probability of most populations of this ESU.

***Spatial Structure and Diversity*.** This species includes all naturally-spawned populations of coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia up to and including the Big White Salmon and Hood rivers; in the Willamette River to Willamette Falls, Oregon; and progeny of 21 artificial propagation programs (79 FR 20802, 4/14/2014). Spatial diversity is rated “moderate” to “very high” for all the populations, except the North Fork Lewis River, which has a “low” rating for spatial structure.

Out of the 24 populations that make up this ESU (Table 2.2-8), 21 have a “very low” probability of persisting for the next 100 years, and none of them are viable (Ford 2011; Lower Columbia Fish Recovery Board 2010; NMFS 2013a; ODFW 2010).

Table 2.2-8. LCR coho salmon strata, ecological subregions, run timing, populations, and scores for the key elements (A/P, spatial structure, and diversity) used to determine current overall net persistence probability of the population (NMFS 2013a). Persistence probability ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH). Shading indicates populations that originate in the action area.

Ecological Subregions	Population (Watershed)	A/P	Spatial Structure	Diversity	Overall Persistence Probability
Coast Range	Young's Bay (OR)	VL	VH	VL	VL
	Grays/Chinook rivers (WA)	VL	H	VL	VL
	Big Creek (OR)	VL	H	L	VL
	Elochoman/Skamokawa creeks (WA)	VL	H	VL	VL
	Clatskanie River (OR)	L	VH	M	L
	Mill, Germany, and Abernathy creeks (WA)	VL	H	L	VL
	Scappoose River (OR)	M	H	M	M
Cascade Range	Lower Cowlitz River (WA)	VL	M	M	VL
	Upper Cowlitz River (WA)	VL	M	L	VL
	Cispus River (WA)	VL	M	L	VL
	Tilton River (WA)	VL	M	L	VL
	South Fork Toutle River (WA)	VL	H	M	VL
	North Fork Toutle River (WA)	VL	M	L	VL
	Coweeman River (WA)	VL	H	M	VL
	Kalama River (WA)	VL	H	L	VL
	North Fork Lewis River (WA)	VL	L	L	VL
	East Fork Lewis River (WA)	VL	H	M	VL
	Salmon Creek (WA)	VL	M	VL	VL
	Clackamas River (OR)	M	VH	H	M
	Sandy River (OR)	VL	H	M	VL
	Washougal River (WA)	VL	H	L	VL
Columbia Gorge	Lower Gorge Tributaries (WA & OR)	VL	M	VL	VL
	Upper Gorge/White Salmon (WA)	VL	M	VL	VL
	Upper Gorge Tributaries/Hood (OR)	VL	VH	L	VL

Abundance and Productivity. In Oregon, the Clatskanie Creek and Clackamas River populations have "low" and "moderate" persistence probability ratings for A/P, while the rest are rated "very low." All of the Washington populations have "very low" A/P ratings. The persistence probability for diversity is "high" in the Clackamas population, "moderate" in the Clatskanie, Scappoose, Lower Cowlitz, South Fork Toutle, Coweeman, East Fork Lewis, and Sandy populations, and "low" to "very low" in the rest (NMFS 2013a). Uncertainty is high because of a lack of adult spawner surveys. Smolt traps indicate some natural production in Washington populations, though given the high fraction of hatchery origin spawners suspected to occur in these populations it is not clear that any are self-sustaining. In the 2011 5-year review for the LCR coho salmon we concluded the species should maintain its threatened listing classification (Ford 2011; NMFS 2011b; NMFS 2013a).

Limiting Factors. Limiting factors include (NMFS 2013a; NOAA Fisheries 2011):

- Degraded estuarine and near-shore marine habitat resulting from cumulative impacts of land use and flow management by the Columbia River hydropower system.
- Fish passage barriers that limit access to spawning and rearing habitats.
- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood supply, stream substrate, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development.
- Hatchery-related effects.
- Harvest-related effects.
- An altered flow regime and Columbia River plume has altered the temperature regime and estuarine food web, and has reduced ocean productivity.
- Reduced access to off-channel rearing habitat in the lower Columbia River.
- Reduced productivity resulting from sediment and nutrient-related changes in the estuary.
- Juvenile fish strandings that result from ship wakes.
- Contaminants affecting fish health and reproduction.

Status of LCR Steelhead. This species is included in the Lower Columbia River recovery plan (NMFS 2013a). For this species, threats in all categories must be reduced, but the most crucial elements are protecting favorable tributary habitat and restoring habitat in the Upper Cowlitz, Cispus, North Fork Toutle, Kalama and Sandy subbasins (for winter steelhead), and the East Fork Lewis, and Hood subbasins (for summer steelhead). Protection and improvement is also need among the South Fork Toutle and Clackamas winter steelhead populations.

Spatial Structure and Diversity. Four strata and 23 historical populations of LCR steelhead occur within the DPS: 17 winter-run populations and six summer-run populations, within the Cascade and Gorge ecological subregions (Table 2.2-9).[77] The DPS also includes the progeny of seven artificial propagation programs (79 FR 20802, 4/14/2014). Summer steelhead return to freshwater long before spawning. Winter steelhead, in contrast, return from the ocean much closer to maturity and spawn within a few weeks. Summer steelhead spawning areas in the Lower Columbia River are found above waterfalls and other features that create seasonal barriers to migration. Where no temporal barriers exist, the winter-run life history dominates.

[77] The White Salmon and Little White Salmon steelhead populations are part of the Middle Columbia steelhead DPS and are addressed in a separate recovery plan, the Middle Columbia River Steelhead Distinct Population Segment ESA Recovery Plan (NMFS 2009c).

Table 2.2-9. LCR steelhead strata, ecological subregions, run timing, populations, and scores for the key elements (A/P, spatial structure, and diversity) used to determine current overall net persistence probability of the population (NMFS 2013a). Persistence probability ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH). Shading indicates populations that originate in the action area.

Stratum		Population (Watershed)	A/P	Spatial Structure	Diversity	Overall Persistence Probability
Ecological Subregion	**Run Timing**					
Cascade Range	Summer	Kalama River (WA)	H	VH	M	M
		North Fork Lewis River (WA)	VL	VL	VL	VL
		East Fork Lewis River (WA)	VL	VH	M	VL
		Washougal River (WA)	M	VH	M	M
	Winter	Lower Cowlitz River (WA)	L	M	M	L
		Upper Cowlitz River (WA)	VL	M	M	VL
		Cispus River (WA)	VL	M	M	VL
		Tilton river (WA)	VL	M	M	VL
		South Fork Toutle River (WA)	M	VH	H	M
		North Fork Toutle River (WA)	VL	H	H	VL
		Coweeman River (WA)	L	VH	VH	L
		Kalama River (WA)	L	VH	H	L
		North Fork Lewis River (WA)	VL	M	M	VL
		East Fork Lewis River (WA)	M	VH	M	M
		Salmon Creek (WA)	VL	H	M	VL
		Clackamas River (OR)	M	VH	M	M
		Sandy River (OR)	L	M	M	L
		Washougal River (WA)	L	VH	M	L
Columbia Gorge	Summer	Wind River (WA)	VH	VH	H	H
		Hood River (OR)	VL	VH	L	VL
	Winter	Lower Gorge (WA & OR)	L	VH	M	L
		Upper Gorge (OR & WA)	L	M	M	L
		Hood River (OR)	M	VH	M	M

It is likely that genetic and life history diversity has been reduced as a result of pervasive hatchery effects and population bottlenecks. Spatial structure remains relatively high for most populations. Out of the 23 populations, 16 are considered to have a "low" or "very low" probability of persisting over the next 100 years, and six populations have a "moderate" probability of persistence (Ford 2011; Lower Columbia Fish Recovery Board 2010; NMFS 2013a; ODFW 2010). All four strata in the DPS fall short of the WLC-TRT criteria for viability (NMFS 2013a).

Baseline persistence probabilities were estimated to be "low" or "very low" for three out of the six summer steelhead populations that are part of the LCR DPS, moderate for two, and high for one – the Wind, which is considered viable (Lower Columbia Fish Recovery Board 2010; NMFS

2013a; ODFW 2010). Thirteen of the 17 LCR winter steelhead populations have "low" or "very low" baseline probabilities of persistence, and the remaining four are at "moderate" probability of persistence (Table 2.2-9) (Lower Columbia Fish Recovery Board 2010; NMFS 2013a; ODFW 2010).

Abundance and Productivity. The "low" to "very low" baseline persistence probabilities of most Lower Columbia River steelhead populations reflects low abundance and productivity (NMFS 2013a). All of the populations increased in abundance during the early 2000s, generally peaking in 2004. Most populations have since declined back to levels within one standard deviation of the long term mean. Exceptions are the Washougal summer-run and North Fork Toutle winter-run, which are still higher than the long term average, and the Sandy, which is lower. In general, the populations do not show any sustained dramatic changes in abundance or fraction of hatchery origin spawners since the 2005 status review (Ford 2011). Although current LCR steelhead populations are depressed compared to historical levels and long-term trends show declines, many populations are substantially healthier than their salmon counterparts, typically because of better habitat conditions in core steelhead production areas (Lower Columbia Fish Recovery Board 2010; NMFS 2013a).

Limiting Factors. Limiting factors include (NMFS 2013a; NOAA Fisheries 2011):

- Degraded estuarine and nearshore marine habitat resulting from cumulative impacts of land use and flow management by the Columbia River hydropower system.
- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and recruitment of large wood, stream substrate, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development.
- Reduced access to spawning and rearing habitat mainly as a result of tributary hydropower projects and lowland development.
- Avian and marine mammal predation in the lower mainstem Columbia River and estuary.
- Hatchery-related effects.
- An altered flow regime and Columbia River plume has altered the temperature regime and estuarine food web, and has reduced ocean productivity.
- Reduced access to off-channel rearing habitat in the lower Columbia River.
- Reduced productivity resulting from sediment and nutrient-related changes in the estuary.
- Juvenile fish strandings that result from ship wakes.
- Contaminants affecting fish health and reproduction.

<u>Status of UWR Steelhead</u>. A recovery plan is available for this species (ODFW and NMFS 2011). Broad recovery goals for UWR steelhead is to reduce extinction risk in all populations to "very low"; within this general goal, more targeted goals to achieve DPS delisting is to assure no population has a higher extinction risk than its current risk level, and to maintain or improve all core populations and one non-core population to a viable level.

Spatial Structure and Diversity. This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in the Willamette River, Oregon, and its tributaries upstream from Willamette Falls to and including the Calapooia River

(79 FR 20802, April 4, 2014). One stratum and four extant populations of UWR steelhead occur within the DPS (Table 2.2-10). Historical observations, hatchery records, and genetics suggest that the presence of UWR steelhead in many tributaries on the west side of the upper basin is the result of recent introductions. Nevertheless, the WLC-TRT recognized that although west-side UWR steelhead does not represent a historical population, those tributaries may provide juvenile rearing habitat or may be temporarily (for one or more generations) colonized during periods of high abundance. Hatchery summer-run steelhead released in the subbasins are from an out-of-basin stock, and are not part of the DPS. Additionally, stocked summer steelhead that have become established in the McKenzie River were not considered in the identification of historical populations (ODFW and NMFS 2011).

Table 2.2-10. Scores for the key elements (A/P, diversity, and spatial structure) used to determine current overall viability risk for UWR steelhead (ODFW and NMFS 2011). All populations are in the Western Cascade Range ecological subregion. Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH). All populations originate in the action area.

Population (Watershed)	A/P	Diversity	Spatial Structure	Overall Extinction Risk
Molalla River	VL	M	M	L
North Santiam River	VL	M	H	L
South Santiam River	VL	M	M	L
Calapooia River	M	M	VH	M

Abundance and Productivity. Since the 2005 status review, UWR steelhead initially increased in abundance but subsequently declined and current abundance is at the levels observed in the mid-1990s when the DPS was first listed. The DPS appears to be at lower risk than the UWR Chinook salmon ESU, but continues to demonstrate the overall low abundance pattern that was of concern during the 2005 status review. The elimination of winter-run hatchery release in the basin reduces hatchery threats, but non-native summer steelhead hatchery releases are still a concern for species diversity. In 2011, we completed a 5-year review for the UWR steelhead and concluded the species should maintain its threatened listing classification (Ford 2011).

Limiting Factors. Limiting factors include (NOAA Fisheries 2011; ODFW and NMFS 2011):

- Degradation of freshwater habitat, including floodplain connectivity and function, channel structure and complexity, riparian areas and large wood recruitment, and stream flow.
- Degraded water quality and altered water temperature.
- Reduced access to spawning and rearing habitats.
- Impacts from the non-native summer steelhead hatchery program.
- Predation and competition (non-native species and out-of-ESU races of salmon or steelhead).

Status of Southern Green Sturgeon. We are in the process of developing a recovery plan for this species, and have released a recovery outline for this species (NMFS 2010a). This preliminary document identifies important threats to abate, including blockage of access to spawning habitat; mortality from fishing and poaching; effects of water diversions, ocean energy projects, and vessel strikes; loss of estuarine/delta function; and other activities that impact spawning, rearing and feeding habitats. Preliminary key recovery needs in the recovery outline include restoring access to suitable habitat, improving potential habitat, establishing additional spawning populations, research, and monitoring.

***Spatial Structure and Diversity*.** Two DPSs have been defined for green sturgeon (*Acipenser medirostris*), a northern DPS (spawning populations in the Klamath and Rogue rivers) and a southern DPS (spawners in the Sacramento River). Southern green sturgeon includes all naturally-spawned populations of green sturgeon that occur south of the Eel River in Humboldt County, California. When not spawning, this anadromous species is broadly distributed in nearshore marine areas from Mexico to the Bering Sea. Although it is commonly observed in bays, estuaries, and sometimes the deep riverine mainstem in lower elevation reaches of non-natal rivers along the west coast of North America, the distribution and timing of estuarine use are poorly understood.

Southern green sturgeon occur in the Willamette and Lower Columbia (WLC), Oregon Coast (OC), and Southern Oregon/Northern California Coasts (SONCC) recovery domains. In many Oregon coastal systems inadequate data exists to dismiss their presence, but presence has been established in Coos Bay, Winchester Bay (Umpqua River), Yaquina Bay, Nehalem Bay, and the Columbia River estuary. Typically, distribution is limited to lower tidal reaches, but green sturgeon have been observed as far upriver in the Columbia as Bonneville Dam. Work by Israel and May (2007) determined that 80% or more of the green sturgeon found in the Columbia River estuary during late summer and early fall are part of the southern DPS. However, interannual variability may be high and in some years the Southern DPS may constitute significantly lower proportion (Lindley *et al*. 2011).

Population abundance is unknown. Recent attempts by Washington Depart of Fish and Wildlife (WDFW) to estimate abundance have been unsuccessful[78], and abundance estimates of adults in the upper Sacramento River for the 5-year review provides only a rough indication of potential presence in Oregon estuaries, as only a portion of these adults will migrate to northern feeding areas.[79] Consequently, the proportion of the Southern DPS population that occurs in the action area in any given year is unknown.

It is likely that green sturgeon inhabit Oregon estuarine waters to feed and optimize growth (Moser and Lindley 2007). Individual green sturgeon exhibit diel movements using deeper water during the day and moving to shallower water during night to feed.[80] The movements of green sturgeon are likely influenced by feeding behavior, tide stage, and possibly light conditions.

[78] E-mail communication between Olaf Langness (WDFW) and Robert Markle (NMFS) regarding Southern green sturgeon population estimates (August 27, 2014).

[79] Pers. comm. Phaedra Doukakis, NMFS Affilliate (August 20, 2015).

[80] NMFS, WDFW, and ODFW conference call (June 23, 2009).

Little is known about green sturgeon diet in the Oregon estuaries. Stomach sampling is challenging and most studies have depended on samples collected from specimens at the dock or processing plant where stomachs have been partially or completely empty. The best results are from samples collected on the boat immediately after landing.[81] Green sturgeon in Willapa Bay were found to feed primarily on benthic prey (*e.g.*, Dungeness crab, crangonid shrimp, and thalassinid shrimp) and fish (Dumbauld *et al.* 2008). A very limited sample of green sturgeon stomachs in the Columbia River found mostly crangonid shrimp and some thalassinid shrimp (Dumbauld *et al.* 2008). The presence of these prey species suggest the sampled green sturgeon fed in the saline and brackish water reaches lower in the Columbia River estuary (below approximately Columbia River mile 30).

Available acoustic tagging data indicate Southern green sturgeon may occur in the Columbia River from early May through early November (Moser and Lindley 2007) with a peak presence from June through August.[82] However, there have been reports of incidental catch of green sturgeon throughout the year in the Columbia River, but this is not common.[83] Based on limited data, the duration of presence varies by individual fish from days to months (Moser and Lindley 2007, Figure 4). Unpublished data indicates individuals may frequent the same estuary repeatedly during any given year for various durations and also visit the same estuary over multiple years.[84]

Southern green sturgeon may exhibit "cohesive social behavior" that results in the social learning of migration routes (Lindley *et al*. 2011). If social learning creates a spatial memory for the population, some individuals "may continue to use a habitat for several generations after the habitat has become suboptimal" (Lindley *et al*. 2011).

Limiting factors. The principal factor for the decline of Southern green sturgeon is the reduction of its spawning area to a single known population limited to a small portion of the Sacramento River. It is currently at risk of extinction primarily because of human-induced ''takes'' involving elimination of freshwater spawning habitat, degradation of freshwater and estuarine habitat quality, water diversions, fishing, and other causes (USDC 2010). Adequate water flow and temperature are issues of concern. Water diversions pose an unknown but potentially serious threat within the Sacramento and Feather Rivers and the Sacramento River Delta. Poaching also poses an unknown but potentially serious threat because of high demand for sturgeon caviar. The effects of contaminants and nonnative species are also unknown but potentially serious (NOAA Fisheries 2011). As mentioned above, retention of green sturgeon in both recreational and commercial fisheries is now prohibited within the western states, but the

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[81] *Id.*

[82] Telephone conversation between Mary Moser (NMFS) and Robert Markle (NMFS) regarding unpublished acoustic tagging data on Southern green sturgeon (August 22, 2014).

[83] Conference call between the National Marine Fisheries Service (Rob Markle, Bridgette Lohrman), Washington Department of Fish and Wildlife (Brad James, Olaf Langness, Steve West) and Oregon Department of Fish and Wildlife (Tom Rien), (June 23, 2009) (discussing green sturgeon and eulachon in the Lower Columbia River).

[84] Telephone conversation between Mary Moser (NMFS) and Robert Markle (NMFS) regarding unpublished acoustic tagging data on Southern green sturgeon (August 22, 2014).

effect of capture/release in these fisheries is unknown. There is evidence of fish being retained illegally, although the magnitude of this activity likely is small (NOAA Fisheries 2011).

Status of Southern Eulachon. We have released a Federal recovery plan outline for this species, which is to serve as interim guidance for recovery efforts (USDC 2013a). A draft recovery plan is targeted for completion by September 2015. The major threats to eulachon are impacts of climate change on oceanic and freshwater habitats (species-wide), fishery by-catch (species-wide), dams and water diversions (Klamath and Columbia supopulations) and predation (Fraser River and British Columbia sub-populations) (NMFS 2013b). Preliminary key recovery actions in the recovery outline include maintaining conservative harvest, reducing by-catch, restoring more natural flows and water quality in the Columbia River, maintaining dredging best management practices, removing Klamath River dams, and research on life history and genetics, climate effects, and habitat effects (NMFS 2013b).

Spatial Structure and Diversity. The southern DPS of eulachon occurs in four salmon recovery domains: Puget Sound, the Willamette and Lower Columbia, Oregon Coast, and Southern Oregon/Northern California Coasts. In many Oregon coastal systems inadequate data exists to dismiss their presence. The ESA-listed population of eulachon includes all naturally-spawned populations that occur in rivers south of the Nass River in British Columbia to the Mad River in California. The BRT identified four subpopulations of Southern eulachon. These include the Klamath River, Columbia River, Fraser River, and British Columbia coastal rivers (north of the Fraser River up to, and including, the Skeena River) (Gustafson *et al*. 2010).

Southern eulachon leave saltwater to spawn in their natal streams late winter through early summer, and typically spawn at night in the lower reaches of larger rivers fed by snowmelt. Eulachon run timing, abundance, and spawning locations vary considerably from year to year. Typically, in the Columbia River eulachon spawning occurs in the Cowlitz River followed by the mainstem Columbia River with periodic runs occur in other tributaries including the Grays, Skamokawa, Elochoman, Kalama, Lewis, and Sandy rivers (Ward (*ed.*) 2002, p. 9). After hatching, larvae are carried downstream and widely dispersed by estuarine and ocean currents. Eulachon movements in the ocean are poorly known although the amount of eulachon bycatch in the pink shrimp fishery seems to indicate that the distribution of these organisms overlap in the ocean.

Abundance and Productivity. In the early 1990s, there was an abrupt decline in the abundance of eulachon returning to the Columbia River with no evidence of returning to their former population levels since then (Drake *et al*. 2008). Persistent low returns and landings of eulachon in the Columbia River from 1993 to 2000 prompted the states of Oregon and Washington to adopt a Joint State Eulachon Management Plan in 2001 that provides for restricted harvest management when parental run strength, juvenile production, and ocean productivity forecast a poor return (WDFW and ODFW 2001). Despite a brief period of improved returns in 2001-2003, the returns and associated commercial landings again declined to the very low levels observed in the mid-1990s (Joint Columbia River Management Staff 2009), and since 2005, the fishery has operated at the most conservative level allowed in the management plan (Joint Columbia River Management Staff 2009). Large commercial and recreational fisheries have occurred in the Sandy River in the past. The most recent commercial harvest in the Sandy River was in 2003. No commercial harvest has been recorded for the Grays River from 1990 to the present, but larval sampling has confirmed successful spawning in recent years (USDC 2011).

Generally, eulachon broadcast eggs "where the substrate consists of coarse sand/fine gravel, and where water flows are 'moderate' in velocity" (Hart and McHugh 1944, as cited in Ward (*ed.*) 2002; Smith and Saalfeld 1955, as cited in Ward (*ed.*) 2002). Eggs sink, are demersal, and usually adhere to the substrate. Sites with stable substrate for eggs to adhere to are important. Outside the main navigation channel, eggs have been collected from substrates ranging from a few meters to approximately 12 meters depth.[85] Egg collection in the navigation channel has proven problematic. Egg incubation takes approximately 30 to 40 days, depending on temperature (Ward (*ed.*) 2002, p. 9). Sampling in the Lower Columbia River (1996-2009) has found larval densities ranging from 0.3 to 42.1 larvae per cubic meter (Table 18 of ODFW and WDFW 2009). While larvae do develop during their time in freshwater they largely drift with the current and rapidly emmigrate to the ocean (Ward (*ed.*) 2002, p. 9).

In the Lower Columbia River, adult eulachon migrate and spawn from December through mid-May with peak presence occurring in February and March. Incubating eulachon eggs and larvae are present from December to mid-June.

Limiting Factors. Limiting factors include (Gustafson *et al*. 2010; Gustafson *et al*. 2012; NOAA Fisheries 2011):

- Changes in ocean conditions due to climate change, particularly in the southern portion of its range where ocean warming trends may be the most pronounced and may alter prey, spawning, and rearing success.
- Climate-induced change to freshwater habitats, dams and water diversions (particularly in the Columbia and Klamath Rivers where hydropower generation and flood control are major activities).
- Bycatch of eulachon in commercial fisheries.
- Adverse effects related to dams and water diversions.
- Artificial fish passage barriers.
- Increased water temperatures, insufficient streamflow.
- Altered sediment balances.
- Water pollution.
- Over-harvest.
- Predation.

[85] NMFS, WDFW, and ODFW conference call (June 23, 2009).

2.2.1.2 Interior Columbia Recovery Domain

Species in the Interior Columbia (IC) recovery domain include UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, UCR steelhead, MCR steelhead, and SRB steelhead. The IC-TRT identified 82 populations of those species based on genetic, geographic (hydrographic), and habitat characteristics (IC-TRT 2003, McClure *et al*. 2005). Of these, 77 extant populations remain, plus one designated experimental population of MCR steelhead in the Crooked River (Table 2.2-11). In some cases, the IC-TRT further aggregated populations into "major groupings" based on dispersal distance and rate, and drainage structure, primarily the location and distribution of large tributaries (IC-TRT 2003). All 77 existing populations identified use the lower mainstem of the Snake River, the mainstem of the Columbia River, and the Columbia River estuary, or part thereof, for migration, rearing, and smoltification.

Table 2.2-11. Populations of ESA-listed salmon and steelhead in the IC recovery domain. MCR steelhead includes one "re-establishing" population (White Salmon) and one experimental population (Crooked River).

Species	Populations
UCR spring-run Chinook salmon	3
SR spring/summer-run Chinook salmon	28
SR fall-run Chinook salmon	1
SR sockeye salmon	1
MCR steelhead	19
UCR steelhead	4
SRB steelhead	24
Domain Total	80

The IC-TRT recommended viability criteria that follow the VSP framework (IC-TRT 2007). The criteria include biological and physical performance conditions that, when met, indicate a population or species has a 5% or less risk of extinction over a 100-year period.

Status of UCR Spring-run Chinook Salmon. A recovery plan is available for this species (UCSRB 2007). The plan indicates that the highest priority for protecting biological productivity of UCR salmonids should be to allow unrestricted stream channel migration, complexity and floodplain function. The principal mean to meet this objective is to protect riparian habitat in category 1 and 2 subwatersheds. The highest priority for increasing biological productivity is to restore the complexity of the stream channel and floodplain.

***Spatial Structure and Diversity*.** This species includes all naturally-spawned populations of Chinook salmon in all river reaches accessible to Chinook salmon in Columbia River tributaries upstream of the Rock Island Dam and downstream of Chief Joseph Dam (excluding the Okanogan River), the Columbia River upstream to Chief Joseph Dam, and progeny of six artificial propagation programs. The IC-TRT identified four independent populations of UCR spring-run Chinook salmon in the upriver tributaries of Wenatchee, Entiat, Methow, and Okanogan Rivers (one of which, the Okanogan, is extirpated), but no major groups due to the relatively small geographic area affected (IC-TRT 2003, McClure *et al*. 2005) (Table 2.2-12).

Table 2.2-12. Scores for the key elements (A/P, diversity, and SS/D) used to determine current overall viability risk for spring-run UCR Chinook salmon (Ford 2011). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH) and extirpated (E). Extirpated populations were not evaluated as indicated by the blank cells. None of the populations originate in the action area.

Population	A/P	Diversity	Integrated SS/D	Overall Viability Risk
Wenatchee River	H	H	H	H
Entiat River	H	H	H	H
Methow River	H	H	H	H
Okanogan River				E

The composite SS/D risks are "high," for all three of the extant populations in this MPG are at "high" risk. The spatial processes component of the SS/D risk is "low" for the Wenatchee River and Methow River populations and "moderate" for the Entiat River (loss of production in lower section increases effective distance to other populations). All three of the extant populations in this MPG are at "high" risk for diversity, driven primarily by chronically high proportions of hatchery-origin spawners in natural spawning areas and lack of genetic diversity among the natural-origin spawners (Ford 2011).

Increases in natural origin abundance relative to the extremely low spawning levels observed in the mid-1990s are encouraging; however, average productivity levels remain extremely low. Overall, the viability of Upper Columbia Spring Chinook salmon ESU has likely improved somewhat since the 2005 status review, but the ESU is still clearly at "moderate-to-high" risk of extinction (Ford 2011). In 2011, we completed a 5-year review for the UCR spring-run Chinook salmon and concluded the species should maintain its endangered listing classification (Ford 2011).

Abundance and Productivity. The UCR spring-run Chinook salmon ESU is not currently meeting the viability criteria (adapted from the IC-TRT) in the Upper Columbia Recovery Plan. A/P remains at "high" risk for each of the three extant populations in this MPG/ESU (Table 2.2-12). The 10-year geometric mean abundance of adult natural origin spawners has increased for each population relative to the levels for the 1981-2003 series, but the estimates remain below the corresponding IC-TRT thresholds. Estimated productivity (spawner to spawner return rate at low to moderate escapements) was on average lower over the years 1987-2009 than for the previous period. The combinations of current abundance and productivity for each population result in a "high" risk rating.

***Limiting Factors*.** Limiting factors include (NOAA Fisheries 2011; UCSRB 2007):

- Effects related to the hydropower system in the mainstem Columbia River, including reduced upstream and downstream fish passage, altered ecosystem structure and function, altered flows, and degraded water quality.
- Degraded floodplain connectivity and function, channel structure and complexity, riparian areas and large woody debris recruitment, stream flow, and water quality.
- Degraded estuarine and nearshore marine habitat.
- Hatchery-related effects.
- Persistence of non-native predatory fish species.
- Harvest in Columbia River fisheries.

<u>Status of SR Spring/summer-run Chinook Salmon</u>. We are developing a recovery plan for this species.

***Spatial Structure and Diversity*.** This species includes all naturally-spawned populations of spring/summer-run Chinook salmon in the mainstem Snake River and the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River subbasins; and progeny of 11 artificial propagation programs (79 FR 20802, 4/14/2014). The IC-TRT currently believes there are 28 extant and four extirpated populations of SR spring/summer-run Chinook salmon, and aggregated these into five major population groups that correspond to ecological subregions (IC-TRT 2003, McClure *et al*. 2005). Each of these populations faces a “high” risk of extinction (Ford 2011) (Table 2.2-13).

Table 2.2-13. SR spring/summer-run Chinook salmon ecological subregions, populations, and scores for the key elements (A/P, diversity, and SS/D) used to determine current overall viability risk for SR spring/summer-run Chinook salmon (Ford 2011). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH), and extirpated (E). Extirpated populations were not evaluated as indicated by the blank cells. Shading indicates populations that originate in the action area.

Ecological Subregions	Spawning Populations (Watershed)	A/P	Diversity	Integrated SS/D	Overall Viability Risk
Lower Snake River	Tucannon River	H	M	M	H
	Asotin River				E
Grande Ronde and Imnaha rivers	Wenaha River	H	M	M	H
	Lostine/Wallowa River	H	M	M	H
	Minam River	H	M	M	H
	Catherine Creek	H	M	M	H
	Upper Grande Ronde R.	H	M	H	H
	Imnaha River	H	M	M	H
	Big Sheep Creek				E
	Lookingglass Creek				E
	Little Salmon River	*	*	*	H

Ecological Subregions	Spawning Populations (Watershed)	A/P	Diversity	Integrated SS/D	Overall Viability Risk
South Fork Salmon River	South Fork mainstem	H	M	M	H
	Secesh River	H	L	L	H
	EF/Johnson Creek	H	L	L	H
Middle Fork Salmon River	Chamberlin Creek	H	L	L	H
	Big Creek	H	M	M	H
	Lower MF Salmon	H	M	M	H
	Camas Creek	H	M	M	H
	Loon Creek	H	M	M	H
	Upper MF Salmon	H	M	M	H
	Sulphur Creek	H	M	M	H
	Bear Valley Creek	H	L	L	H
	Marsh Creek	H	L	L	H
Upper Salmon River	N. Fork Salmon River	H	L	L	H
	Lemhi River	H	H	H	H
	Pahsimeroi River	H	H	H	H
	Upper Salmon-lower mainstem	H	L	L	H
	East Fork Salmon River	H	H	H	H
	Yankee Fork	H	H	H	H
	Valley Creek	H	M	M	H
	Upper Salmon main	H	M	M	H
	Panther Creek				E

* Insufficient data.

Abundance and Productivity. Population level status ratings remain at "high" risk across all MPGs within the ESU, although recent natural spawning abundance estimates have increased, all populations remain below minimum natural origin abundance thresholds (Table 2.2-13). Spawning escapements in the most recent years in each series are generally well below the peak returns but above the extreme low levels in the mid-1990s. Relatively low natural production rates and spawning levels below minimum abundance thresholds remain a major concern across the ESU.

The ability of SR spring/summer-run Chinook salmon populations to be self-sustaining through normal periods of relatively low ocean survival remains uncertain. Factors cited by Good *et al*. (2005) remain as concerns or key uncertainties for several populations. Our 2011five-year review determined that, overall, the new information considered did not indicate a change in the biological risk category since the previous status review (Ford 2011).

***Limiting Factors*.** Limiting factors include (NOAA Fisheries 2011):

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood supply, stream substrate, elevated water temperature, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development.
- Mainstem Columbia River and Snake River hydropower impacts.
- Harvest-related effects.
- Predation.

Status of SR Fall-run Chinook Salmon. We are developing a recovery plan for this species.

***Spatial Structure and Diversity*.** This species includes all naturally-spawned populations of fall-run Chinook salmon in the mainstem Snake River below Hells Canyon Dam, and in the Tucannon River, Grande Ronde River, Imnaha River, Salmon River, and Clearwater River, and progeny of four artificial propagation programs. The IC-TRT identified three populations of this species, although only the lower mainstem population exists at present, and it spawns in the lower main stem of the Clearwater, Imnaha, Grande Ronde, Salmon and Tucannon rivers. The lower Snake, Imnaha, and Grande Ronde rivers occur in the action area. The extant population of Snake River fall-run Chinook salmon is the only remaining population from an historical ESU that also included large mainstem populations upstream of the current location of the Hells Canyon Dam complex (IC-TRT 2003, McClure *et al*. 2005). The population is at moderate risk for diversity and spatial structure (Ford 2011). In 2011, we completed a 5-year review for the SR fall-run Chinook salmon and concluded the species should maintain its threatened listing classification (Ford 2011).

***Abundance and Productivity*.** The recent increases in natural origin abundance are encouraging. However, hatchery origin spawner proportions have increased dramatically in recent years – on average, 78% of the estimated adult spawners have been hatchery origin over the most recent brood cycle. The apparent leveling off of natural returns in spite of the increases in total brood year spawners may indicate that density dependent habitat effects are influencing production or that high hatchery proportions may be influencing natural production rates. The A/P risk rating for the population is "moderate." Given the combination of current A/P and SS/D ratings summarized above, the overall viability rating for Lower SR fall Chinook salmon is "maintained."[86]

***Limiting Factors*.** Limiting factors include (NOAA Fisheries 2011):

- Degradation of freshwater habitat, including floodplain connectivity and function, and channel structure and complexity.
- Harvest-related effects.
- Loss of access to historic habitat above Hells Canyon and other Snake River dams.
- Impacts from the mainstem Columbia River and Snake River hydropower systems.
- Hatchery-related effects.

[86] "Maintained" population status is for populations that do not meet the criteria for a viable population but do support ecological functions and preserve options for ESU/DPS recovery.

- Degraded estuarine and nearshore habitat.

Status of SR Sockeye Salmon. We adopted a recovery plan on this species on June 8, 2015. The plan calls for conservation of genetic diversity via a captive broodstock program, and expanding reintroduction efforts with an adaptive management strategy to reestablish self-sustaining broodstock to recolonize populations in Redfishm, Pettit, and Alturas Lakes (NMFS 2015a).

Spatial Structure and Diversity. This species includes one population comprised of all anadromous and residual sockeye salmon from the Snake River basin, Idaho, and artificially-propagated sockeye salmon from the Redfish Lake captive propagation program. This population originates outside of action area. The IC-TRT identified historical sockeye salmon production in at least five Stanley Basin and Sawtooth Valley lakes and in lake systems associated with Snake River tributaries currently cut off to anadromous access (*e.g.,* Wallowa and Payette Lakes), although current returns of SR sockeye salmon are extremely low and limited to Redfish Lake (IC-TRT 2007).

Abundance and Productivity. This species is still at extremely high risk across all four basic risk measures (abundance, productivity, spatial structure and diversity. Although the captive brood program has been successful in providing substantial numbers of hatchery produced *O. nerka* for use in supplementation efforts, substantial increases in survival rates across life history stages must occur to re-establish sustainable natural production (Hebdon *et al*. 2004; Keefer *et al*. 2008). Although the risk status of the Snake River sockeye salmon ESU appears to be on an improving trend, we completed a 5-year review in 2011 and concluded the species should maintain its endangered listing classification (Ford 2011).

Limiting Factors. The key factor limiting recovery of SR sockeye salmon ESU is survival outside of the Stanley Basin. Portions of the migration corridor in the Salmon River are impeded by water quality and temperature (Idaho Department of Environmental Quality 2011). Increased temperatures likely reduce the survival of adult sockeye returning to the Stanley Basin. The natural hydrological regime in the upper mainstem Salmon River Basin has been altered by water withdrawals. In most years, sockeye adult returns to Lower Granite suffer catastrophic losses (Reed *et al*. 2003) (*e.g.,* > 50% mortality in one year) before reaching the Stanley Basin, although the factors causing these losses have not been identified. In the Columbia and lower Snake River migration corridor, predation rates on juvenile sockeye salmon are unknown, but terns and cormorants consume 12% of all salmon smolts reaching the estuary, and piscivorous fish consume an estimated 8% of migrating juvenile salmon (NOAA Fisheries 2011).

Status of MCR Steelhead. A recovery plan is available for this species (NMFS 2009c).

Spatial Structure and Diversity. This species includes all naturally-spawned steelhead populations originating below natural and manmade impassable barriers from the Columbia River and its tributaries upstream of the Wind and Hood Rivers (exclusive) to and including the Yakima River; excluding steelhead originating from the Snake River basin. This DPS does include steelhead from seven artificial propagation programs (79 FR 20802, 4/14/2014). The DPS does not currently include steelhead that are designated as part of an experimental population above the Pelton Round Butte Hydroelectric Project in the Deschutes River Basin, Oregon (78 FR 2893; 1/15/2013). The IC-TRT identified 17 extant populations in this DPS plus 2 extirpated populations that are being re-established (*i.e.*, White Salmon and Crooked River) (IC-TRT 2003, McClure *et al*. 2005). The populations fall into four major population groups: the Yakima River Basin (four extant populations), the Umatilla/Walla-Walla drainages (three extant populations); the John Day River drainage (five extant populations) and the Eastern Cascades group (five extant and two extirpated populations that are being re-established) (Table 2.2-14) (IC-TRT 2003, McClure *et al*. 2005). Viability ratings for these populations range from extirpated to viable (Table 2.2-14) (NMFS 2009c, Ford 2011).

Table 2.2-14. Ecological subregions, populations, and scores for the key elements (A/P, diversity, and SS/D) used to determine current overall viability risk for MCR steelhead (Ford 2011; NMFS 2009c). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH), and extirpated (E). Maintained (MT) population status indicates that the population does not meet the criteria for a viable population but does support ecological functions and preserve options for recovery of the DPS. Extirpated populations were not evaluated as indicated by the blank cells. The White Salmon population is re-establishing itself following removal of Condit Dam. The Crooked River population was designated an experimental population on January 15, 2013 (78 FR 2893). Shading indicates populations that originate in the action area.

Ecological Subregions	Population (Watershed)	A/P	Diversity	Integrated SS/D	Overall Viability Risk
Cascade Eastern Slope Tributaries	Fifteenmile Creek	L	L	L	Viable
	Klickitat River	M	M	M	MT?
	Eastside Deschutes River	L	M	M	Viable
	Westside Deschutes River	H	M	M	H*
	Rock Creek	H	M	M	H?
	White Salmon				E*
	Crooked River				E*
John Day River	Upper Mainstem	M	M	M	MT
	North Fork	VL	L	L	Highly Viable
	Middle Fork	M	M	M	MT
	South Fork	M	M	M	MT
	Lower Mainstem	M	M	M	MT
Walla Walla and Umatilla rivers	Umatilla River	M	M	M	MT
	Touchet River	M	M	M	H
	Walla Walla River	M	M	M	MT
Yakima River	Satus Creek	M	M	M	Viable (MT)
	Toppenish Creek	M	M	M	Viable (MT)

Ecological Subregions	Population (Watershed)	A/P	Diversity	Integrated SS/D	Overall Viability Risk
	Naches River	H	M	M	H
	Upper Yakima	H	H	H	H

* Re-introduction efforts underway (NMFS 2009c).

Straying frequencies into at least the Lower John Day River population are high. Out-of-basin hatchery stray proportions, although reduced, remain very high in the Deschutes River basin.

Abundance and Productivity. Returns to the Yakima River basin and to the Umatilla and Walla Walla Rivers have been higher over the most recent brood cycle, while natural origin returns to the John Day River have decreased. There have been improvements in the viability ratings for some of the component populations, but the MCR steelhead DPS is not currently meeting the viability criteria (adopted from the IC-TRT) in the MCR steelhead recovery plan (NMFS 2009c). In addition, several of the factors cited by Good *et al.* (2005) remain as concerns or key uncertainties. Natural origin spawning estimates of populations have been highly variable with respect to meeting minimum abundance thresholds. In 2011, we completed a 5-year review for the MCR steelhead and concluded the species should maintain its threatened listing classification (Ford 2011).

Limiting Factors. Limiting factors include (NMFS 2009c):

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas, fish passage, stream substrate, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, tributary hydro system activities, and development.
- Mainstem Columbia River hydropower–related impacts.
- Degraded estuarine and nearshore marine habitat.
- Hatchery-related effects.
- Harvest-related effects.
- Effects of predation, competition, and disease.

Status of UCR Steelhead. A recovery plan is available for this species (UCSRB 2007). The plan indicates that the highest priority for protecting biological productivity of UCR salmonids should be to allow unrestricted stream channel migration, complexity and floodplain function. The principal mean to meet this objective is to protect riparian habitat in category 1 and 2 subwatersheds. The highest priority for increasing biological productivity is to restore the complexity of the stream channel and floodplain.

Spatial Structure and Diversity. This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in streams in the Columbia River Basin upstream from the Yakima River, Washington, to the U.S.-Canada border, and progeny of six artificial propagation programs. Four independent populations of UCR steelhead were identified by the IC-TRT in the same upriver tributaries as for UC spring-run

Chinook salmon (*i.e.*, Wenatchee, Entiat, Methow, and Okanogan)(Table 2.2-15) and, similarly, no major population groupings were identified due to the relatively small geographic area involved (Ford 2011; IC-TRT 2003). All extant populations are considered to be at high risk of extinction (Table 2.2-15) (Ford 2011). With the exception of the Okanogan population, the Upper Columbia populations rated as "low" risk for spatial structure. The "high" risk ratings for SS/D are largely driven by chronic high levels of hatchery spawners within natural spawning areas and lack of genetic diversity among the populations. The proportions of hatchery origin returns in natural spawning areas remain extremely high across the DPS, especially in the Methow and Okanogan River populations. In 2011, we completed a 5-year review for the UCR steelhead and concluded the species should maintain its threatened listing classification (Ford 2011).

Table 2.2-15. Summary of the key elements (A/P, diversity, and SS/D) and scores used to determine current overall viability risk for UCR steelhead populations (Ford 2011). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH). None of the populations originate in the action area.

Population (Watershed)	A/P	Diversity	Integrated SS/D	Overall Viability Risk
Wenatchee River	H	H	H	H
Entiat River	H	H	H	H
Methow River	H	H	H	H
Okanogan River	H	H	H	H

Abundance and Productivity. Upper Columbia steelhead populations have increased in natural origin abundance in recent years, but productivity levels remain low. The modest improvements in natural returns in recent years are probably primarily the result of several years of relatively good natural survival in the ocean and tributary habitats.

Limiting Factors. Limiting factors include (NOAA Fisheries 2011; UCSRB 2007):

- Mainstem Columbia River hydropower–related adverse effects.
- Impaired tributary fish passage.
- Degraded floodplain connectivity and function, channel structure and complexity, riparian areas, large woody debris recruitment, stream flow, and water quality.
- Hatchery-related effects.
- Predation and competition.
- Harvest-related effects.

Status of SRB Steelhead. We are developing a recovery plan for this species.

Spatial Structure and Diversity. This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in streams in the Snake River Basin of southeast Washington, northeast Oregon, and Idaho, and progeny of six artificial propagation programs. The IC-TRT identified 24 historical populations in five major groups (Table 2.2-16) (Ford 2011; IC-TRT 2011). The IC-TRT has not assessed the viability of this species. The relative proportion of hatchery fish in natural spawning areas near major hatchery release sites is highly uncertain. There is little evidence for substantial change in ESU viability relative to the previous BRT and IC-TRT reviews. In 2011, we completed a 5-year review for the SRB steelhead and concluded the species should maintain its threatened listing classification (Ford 2011).

Table 2.2-16. Ecological subregions, populations, and scores for the key elements (A/P, diversity, and SS/D) used to determine current overall viability risk for SRB steelhead (Ford 2011; NMFS 2011c). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH). Maintained (MT) population status indicates that the population does not meet the criteria for a viable population but does support ecological functions and preserve options for recovery of the DPS. Shading indicates populations that originate in the action area.

Ecological subregions	Spawning Populations (Watershed)	A/P	Diversity	Integrated SS/D	Overall Viability Risk*
Lower Snake River	Tucannon River	**	M	M	H
	Asotin Creek	**	M	M	MT
Grande Ronde River	Lower Grande Ronde	**	M	M	Not rated
	Joseph Creek	VL	L	L	Highly viable
	Upper Grande Ronde	M	M	M	MT
	Wallowa River	**	L	L	H
Clearwater River	Lower Clearwater	M	L	L	MT
	South Fork Clearwater	H	M	M	H
	Lolo Creek	H	M	M	H
	Selway River	H	L	L	H
	Lochsa River	H	L	L	H
Salmon River	Little Salmon River	**	M	M	MT
	South Fork Salmon	**	L	L	H
	Secesh River	**	L	L	H
	Chamberlain Creek	**	L	L	H
	Lower MF Salmon	**	L	L	H
	Upper MF Salmon	**	L	L	H
	Panther Creek	**	M	H	H
	North Fork Salmon	**	M	M	MT
	Lemhi River	**	M	M	MT
	Pahsimeroi River	**	M	M	MT
	East Fork Salmon	**	M	M	MT
	Upper Main Salmon	**	M	M	MT
Imnaha	Imnaha River	M	M	M	MT

* There is uncertainty in these ratings due to a lack of population-specific data.

** Insufficient data.

***Abundance and Productivity*.** The level of natural production in the two populations with full data series and the Asotin Creek index reaches is encouraging, but the status of most populations in this DPS remains highly uncertain. Population-level natural origin abundance and productivity inferred from aggregate data and juvenile indices indicate that many populations are likely below the minimum combinations defined by the IC-TRT viability criteria.

***Limiting Factors*.** Limiting factors include (NMFS 2011g; NMFS 2011c):

- Mainstem Columbia River hydropower–related adverse effects.
- Impaired tributary fish passage.
- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large woody debris recruitment, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development.
- Impaired water quality and increased water temperature.
- Related harvest effects, particularly for B-run steelhead.
- Predation.
- Genetic diversity effects from out-of-population hatchery releases.

2.2.1.3 Oregon Coast Recovery Domain

The OC recovery domain includes OC coho salmon, Southern green sturgeon, and Southern eulachon,[87] covering Oregon coastal streams south of the Columbia River and north of Cape Blanco. Streams and rivers in this area drain west into the Pacific Ocean, and vary in length from less than a mile to more than 210 miles.

Status of OC Coho Salmon. We are developing a recovery plan for this species.

***Spatial Structure and Diversity*.** This species includes populations of coho salmon in Oregon coastal streams south of the Columbia River and north of Cape Blanco. The Cow Creek Hatchery Program (South Umpqua population) is included as part of the ESU because the original brood stock was founded from the local, natural origin population and natural origin coho salmon have been incorporated into the brood stock on a regular basis.

The OC-TRT identified 56 populations; 21 independent and 35 dependent (Table 2.2-17). The dependent populations were dependent on strays from other populations to maintain them over long time periods. The TRT also identified 5 biogeographic strata (Lawson *et al.* 2007).

[87] The status of Southern green sturgeon and Southern eulachon were previously presented under the Willamette-Lower Columbia Recovery Domain discussion and are not repeated here.

Table 2.2-17. OC coho salmon populations. Dependent populations (D) are populations that historically would not have had a high likelihood of persisting in isolation for 100 years. These populations relied upon periodic immigration from other populations to maintain their abundance. Independent populations are populations that historically would have had a high likelihood of persisting in isolation from neighboring populations for 100 years and are rated as functionally independent (FI) and potentially independent (PI) (Lawson *et al*. 2007; McElhany *et al*. 2000). All populations originate in the action area.

Stratum	Population	Type	Stratum	Population	Type
North Coast	Necanicum River	PI	Mid-Coast (cont.)	Alsea River	FI
	Ecola Creek	D		Big Creek (Alsea)	D
	Arch Cape Creek	D		Vingie Creek	D
	Short Sands Creek	D		Yachats River	D
	Nehalem River	FI		Cummins Creek	D
	Spring Creek	D		Bob Creek	D
	Watseco Creek	D		Tenmile Creek	D
	Tillamook Bay	FI		Rock Creek	D
	Netarts Bay	D		Big Creek (Siuslaw)	D
	Rover Creek	D		China Creek	D
	Sand Creek	D		Cape Creek	D
	Nestucca River	FI		Berry Creek	D
	Neskowin Creek	D		Siuslaw River	FI
Mid-Coast	Salmon River	PI	Lakes	Sutton Creek	D
	Devils Lake	D		Siltcoos Lake	PI
	Siletz River	FI		Tahkenitch Lake	PI
	Schoolhouse Creek	D		Tenmile Lakes	PI
	Fogarty Creek	D	Umpqua	Lower Umpqua River	FI
	Depoe Bay	D		Middle Umpqua River	FI
	Rocky Creek	D		North Umpqua River	FI
	Spencer Creek	D		South Umpqua River	FI
	Wade Creek	D	Mid-South Coast	Threemile Creek	D
	Coal Creek	D		Coos River	FI
	Moolack Creek	D		Coquille River	FI
	Big Creek (Yaquina)	D		Johnson Creek	D
	Yaquina River	FI		Twomile Creek	D
	Theil Creek	D		Floras Creek	PI
	Beaver Creek	PI		Sixes River	PI

A 2010 BRT noted significant improvements in hatchery and harvest practices have been made (Stout *et al*. 2012). However, harvest and hatchery reductions have changed the population dynamics of the ESU. Current concerns for spatial structure focus on the Umpqua River. Of the four populations in the Umpqua stratum, the North Umpqua and South Umpqua were of particular concern. The North Umpqua is controlled by Winchester Dam and has historically been dominated by hatchery fish. Hatchery influence has recently been reduced, but the natural productivity of this population remains to be demonstrated. The South Umpqua is a large, warm system with degraded habitat. Spawner distribution appears to be seriously restricted in this population, and it is probably the most vulnerable of any population in this ESU to increased temperatures.

Current status of diversity shows improvement through the waning effects of hatchery fish on populations of OC coho salmon. In addition, recent efforts in several coastal estuaries to restore lost wetlands should be beneficial. However, diversity is lower than it was historically because of the loss of both freshwater and tidal habitat loss coupled with the restriction of diversity from very low returns over the past 20 years.

Abundance and Productivity. It has not been demonstrated that productivity during periods of poor marine survival is now adequate to sustain the ESU. Recent increases in adult escapement do not provide strong evidence that the century-long downward trend has changed. The ability of the OC coho salmon ESU to survive another prolonged period of poor marine survival remains in question.

Overall population declines of OC coho salmon are a likely outcome of climate change (Wainwright and Weitkamp 2013).

> In the face of climate change and other human-driven and natural stressors, it is important that management for this species [*OC coho salmon*] focus on improving resilience of both populations and the habitats on which they depend. This will require a shift in policies toward managing diversity of habitats and fish populations and an integrated perspective linking resilience in ecological and human systems; without this shift, the future does not look bright for these salmon. [Wainwright and Weitkamp 2013, p. 235.]

Wainwright *et al*. (2008) determined that the weakest strata of OC coho salmon were in the North Coast and Mid-Coast of Oregon, which had only “low” certainty of persisting. The strongest strata were the Lakes and Mid-South Coast, which had “high” certainty of persisting. To increase certainty that the ESU as a whole is persistent, they recommended that restoration work should focus on those populations with low persistence, particularly those in the North Coast, Mid-Coast, and Umpqua strata.

Limiting Factors. Limiting factors include (NOAA Fisheries 2011; Stout *et al*. 2012):

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood supply, stream substrate, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, instream mining, dams, road crossings, dikes, levees, urbanization, etc.
- Fish passage barriers that limit access to spawning and rearing habitats.
- Loss of estuarine and tidal freshwater habitat.
- Adverse climate, altered past ocean/marine productivity, and current ocean ecosystem conditions have favored competitors and predators and reduced salmon survival rates in freshwater rivers and lakes, estuaries, and marine environments.

2.2.1.4 Southern Oregon and Northern California Coasts Recovery Domain

The SONCC recovery domain includes coho salmon, Southern green sturgeon, and Southern eulachon. The SONCC recovery domain extends from Cape Blanco, Oregon, to Punta Gorda, California. This area includes many small-to-moderate-sized coastal basins, where high quality habitat occurs in the lower reaches of each basin, and three large basins (Rogue, Klamath and Eel) where high quality habitat is in the lower reaches, little habitat is provided by the middle reaches, and the largest amount of habitat is in the upper reaches.

Status of SONCC Coho Salmon. A recovery plan is available for this species (NMFS 2014a).

***Spatial Structure and Diversity*.** This species includes all naturally-spawned populations of coho salmon in coastal streams from the Elk River near Cape Blanco, Oregon, through and including the Mattole River near Punta Gorda, California, and progeny of three artificial propagation programs (NMFS in press). Williams *et al*. (2006) designated 45 populations of coho salmon in the SONCC coho salmon ESU as dependent or independent based on their historical population size. Independent populations are populations that historically would have had a high likelihood of persisting in isolation from neighboring populations for 100 years and are rated as functionally independent or potentially independent. Dependent populations historically would not have had a high likelihood of persisting in isolation for 100 years. These populations relied upon periodic immigration from other populations to maintain their abundance. Two ephemeral populations are both small enough and isolated enough that they are only intermittently present (McElhany *et al*. 2000; Williams *et al*. 2006; NMFS in press). These populations were further grouped into seven diversity strata based on the geographical arrangement of the populations and basin-scale genetic, environmental, and ecological characteristics. Thirteen populations occur in Oregon (Table 2.2-18).

NMFS (in press) determined the role each of the independent populations will serve in recovery (Table 2.2-18). Independent populations likely to respond to recovery actions and achieve a low risk of extinction most quickly are designated “Core” populations. We based this designation on current condition, geographic location in the ESU, a low risk threshold compared to the number of spawners needed for the entire stratum, and other factors. Independent populations with little to no documentation of coho salmon presence in the last century, and poor prospects for recovery were designated as non-core 2. All other independent populations are designated non-core 1. With improved data from 2006, NMFS (in press) determined five of the 45 populations are ephemeral.

Table 2.2-18. Independent and dependent SONCC coho salmon populations by stratum and role of each population in recovery (Williams *et al.* 2006). Ephemeral populations per NMFS (in press) not listed. All populations originate in the action area.

Stratum	Population	Population Type
Northern Coastal	Elk River	Independent - Core
	Brush Creek	Dependent
	Mussel Creek	Dependent
	Lower Rogue River	Independent - Non-Core 1
	Hunter Creek	Dependent
	Pistol River	Dependent
	Chetco River	Independent - Core
	Winchuck River*	Independent - Non-Core 1
Interior Rogue	Illinois River*	Independent - Core
	Middle Rogue/Applegate*	Independent - Non-Core 1
	Upper Rogue River	Independent - Core
Interior Klamath	Upper Klamath River*	Independent - Core
Central Coastal	Smith River*	Independent - Core

* Populations that also occur partly in California.

We established biological recovery objectives and criteria for each population role (Table 2.2-19) in our recovery plan for this species (NMFS in press).

Table 2.2-19. Biological recovery objectives and criteria to measure whether recovery objectives are met for SONCC coho salmon (NMFS in press).

VSP Parameter	Population Role	Biological Recovery Objective	Biological Recovery Criteria[1]
Abundance	Core	Achieve a low risk of extinction.	The geometric mean of wild adults over 12 years meets or exceeds the "low risk threshold" of spawners for each core population[2]
	Non-Core 1	Achieve a moderate or low risk of extinction.	The annual number of wild adults is greater than or equal to four spawners per IP-km for each non-core population[2]
Productivity	Core and Non-Core 1	Population growth rate is not negative.	Slope of regression of the geometric mean of wild adults over the time series ≥ zero[2]
Spatial Structure	Core and Non-Core 1	Ensure populations are widely distributed.	Annual within-population distribution ≥ 80%[4] of habitat[3,4] (outside of a temperature mask[5])
	Non-Core 2 and Dependent	Achieve inter- and intra-stratum connectivity.	≥ 80% of accessible habitat[3] is occupied in years[6] following spawning of cohorts that experienced high marine survival[7]
Diversity	Core and Non-Core 1	Achieve low or moderate hatchery impacts on wild fish.	Proportion of hatchery-origin adults (pHOS) < 0.05
	Core and Non-Core 1	Achieve life history diversity.	Variation is present in migration timing, age structure, size, and behavior. The variation in these parameters,[8] is retained.

[1]All applicable criteria must be met for each population in order for the ESU to be viable.
[2]Assess for at least 12 years, striving for a coefficient of variation (CV) of 15% or less at the population level (Crawford and Rumsey 2011).
[3]Based on available rearing habitat within the watershed (Wainwright *et al.* 2008). For purposes of these biological recovery criteria, "available" means accessible. 70% of habitat occupied relates to a truth value of approximately 0.60, providing a "high" certainty that juveniles occupy a high proportion of the available rearing habitat (Wainwright *et al.* 2008).
[4]The average for each of the three year classes over the 12 year period used for delisting evaluation must each meet this criterion. Strive to detect a 15% change in distribution with 80% certainty (Crawford and Rumsey 2011).
[5]Williams *et al.* (2008) identified a threshold air temperature, above which juvenile coho salmon generally do not occur, and identified areas with air temperatures over this threshold. These areas are considered to be within the temperature mask.
[6]If young-of-year are sampled, sampling would occur the spring following spawning of the cohorts experiencing high marine survival. If juveniles are sampled, sampling would occur approximately 1.5 years after spawning of the cohorts experiencing high marine survival, but before juveniles outmigrate to the estuary and ocean.
[7]High marine survival is defined as 10.2% for wild fish and 8% for hatchery fish (Sharr *et al.* 2000). If marine survival is not high, then this criterion does not apply.
[8]This variation is documented in the population profiles in Volume II of the recovery plan (NMFS in press).

Abundance and Productivity. Although long-term data on abundance of SONCC coho salmon are scarce, available evidence from shorter-term research and monitoring efforts indicate that conditions have worsened for populations since the last formal status review was published (Williams *et al.* 2011). Because the extinction risk of an ESU depends upon the extinction risk of its constituent independent populations and the population abundance of most independent populations are below their depensation threshold, the SONCC coho salmon ESU is at high risk of extinction and is not viable (Williams *et al*. 2011).

Limiting Factors. Threats from natural or man-made factors have worsened in recent years, primarily due to four factors: small population dynamics, climate change, multi-year drought, and poor ocean survival conditions (NOAA Fisheries 2011, NMFS in press). Limiting factors for this species include:

- Lack of floodplain and channel structure.
- Impaired water quality.
- Altered hydrologic function (timing of volume of water flow).
- Impaired estuary/mainstem function.
- Degraded riparian forest conditions.
- Altered sediment supply.
- Increased disease/predation/competition.
- Barriers to migration.
- Fishery effects.
- Hatchery effects.

2.2.1.5 Marine Domain

Status of Southern Resident Killer Whale. The Southern Resident killer whale Distinct Population Segment (DPS) was listed as endangered under the ESA on November 18, 2005 (70 FR 69903; November 18, 2005). Southern Residents are designated as depleted and strategic under the Marine Mammal Protection Act (68 FR 31980; May 29, 2003). NMFS issued the final recovery plan for Southern Residents in January 2008 (NMFS 2008a). This section summarizes information taken largely from the recovery plan and recent five-year status review (NMFS 2011e) as well as new data that became available more recently.

Abundance and Productivity. 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 (Bain 1990, Olesiuk *et al.* 1990). Southern Resident females appear to have reduced fecundity relative to Northern Residents; the average interbirth interval for reproductive Southern Resident females is 6.1 years, which is longer than that of Northern Resident killer whales (Olesiuk *et al.* 2005). 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 (Baird 2000, Bigg *et al.* 1990, 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.

The historical abundance of Southern Resident killer whales is estimated from 140 to an unknown upper bound. The minimum historical estimate (~140) included whales killed or removed for public display in the 1960s and 1970s added to the remaining population at the time the captures ended. Several lines of evidence (*i.e.*, known kills and removals [Olesiuk *et al.* 1990], salmon declines [Krahn *et al.* 2002] and genetics [Krahn *et al.* 2002, Ford *et al.* 2011]) all indicate that the population used to be much larger than it is now, but there is currently no reliable estimate of the upper bound of the historical population size. When faced with developing a population viability analysis for this population, NMFS' biological review team found it reasonable to assume an upper bound of as high as 400 whales to estimate carrying capacity (Krahn *et al.* 2004).

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 2.2-1). Since censuses began in 1974, J and K pods have steadily increased their sizes. However, the population suffered an almost 20% decline from 1996-2001 (from 97 whales in 1996 to 81 whales in 2001), largely driven by lower survival rates in L pod. Over the last 30 years (1983-2013), population growth has been variable, with an average annual population growth rate of 0.3% and standard deviation of ± 3.2%. Seasonal mortality rates among Southern and Northern Resident whales may 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 season. At least 12 newborn calves (nine in the southern community and three in the 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). Between 1925 and 2011, data were collected on a total of 371 killer whales that stranded in the North Pacific (Barbieri *et al*. 2013). Since the beginning of the annual census in 1974, 19 confirmed Southern Resident killer whale carcasses were found, suggesting a recovery rate of approximately 20% (Barbieri *et al*. 2013). Several of these stranding events occurred in the waters off of Washington and British Columbia (*e.g.*, 1995 and 1996 off of Northern Vancouver Island and Haida Gwaii (Queen Charlotte Islands), and 2002 offshore of Long Beach, Washington State; 2006 in Nootka Sound British Columbia; 2008 off Henry Island, San Juan County, WA; 2012 Long Beach WA; and 2013 Dungeness Spit) (NMFS 2008a, Gaydos *et al*. 2013). On an annual basis, approximately 10 stranded killer whales are observed in the region. Most of the causes of death are unknown.

As of July 2015, the Southern Resident killer whale population totaled 81 individuals: 27 whales in J pod, 19 whales in K pod and 35 whales in L pod (Center for Whale Research, unpublished data). There are several demographic factors of the Southern Resident population that are cause for concern, namely the small number of breeding males (particularly in J and K pods), reduced fecundity, sub-adult survivorship in L pod, and the total number of individuals in the population (review in NMFS 2008a). The current population abundance (81 individuals) is small, at approximately 20 to 60% of its likely previous size (140 to an unknown upper bound that could be as high at 400 whales, as discussed above). The estimated effective size of the population (based on the number of breeders under ideal genetic conditions) is very small at approximately 26 whales or roughly 1/3 of the current population size (Ford *et al.* 2011). The small effective population size and the absence of gene flow from other populations may elevate the risk from inbreeding and other issues associated with genetic deterioration, as evident from documented breeding within pods (Ford *et al.* 2011). As well, the small effective population size may contribute to the lower growth rate of the Southern Resident population in contrast to the Northern Resident population (Ford *et al.* 2011, Ward *et al.* 2009).

Because of this population's small abundance, it is also susceptible to demographic stochasticity – randomness in the pattern of births and deaths among individuals in a population. Several other sources of stochasticity can affect small populations and contribute to variance in a population's growth and extinction risk. Other sources include environmental stochasticity, or fluctuations in the environment that drive fluctuations in birth and death rates, and demographic heterogeneity, or variation in birth or death rates of individuals because of differences in their individual fitness (including sexual determinations). In combination, these and other sources of random variation combine to amplify the probability of extinction, known as the extinction vortex (Gilpin and Soule 1986, Fagen and Holmes 2006, Melbourne and Hastings 2008). The larger the population size, the greater the buffer against stochastic events and genetic risks. A delisting criterion for the Southern Resident killer whale DPS is an average growth rate of 2.3% for 28 years (NMFS 2008a). In light of the current average growth rate of 0.3%, this recovery criterion reinforces the need to allow the population to grow quickly.

Figure 2.2-1. Population size and trend of Southern Resident killer whales, 1960-2013. Data from 1960-1973 (open circles, gray line) are number projections from the matrix model of Olesiuk *et al.* (1990). Data from 1974-2013 (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 (unpublished data) and NMFS (2008). Data for these years represent the number of whales present at the end of each calendar year, except for 2013, when data only extend to July.

Population growth is also important because of the influence of demographic and individual heterogeneity on a population's long-term viability. Population-wide distribution of lifetime reproductive success can be highly variable, such that some individuals produce more offspring than others to subsequent generations, and male variance in reproductive success can be greater than that of females (*i.e.*, Clutton-Brock 1988, Hochachka 2006). For long-lived vertebrates such as killer whales, some females in the population might contribute less than the number of offspring required to maintain a constant population size (n = 2), while others might produce more offspring. The smaller the population, the more weight an individual's reproductive success has on the population's growth or decline (*i.e.*, Coulson *et al.* 2006). This further illustrates the risk of demographic stochasticity for a small population like Southern Resident killer whales – the smaller a population, the greater the chance that random variation will result in too few successful individuals to maintain the population.

***Spatial Distribution*.** Southern Resident killer whales range as far south as central California and as far north as Southeast Alaska (Figure 2.2-2). The figure does not reflect a recent sighting in Chatham Strait, Alaska (J. Ford pers. comm.), approximately 200 miles north of Haida Gwaii, British Columbia.

From late spring to early autumn, Southern Residents spend considerable time in the Salish Sea, of which Puget Sound is a portion. Activity is concentrated around the San Juan Islands and then moves south into Puget Sound in early autumn. Pods make frequent trips to the outer coast during this time (Table 2.2-20). Although the entire Southern Resident killer whale DPS has the potential to occur along the outer coast at any time during the year, occurrence along the outer coast is more likely from late autumn to early spring.

There is limited information on the distribution and habitat use of Southern Residents along the outer Pacific Coast, but the K and L pods are thought to range more widely than the J pod (Center for Whale Research, unpublished data). During late fall, winter, and early spring, the ranges and movements of the Southern Residents are not 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). Southern Residents are highly mobile and can travel up to 86 nautical miles (nmi, or 99 miles) in a single day (Erickson 1978, Baird 2000). To date, there is no evidence that Southern Residents travel further than 31 miles (50 km) offshore (Ford *et al*. 2005).

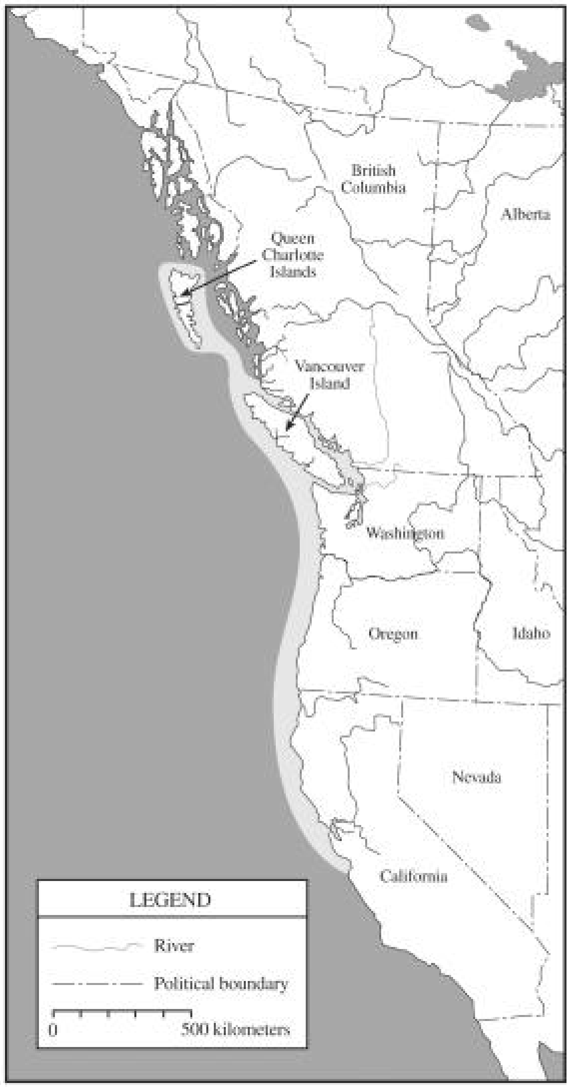

Figure 2.2-2. Geographic Range (light shading) of the Southern Resident Killer Whale DPS. Source: Wiles (2004). Figure excludes a recent sighting in Chatham Strait, Alaska (J. Ford pers. comm.), approximately 200 miles north of Haida Gwaii, British Columbia.

Table 2.2-20. Average number of days spent by Southern Resident killer whales in inland and coastal waters by month, 2003-2007 (Hanson and Emmons, unpublished report).

	L pod		J pod		K pod	
Month	Days Inland	Days Coastal	Days Inland	Days Coastal	Days Inland	Days Coastal
Jan	5	26	3	29	8	23
Feb	0	28	4	24	0	28
March	2	29	7	24	2	29
April	0	30	13	17	0	30
May	2	29	26	5	0	31
June	14	16	26	5	12	18
July	18	13	24	7	17	14
Aug	17	15	17	15	17	14
Sep	20	10	19	11	17	13
Oct	12	19	14	17	8	24
Nov	5	25	13	17	7	23
Dec	1	30	8	23	10	21

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). In recent years, several sightings or acoustic detections have been obtained off the Washington and Oregon coasts for these pods in the winter and spring (NWFSC, unpublished data, Hanson *et al*. 2008, 2010a, 2013). Even fewer sightings/acoustic detections are available for J pod on the outer coast in the winter and spring, but the limited range of the sighting/acoustic detections and a lack of coincident occurrence during the K and L pod sightings suggest a much more restricted coastal range.

Sightings in Monterey Bay, California coincided with occurrence of salmon, with feeding witnessed in 2000 (Black *et al*. 2001). Southern Residents were also sighted in Monterey Bay during 2008, when salmon runs from California were expected to be near record lows (PFMC 2010). 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, personal observation as cited in Krahn *et al*. 2004). In March 2005, L pod was sighted working a circuit across the Columbia River plume from the North Jetty across to the South Jetty during the spring Chinook salmon run in the Columbia River (Zamon *et al*. 2007). Also in March of 2006, K and L pods were encountered off the Columbia River (Hanson *et al*. 2008). L pod was again seen feeding off Westport, Washington in March 2009, and genetic analysis of prey remains collected from two predation events identified one fish as spring Chinook salmon and the other as a summer/fall Chinook salmon from Columbia River stocks (Hanson *et al*. 2010a). Recent evidence shows K and L pods are spending significantly more time off of the Columbia River in March than previously recognized, suggesting the importance of Columbia River spring Chinook salmon in their diet (Hanson *et al*. 2013).

The Northwest Fisheries Science Center (NWFSC) also deploys and collects data from remote autonomous acoustic recorders from seven sites off Washington, Oregon, and California (Emmons *et al*. 2009, Hanson *et al*. 2013). In 2009, 52 Southern Resident killer whale detections were documented from this acoustic system (Emmons *et al.* 2009). Between 2006 and 2011, the whales were detected on 131 days (Hanson *et al*. 2013). The data suggest that J, K, and L pods spend a relatively large amount of time off of Washington, with K and L pods only detected off California in February (Hanson *et al*. 2013).

Acoustic recorder data from January to April 2013, indicated the K pod migrated up and down the coast between the entrance to the Strait of Juan de Fuca and Bodega Bay, California (NWFSC, unpublished data). K pod was observed off the Oregon coast during portions of each month during that period. In January, K pod was observed chasing unidentified salmon off Coos Bay, Oregon (NWFSC, unpublished data). For a brief period in March, an individual in the L pod was also tagged. During this time the K and L pods largely traveled together off the Oregon coast, including in the vicinity of the Columbia River mouth. K pod was observed spending time off the Columbia River mouth in January, March, and April.

Unpublished tagging data from 2015 and 2016 which continue to show SRKW from L and K pods off the coast of Oregon and Washington is available online at *http://www.nwfsc.noaa.gov/research/divisions/cb/ecosystem/marinemammal/satellite_tagging/index.cfm*.

The Department of Fisheries and Oceans (DFO), Canada also maintains acoustic recorders in British Columbia. When the NWFSC and DFO analyze these data, more information will be available about the seasonal distribution, movements, habitat use, and diet of Southern Resident killer whales in coastal waters.

Limiting Factors. Several factors identified in the final recovery plan for Southern Resident killer whales may be limiting recovery. These are quantity and quality of prey (particularly their primary prey, Chinook salmon), exposure to toxic chemicals that accumulate in top predators, and disturbance from sound and vessels. Oil spills are also a risk factor. It is likely that multiple threats are acting in concert to impact the whales. Although it is not clear which threat or threats are most significant to the survival and recovery of Southern Residents, all of the threats identified are potential limiting factors in their population dynamics (NMFS 2008a). Here we focus on the quantity and quality of prey, and the toxic chemicals in the whales because these are affected by the proposed action.

<u>Prey</u>. Healthy killer whale populations depend on adequate prey levels. Southern Residents consume a variety of fish species (22 species) and one species of squid (Scheffer and Slipp 1948; Ford *et al*. 1998, 2000; Ford and Ellis 2006; Saulitis *et al*. 2000), but salmon are identified as their primary prey (*i.e.*, a high percent of prey consumed during spring, summer and fall, from long-term studies of resident killer whale diet; Ford and Ellis 2006, Hanson *et al*. 2010b). Feeding records for Southern and Northern Residents show a predominant consumption of Chinook salmon during late spring to fall (Ford and Ellis 2006). Chum salmon are also taken in significant amounts, especially in fall. Other salmon eaten include coho, pink, steelhead (*O. mykiss*), and sockeye (*O. nerka*). The non salmonids included Pacific herring, sablefish, Pacific halibut, quillback and yelloweye rockfish (*Sebastes maliger*), lingcod (*Ophiodon elongates*), and Dover sole (*Microstomus pacificus*) (Ford *et al.* 1998, Hanson *et al*. 2010b). Chinook salmon were the primary prey despite the much lower abundance of Chinook salmon in the study area in

comparison to other salmonids (primarily sockeye), for mechanisms that remain unknown but factors of potential importance include 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). Recent research suggests that killer whales are capable of detecting, localizing, and recognizing Chinook salmon through their ability to distinguish Chinook salmon echo structure as different from other salmon (Au *et al.* 2010).

Most diet information is for inland waters. Less is known about the diet of Southern Residents off the Pacific coast. The available information indicates that salmon, and Chinook salmon in particular, are also important when the whales occur in coastal waters. To date, there are direct observations of two different predation events (where the prey was identified to species and stock from genetic analysis of prey remains) when the whales were in coastal waters. Both were identified as Columbia River Chinook stocks (Hanson *et al*. 2010a). More recently, the Northwest Fisheries Science Center observed several predation events and collected prey and fecal samples during the winter 2013 cruise (NWFSC unpublished data). Preliminary results indicate the whales are consuming primarily Chinook salmon (potentially from the Klamath River, Lower Columbia Springs, Middle Columbia Tule, Upper Columbia Summer/Fall, and north and south Puget Sound.

Chemical analyses also support the importance of salmon in the year round diet of Southern Resident killer whales (Krahn *et al.* 2002, 2007, 2009). Krahn *et al.* (2002), examined the ratios of dichlorodiphenyltrichloroethane (DDT) and its metabolites to various polychlorinated biphenyls (PCB) compounds in the whales, and concluded that the whales feed primarily on salmon throughout the year rather than other fish species. The predominance of Chinook in their diet in inland waters, even when other species are more abundant, combined with information to date about prey in coastal waters, makes it reasonable to expect that Chinook salmon are equally predominant in the whales' diet when available in coastal waters. It is also reasonable to expect that the diet of Southern Residents is predominantly on larger Chinook when available in coastal waters. The diet of Southern Residents in coastal waters is a subject of ongoing research.

Prey Quantity. Human influences have had profound impacts on the abundance of many prey species in the northeastern Pacific during the past 150 years, including anadromous salmonids. As discussed elsewhere herein, the health and abundance of wild salmonid stocks have been negatively affected by altered or degraded freshwater and estuarine habitat, including numerous land use activities, from hydropower systems to urbanization, forestry, agriculture, and development. Harmful artificial propagation practices and overfishing have also negatively affected wild salmonid stocks. Predation also contributes to salmonid mortality. Future threats include climate change. Salmonids are prey for pelagic fish, birds, and marine mammals, including killer whales.

When prey is scarce, whales likely spend more time foraging than when it is plentiful. Increased energy expenditure and prey limitation can cause nutritional stress. Nutritional stress is the condition of being unable to acquire adequate energy and nutrients from prey resources and as a chronic condition can lead to reduced body size and condition of individuals and lower reproductive and survival rates of a population (*e.g.*, Trites and Donnelly 2003). Food scarcity could also cause whales to draw on fat stores, mobilizing contaminants stored in their fat that are at relatively high levels (Krahn *et al.* 2007, 2009) and affecting reproduction and immune function (discussed below).

Between 1994 and 2008, the Center for Whale Research observed very poor body condition in 13 members of the Southern Resident population. Both females and males across a range of ages were found in poor body condition (Durban *et al.* 2009). All but two of those whales subsequently died (Durban *et al.* 2009). None of the whales that died were subsequently recovered, and therefore definitive cause of death could not be identified.

Regardless of the cause(s) of death, it is possible that poor nutrition could contribute to mortality through a variety of mechanisms. To demonstrate how this is possible, we reference studies that have demonstrated the effects of energetic stress (caused by incremental increases in energy expenditures or incremental reductions in available energy) on adult females and juveniles, which have been studied extensively (*e.g.*, adult females: Gamel *et al.* 2005, Daan *et al.* 1996; juveniles: Noren *et al.* 2009, Trites and Donnelly 2003). Small, incremental increases in energy demands should have the same effect on an animal's energy budget as small, incremental reductions in available energy, such as one would expect from reductions in prey. Ford and Ellis (2006) report that resident killer whales engage in prey sharing about 76% of the time. Prey sharing presumably would distribute more evenly the effects of prey limitation across individuals of the population than would otherwise be the case (*i.e.*, if the most successful foragers did not share with other individuals). Therefore, although cause of death for these specific individuals is unknown, poor nutrition could contribute to additional mortality in this population.

Demographic modeling conducted to date identifies Chinook salmon abundance as strongly correlated with changes in demographic rates of the Southern Resident killer whale population. Ford *et al*. (2005 and 2010b) evaluated 25 years of demographic data from Southern and Northern Resident killer whales and found that changes in survival largely drive their population trends, and the populations' survival rates are strongly correlated with coast-wide availability of Chinook salmon (from Pacific Salmon Commission abundance indices that estimate abundance between Southeast Alaska and Oregon). Ward *et al.* (2009) found that Northern and Southern Resident killer whale fecundity is highly correlated with Chinook salmon abundance indices, and reported the probability of calving increased by 50% between low and high Chinook salmon abundance years. The Pacific Salmon Commission's Chinook salmon abundance indices from the West Coast of Vancouver Island were the most important predictor of the relationship. Recently, Ward (2010) considered new information to update the 2009 fecundity model with new birth data and a singular focus on the Southern Resident killer whale population. Ward (2010) also conducted the updated analysis for survival, where the survival of L pod was evaluated separately from the survival of J and K pods because of the apparent lower survival in L pod (Ward *et al.* 2011, Krahn *et al.* 2004). Best-ranked models all included one of the Pacific Salmon Commission's Chinook indices. The results are consistent with findings from Ford *et al.* 2010. More recently, Ward *et al*. (2013) considered new stock-specific Chinook salmon indices and found strong correlations between the indices of Chinook salmon abundance and killer whale demographic rates. However, no single stock or group of stocks was identified as being more correlated with the whales' demographic rates. Further, they stress that the relative importance of specific stocks to the whales likely changes over time (Ward *et al*. 2013).

Prey Quality. The quality of prey, particularly Chinook salmon, the Southern Resident killer whales' primary prey, is likely influenced by a variety of factors, including contaminant load, prey size, fat content, and origin (natural vs. hatchery). Overall, Chinook salmon have the highest lipid content (Stansby 1976, Winship and Trites 2003), largest size, and highest caloric value per kilogram of any salmonid species (Ford and Ellis 2006, Osborne 1999).

Levels of persistent organic pollutants (POPs) in killer whales are primarily determined by contaminant levels in their prey and the geographic region, although the age, gender, and birth order of the whale also influence accumulation. Various studies have documented a range of concentrations of POPs in many populations of adult Pacific salmon. POP accumulation in Pacific salmon is primarily determined by geographic proximity to contaminated environments (Mongillo *et al.* in prep.). Because Chinook salmon are distributed in more coastal waters, they are more readily exposed to contaminants that are present in coastal waters than other species. In contrast, sockeye, pink, and chum salmon have lower POP concentrations because by the end of their first year, they have migrated through the coastal waters and are found in the open waters of the North Pacific, Gulf of Alaska, and Bering Sea (Quinn 2005). Measured average concentrations of PCBs and polybrominated diphenyl ethers (PBDEs) were highest for Chinook salmon, intermediate for coho salmon, less for sockeye salmon, and lowest for pink and chum salmon. Similarly, average DDT values were higher in Chinook and coho salmon compared to sockeye salmon and lowest for pink and chum salmon. Intermediate levels of PCB and PBDEs were measured in California and Oregon populations and the lowest average levels were measured in populations off Alaska (Mongillo *et al.* in prep.). The biological traits in Pacific salmon (*e.g.* trophic status, lipid content, age, exposure duration, metabolism, and detoxification) may also affect the degree to which POPs accumulate (Mongillo *et al.* in prep.).

Size of individual salmon is an aspect of prey quality that could affect the foraging efficiency of Southern Resident killer whales. As discussed above, available data suggests that Southern Residents consume larger prey. The degree to which this is a function of the availability of all sizes of fish in the coastal range of the whales, their ability to detect all sizes, or a true preference of only large fish is unknown. It is possible although not conclusive that there has been a historical decrease in salmon age, size, or size at a given age (*i.e.*, Bigler *et al.* 1996, but also see PFMC data (PFMC 2011)). 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).

Southern Resident killer whales likely consume both natural and hatchery salmon (Hanson *et al*. 2010b). The best available information does not indicate that natural and hatchery salmon generally differ in size, run-timing, or ocean distribution (*e.g.*, Nickum *et al.* 2004, NMFS 2008b, Weitkamp and Neely 2002, regarding differences that could affect Southern Residents); however, there is evidence of size and run-timing differences between hatchery and natural salmon from specific river systems or runs (*i.e.*, size and run timing differences as described for

Willamette River Chinook in NMFS 2008d). Potential run-specific differences in the quality of natural and hatchery salmon are evaluated where data are available.

Toxic Chemicals and Trace Elements. Contaminants enter fresh and marine waters and sediments from numerous sources, such as industrial outfalls, sewage treatment facility discharges, flood water inundation of agricultural and urban development areas, terrestrial runoff, atmospheric transport and deposition, and ocean current transport. Typically, contaminants are concentrated near populated areas of high human activity and industrialization. Oceans act as a repository for domestic and industrial wastes, and significant contaminant concentrations have been measured in the sediment, water, and biota. Persistent contaminants can biomagnify or accumulate up the food chain in such a degree where levels in upper trophic-level mammals can have significantly higher concentrations than that found in the water column or in lower trophic-level species. Southern Resident killer whales are exposed to relatively high levels of persistent pollutants because they are long-lived, upper trophic-level predators that are in close proximity to industrial and agricultural areas. Consequentially, Southern Resident killer whales are a highly contaminated population.

Persistent pollutants are highly lipophilic (*i.e.*, fat soluble) and are primarily stored in the fatty tissues in marine mammals (O'Shea 1999, Reijnders and Aguilar 2002). Therefore, when killer whales consume contaminated prey they store the contaminants primarily in their blubber. However, some persistent contaminants (*e.g.*, the butyltins) are primarily stored in the liver and kidneys of marine mammals (Iwata *et al.* 1997). Persistent pollutants can resist metabolic degradation and can remain stored in the tissues or organs of an individual whale for extended periods of time. When prey is scarce and when other stressors reduce foraging efficiency (*e.g.*, as possible from vessel disturbance, disease, *etc.*), killer whales metabolize their blubber lipid stores and the contaminants can become mobilized to other organs or they can remain in the blubber and become more concentrated (Krahn *et al.* 2002). Nursing mothers can also transmit large quantities of contaminants to their offspring, particularly during lactation. The mobilized contaminants can reduce the whales' resistance to disease, can affect reproduction, disrupt the endocrine system, disrupt enzyme function and vitamin A physiology, induce developmental neurotoxicity, and cause skeletal deformities (see NMFS 2008a for a review, Mongillo *et al.* in prep.).

Unlike the persistent pollutants, trace elements (commonly referred to as metals) are naturally found in the environment and some are essential to an animals' nutrition. Heavy metals in marine mammals are primarily determined by the levels in prey and the geographic region, as well as age and gender of the individual. For example, marine mammals that feed on squid can be exposed to higher levels of cadmium, copper, and zinc because squid have the ability to retain these elements (Reijnders and Aguilar 2002). Human activities can increase the concentrations and metals can become toxic at certain exposure levels. Currently, there is little information on metals in killer whales or in their prey. Most metals, like persistent pollutants, settle to the ocean floor where they can accumulate in sediment. Therefore, areas with high human activity can become hotspots of multiple toxic chemicals.

The distribution or storage of heavy metals in marine mammals is dependent on the metal. In general, heavy metals are found in the liver, kidneys, muscles, and bones (O'Shea 1999, Reijnders and Aguilar 2002, Das *et al.* 2003). Some metals may transfer from mother to offspring during gestation and lactation, although not to the same degree as the persistent organic pollutants. For example, Honda *et al.* (1987) found the hepatic concentrations of iron, lead, nickel, and cobalt decreased in adult female southern minke whales with progress of gestation. Pregnant pilot whales had less mercury in the serum than non-pregnant females, indicating a potential transplacental transfer to the fetus (Nielsen *et al.* 2000). However, it may also be possible that a change in the diet of the pregnant pilot whales can explain the change in mercury levels (Nielsen *et al.* 2000).

Non-essential metals that can be toxic to marine mammals, even at low doses, include mercury, cadmium, and lead. Mercury, cadmium, and lead in the tissues of marine mammals have been the focus of several studies because of their known toxicity to humans and other wildlife, such as damage to the central nervous system, skeletal deformities, kidney lesions and kidney or liver damage, as well as carcinogenic, mutagenic, and teratogenic effects (O'Shea 1999, Das *et al.* 2003). However, little information is known about toxic effects of heavy metals in marine mammals. Essential metals that occur naturally in the environment can also be toxic and their concentrations can be elevated in areas of high human activities. These essential metals include copper, chromium, nickel, zinc, iron, and selenium.

<u>Extinction Risk</u>. In conjunction with the 2004 status review, NMFS conducted a population viability analysis for Southern Resident killer whales (Krahn *et al.* 2004). Demographic information (1974-2003, 1990-2003, and 1994-2003) were considered to estimate extinction and quasi-extinction risk. The NMFS defined "quasi-extinction" as the stage at which 10 or fewer males or females remained, a threshold from which the population was not expected to recover.

The model evaluated a range in Southern Resident survival rates, based on variability in mean survival rates documented from past time intervals (highest, intermediate, and lowest survival). The model used a single fecundity rate for all simulations. The study considered seven values of carrying capacity for the population ranging from 100 to 400 whales, three levels of catastrophic event (*e.g.*, oil spills and disease outbreaks) frequency ranging from none to twice per century, and three levels of catastrophic event magnitude in which 0, 10, or 20% of the animals died per event.

The analysis indicated that the Southern Resident killer whales have a range of extinction risk from 0.1 to 18.7% in 100 years and 1.9 to 94.2% in 300 years, and a range of quasi-extinction risk from 1 to 66.5% in 100 years and 3.6 to 98.3% in 300 years (Table 2.2-21). The population is generally at greater risk of extinction as survival rate decreases and over a longer time horizon (300 years) than over a shorter time horizon (100 years), as would be expected with long-lived mammals. There is a greater extinction risk associated with increased probability and magnitude of catastrophic events. The NWFSC continues to evaluate mortality rates and reproduction, and will complete work on a population viability analysis similar to the analysis summarized above. Until these updated analyses are completed, the Krahn *et al.* (2004) analysis represents the best available science on extinction risk of Southern Resident killer whales.

Table 2.2-21. Range of extinction and quasi-extinction risk for Southern Resident killer whales in 100 and 300 years, assuming a range in survival rates (depicted by time period), a constant rate of fecundity, between 100 and 400 whales, and a range catastrophic probabilities and magnitudes (Krahn *et al.* 2004).

	Extinction Risk (%)		Quasi-Extinction Risk (%)	
Survival	100 years	300 years	100 years	300 years
Highest	0.1 – 2.8	1.9 – 42.4	1.0 – 14.6	3.6 – 67.7
Intermediate	0.2 – 5.2	14.4 – 65.6	6.1 – 29.8	21.4 – 85.3
Lowest	5.6 – 18.7	68.2 – 94.2	39.4 – 66.5	76.1 – 98.3

2.2.2 Status of Critical Habitat

This section examines the status of designated critical habitat affected by the proposed action by examining the condition and trends of essential physical and biological features throughout the designated areas. These features are essential to the conservation of the listed species because they support one or more of the species' life stages (*e.g.*, sites with conditions that support spawning, rearing, migration and foraging).

NMFS has described the lateral extent of critical habitat in various ways, ranging from fixed distances to ''functional'' zones defined by important riparian functions (65 FR 7764). The quality of aquatic habitat within stream channels is intrinsically related to the adjacent riparian zones and floodplain, to surrounding wetlands and uplands, and to non-fish-bearing streams above occupied stream reaches. Streams regularly submerge portions of the riparian zone via floods and channel migration, and portions of the riparian zone may contain off-channel rearing habitats used by juvenile salmonids, especially during periods of high flow. The riparian zone also provides an array of important watershed functions that directly benefit salmonids. Vegetation in the zone shades the stream, stabilizes banks, and provides organic litter and large woody debris. The riparian zone stores sediment, recycles nutrients and chemicals, mediates stream hydraulics, and controls microclimate. Healthy riparian zones help ensure water quality essential to salmonids, as well as the forage species they depend on. Consequently, human activities that occur outside the stream or designated critical habitat can modify or destroy physical and biological features of the stream. In addition, human activities that occur within and adjacent to reaches upstream (*e.g.*, road failures) or downstream (*e.g.*, dams) of designated stream reaches can also have demonstrable effects on physical and biological features of designated reaches.

In most instances, critical habitat includes the stream channels within the designated stream reaches, and includes a lateral extent as defined by the ordinary high-water line (Table 2.2-22). In areas where ordinary high-water line has not been defined, the lateral extent is defined by the bankfull elevation.[88] Critical habitat in lake areas is defined by the perimeter of the water body

[88] Bankfull elevation is the level at which water begins to leave the channel and move into the floodplain and is reached at a discharge which generally has a recurrence interval of 1 to 2 years on the annual flood series.

as displayed on standard 1:24,000 scale topographic maps or the elevation of ordinary high water, whichever is greater. In terms of Snake River sockeye salmon, Snake River spring/summer Chinook salmon, Snake River fall Chinook salmon, and Southern Oregon/Northern California Coasts coho salmon, critical habitat includes the water, waterway bottom, and adjacent riparian zone within the designated lake and river reaches (Table 2.2-22). In estuarine, and nearshore marine areas where designated, the lateral extent of critical habitat generally extends to the extreme high water line or the mean higher-high water line (Table 2.2-22). Refer to the associated Federal Register notices for the species-specific designations.

Table 2.2-22. Lateral extent of designated critical habitat by anadromous species for tidal and non-tidal reaches, and their associated Federal Register notice.

Species	Lateral Extent		Federal Register
	Tidal Reaches	Non-Tidal Reaches	
Chinook salmon *(Oncorhynchus tshawytscha)*			
Lower Columbia River	Extreme High Water	Ordinary High Water	9/02/05; 70 FR 52630
Upper Willamette River spring-run	Extreme High Water	Ordinary High Water	9/02/05; 70 FR 52630
Upper Columbia River spring-run	Extreme High Water	Ordinary High Water	9/02/05; 70 FR 52630
Snake River spring/summer-run	300 ft from High Water	300 ft from High Water	10/25/99; 64 FR 57399
Snake River fall-run	300 ft from High Water	300 ft from High Water	12/28/93; 58 FR 68543
Chum salmon *(O. keta)*			
Columbia River	Extreme High Water	Ordinary High Water	9/02/05; 70 FR 52630
Coho salmon *(O. kisutch)*			
Lower Columbia River	Not Specified	Ordinary High Water	2/24/16; 81 FR 9252
Oregon Coast	Extreme High Water	Ordinary High Water	2/11/08; 73 FR 7816
Southern Oregon/Northern California Coasts	Not Specified	Adjacent Riparian Zone	5/5/99; 64 FR 24049
Sockeye salmon *(O. nerka)*			
Snake River	300 ft from High Water	300 ft from High Water	12/28/93; 58 FR 68543
Steelhead (*O. mykiss*)			
Lower Columbia River	Extreme High Water	Ordinary High Water	9/02/05; 70 FR 52630
Upper Willamette River	Extreme High Water	Ordinary High Water	9/02/05; 70 FR 52630
Middle Columbia River	Extreme High Water	Ordinary High Water	9/02/05; 70 FR 52630
Upper Columbia River	Extreme High Water	Ordinary High Water	9/02/05; 70 FR 52630
Snake River Basin	Extreme High Water	Ordinary High Water	9/02/05; 70 FR 52630
Green sturgeon (*Acipenser medirostris*)			
Southern DPS	Mean Higher-High Water	Ordinary High Water	10/09/09; 74 FR 52300
Eulachon *(Thaleichthys pacificus)*			
Southern DPS	Mean Higher-High Water	Ordinary High Water	10/20/11; 76 FR 65324

For salmon and steelhead, NMFS ranked watersheds containing designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC_5) in terms of the conservation value the watersheds provide to each listed species they support.[89] The conservation rankings are high,

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

medium, or low. To determine the conservation value of each watershed to species viability, NMFS' critical habitat analytical review teams (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 species' range, and the significance to the population of the species occupying that area (NOAA Fisheries 2005). Thus, even a location that has poor quality of habitat could be ranked with a high conservation value if it were essential due to factors such as limited availability (*e.g.*, one of a very few spawning areas), a unique contribution to the population it served (*e.g.*, a population at the extreme end of geographic distribution), or the fact that it serves another important role (*e.g.*, obligate area for migration to upstream spawning areas).

The physical or biological features of freshwater spawning and incubation sites include water flow, quality, and temperature conditions, and suitable substrate for spawning and incubation, as well as migratory access for adults and juveniles (Tables 2.2-23 & 2.2-24). These features are essential to conservation because without them the species cannot successfully spawn and produce offspring. The physical or biological features of freshwater migration corridors associated with spawning and incubation sites include water flow, quality and temperature conditions supporting larval and adult mobility, abundant prey items supporting larval feeding after yolk sac depletion, and free passage (no obstructions) for adults and juveniles. These features are essential to conservation because they allow adult fish to swim upstream to reach spawning areas and they allow larval fish to proceed downstream and reach the ocean.

Table 2.2-23 PCEs of critical habitats designated for ESA-listed salmon and steelhead species considered in the opinion (except SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, and SONCC coho salmon), and corresponding species life history events.

Primary Constituent Elements		**Species Life History Event**
Site Type	**Site Attribute**	
Freshwater spawning	Substrate Water quality Water quantity	Adult spawning Embryo incubation Alevin growth and development
Freshwater rearing	Floodplain connectivity Forage Natural cover Water quality Water quantity	Fry emergence from gravel Fry/parr/smolt growth and development
Freshwater migration	Free of artificial obstruction Natural cover Water quality Water quantity	Adult sexual maturation Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration

Primary Constituent Elements		Species Life History Event
Site Type	**Site Attribute**	
Estuarine areas	Forage Free of artificial obstruction Natural cover Salinity Water quality Water quantity	Adult sexual maturation and “reverse smoltification” Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Nearshore marine areas	Forage Free of artificial obstruction Natural cover Water quantity Water quality	Adult growth and sexual maturation Adult spawning migration Nearshore juvenile rearing
Offshore marine areas	Forage Water quality	Adult growth and sexual maturation Adult spawning migration Subadult rearing

Table 2.2-24. PCEs of critical habitats designated for SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, SONCC coho salmon, and corresponding species life history events.

Primary Constituent Elements		Species Life History Event
Site	**Site Attribute**	
Spawning and juvenile rearing areas	Access (sockeye) Cover/shelter Food (juvenile rearing) Riparian vegetation Space (Chinook, coho) Spawning gravel Water quality Water temp (sockeye) Water quantity	Adult spawning Embryo incubation Alevin growth and development Fry emergence from gravel Fry/parr/smolt growth and development
Adult and juvenile migration corridors	Cover/shelter Food (juvenile) Riparian vegetation Safe passage Space Substrate Water quality Water quantity Water temperature Water velocity	Adult sexual maturation Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration

Primary Constituent Elements		Species Life History Event
Site	Site Attribute	
Areas for growth and development to adulthood	Ocean areas – not identified	Nearshore juvenile rearing Subadult rearing Adult growth and sexual maturation Adult spawning migration

2.2.2.1 CHART Salmon and Steelhead Critical Habitat Assessments

The CHART for each recovery domain assessed biological information pertaining to areas under consideration for designation as critical habitat to identify the areas occupied by listed salmon and steelhead, determine whether those areas contained PCEs essential for the conservation of those species, and whether unoccupied areas existed within the historical range of the listed salmon and steelhead that are also essential for conservation. The CHARTs assigned a 0 to 3 point score for the PCEs in each HUC_5 watershed:

Factor 1. Quantity,
Factor 2. Quality – Current Condition,
Factor 3. Quality – Potential Condition,
Factor 4. Support of Rarity Importance,
Factor 5. Support of Abundant Populations, and
Factor 6. Support of Spawning/Rearing.

Thus, the quality of habitat in a given watershed was characterized by the scores for Factor 2 (quality – current condition), which considers the existing condition of the quality of PCEs in the HUC_5 watershed; and Factor 3 (quality – potential condition), which considers the likelihood of achieving PCE potential in the HUC_5 watershed, either naturally or through active conservation/restoration, given known limiting factors, likely biophysical responses, and feasibility.

2.2.2.2 Southern Green Sturgeon Critical Habitat

A team similar to the CHARTs identified and analyzed the conservation value of particular areas occupied by Southern green sturgeon, and unoccupied areas the team felt were necessary to ensure the conservation of the species (USDC 2009). The CHART did not identify those particular areas using hydrologic unit code (HUC) nomenclature, but did provide geographic place names for those areas, including the names of freshwater rivers, the bypasses, the Sacramento-San Joaquin Delta, coastal bays and estuaries, and coastal marine areas (within 110 m depth) extending from the California/Mexico border north to Monterey Bay, California, and from the Alaska/Canada border northwest to the Bering Strait; and certain coastal bays and estuaries in California, Oregon, and Washington.

For freshwater rivers north of and including the Eel River, the areas upstream of the head of the tide were not considered part of the geographical area occupied by the southern DPS. However, the critical habitat designation recognizes not only the importance of natal habitats, but of habitats throughout their range. Critical habitat has been designated in coastal U.S. marine waters within 60 fathoms depth from Monterey Bay, California (including Monterey Bay), north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to its United States boundary; the Sacramento River, lower Feather River, and lower Yuba River in California; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; the lower Columbia River estuary; and certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor) and freshwater (USDC 2009). Table 2.2-25 below delineates PCEs for Southern green sturgeon.

Table 2.2-25. PCEs of critical habitat designated for Southern green sturgeon and corresponding species life history events.

Primary Constituent Elements		**Species Life History Event**
Site Type	**Site Attribute**	
Freshwater riverine system	Food resources Migratory corridor Sediment quality Substrate type or size Water depth Water flow Water quality	Adult spawning Embryo incubation, growth and development Larval emergence, growth and development Juvenile metamorphosis, growth and development
Estuarine areas	Food resources Migratory corridor Sediment quality Water flow Water depth Water quality	Juvenile growth, development, seaward migration Subadult growth, development, seasonal holding, and movement between estuarine and marine areas Adult growth, development, seasonal holding, movements between estuarine and marine areas, upstream spawning movement, and seaward post-spawning movement
Coastal marine areas	Food resources Migratory corridor Water quality	Subadult growth and development, movement between estuarine and marine areas, and migration between marine areas Adult sexual maturation, growth and development, movements between estuarine and marine areas, migration between marine areas, and spawning migration

The CHART identified several activities that threaten the PCEs in coastal bays and estuaries and necessitate the need for special management considerations or protection. The application of pesticides is likely to adversely affect prey resources and water quality within the bays and estuaries, as well as the growth and reproductive health of Southern green sturgeon through bioaccumulation. Other activities of concern include those that disturb bottom substrates, adversely affect prey resources, or degrade water quality through re-suspension of contaminated sediments. Of particular concern are activities that affect prey resources. Prey resources are affected by: commercial shipping and activities generating point source pollution and non-point source pollution that discharge contaminants and result in bioaccumulation of contaminants in green sturgeon; disposal of dredged materials that bury prey resources; and bottom trawl fisheries that disturb the bottom (but result in beneficial or adverse effects on prey resources for green sturgeon). In addition, petroleum spills from commercial shipping and proposed hydrokinetic energy projects are likely to affect water quality or hinder the migration of green sturgeon along the coast (USDC 2009).

2.2.2.3 Southern Eulachon Critical Habitat

Critical habitat for Southern eulachon includes portions of 16 rivers and streams in California, Oregon, and Washington (USDC 2011). All of these areas are designated as migration and spawning habitat for this species. In Oregon, 24.2 miles of the lower Umpqua River, 12.4 miles of the lower Sandy River, and 0.2 miles of Tenmile Creek have been designated. The mainstem Columbia River from the mouth to the base of Bonneville Dam, a distance of 143.2 miles is also designated as critical habitat. Table 2.2-26 delineates the designated physical or biological features for Southern eulachon.

Table 2.2-26. Physical or biological features of critical habitats designated for Southern eulachon and corresponding species life history events.

Physical or biological features		Species Life History Event
Site Type	**Site Attribute**	
Freshwater spawning and incubation	Flow Water quality Water temperature Substrate	Adult spawning Incubation
Freshwater migration	Flow Water quality Water temperature Food	Adult and larval mobility Larval feeding

The range of Southern eulachon in the Pacific Northwest completely overlaps with the range of several ESA-listed stocks of salmon and steelhead as well as Southern green sturgeon. Although the habitat requirements of these fishes differ somewhat from Southern eulachon, efforts to protect habitat generally focus on the maintenance of watershed processes that would be expected to benefit Southern eulachon. The BRT identified dams and water diversions as moderate threats to Southern eulachon in the Columbia and Klamath rivers where hydropower generation and flood control are major activities. Degraded water quality is common in some areas occupied by Southern eulachon. In the Columbia and Klamath systems, large-scale impoundment of water has increased winter water temperatures, potentially altering the water temperature during eulachon spawning periods (Gustafson *et al*. 2010). Numerous chemical contaminants are also present in spawning rivers, but the exact effect these compounds have on spawning and egg development is unknown (Gustafson *et al.* 2010). The BRT identified dredging as a low to moderate threat to Southern eulachon in the Columbia River. Dredging during eulachon spawning would be particularly detrimental because eggs could be destroyed by mechanical disturbance or smothered by in-water disposal of dredged materials. The lower Columbia River mainstem provides spawning and incubation sites, and a large migratory corridor to spawning areas in the tributaries. Prior to the construction of Bonneville Dam, Southern eulachon ascended the Columbia River as far as Hood River, Oregon. Major tributaries that support spawning runs include the Grays, Skamokawa, Elochoman, Kalama, Lewis, and Sandy rivers.

The number of Southern eulachon returning to the Umpqua River seems to have declined in the 1980s, and does not appear to have rebounded to previous levels. Additionally, Southern eulachon are regularly caught in salmonid smolt traps operated in the lower reaches of Tenmile Creek by the Oregon Dpartment of Fish and Wildlife (ODFW).

2.2.2.4 Willamette-Lower Columbia Recovery Domain

Critical habitat was designated in the WLC recovery domain for UWR spring-run Chinook salmon, LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR steelhead, CR chum salmon, Southern green sturgeon, and Southern eulachon. In addition to the Willamette and Columbia River mainstems, important tributaries on the Oregon side of the WLC include Youngs Bay, Big Creek, Clatskanie River, and Scappoose River in the Oregon Coast subbasin; Hood River in the Gorge; and the Sandy, Clackamas, Molalla, North and South Santiam, Calapooia, McKenzie, and Middle Fork Willamette rivers in the West Cascades subbasin.

Land management activities have severely degraded stream habitat conditions in the Willamette River mainstem above Willamette Falls and in associated subbasins. In the Willamette River mainstem and lower sub-basin mainstem reaches, high density urban development and widespread agricultural effects have reduced aquatic and riparian habitat quality and complexity, and altered sediment and water quality and quantity, and watershed processes. The Willamette River, once a highly braided river system, has been dramatically simplified through channelization, dredging, and other activities that have reduced rearing habitat by as much as 75%. In addition, the construction of 37 dams in the basin blocked access to more than 435 miles of stream and river spawning habitat. The dams alter the temperature regime of the Willamette River and its tributaries, affecting the timing and development of naturally-spawned eggs and fry. Logging in the Cascade and Coast Ranges, and agriculture, urbanization, and gravel mining on valley floors have contributed to increased erosion and sediment loads throughout the WLC domain.

The mainstem Willamette River has been channelized and stripped of large wood. Development began to encroach on the riparian forest beginning in the 1870s (Sedell and Froggatt 1984). Gregory *et al*. (2002a) calculated that the total mainstem Willamette River channel area decreased from 41,000 to 23,000 acres between 1895 and 1995. They noted that the lower reach, from the mouth of the river to Newberg (RM 50), is confined within a basaltic trench, and that due to this geomorphic constraint, less channel area has been lost than in upstream areas. The middle reach from Newberg to Albany (RM 50 to 120) incurred losses of 12% primary channel area, 16% side channels, 33% alcoves, and 9% islands. Even greater changes occurred in the upper reach, from Albany to Eugene (RM 187). There, approximately 40% of both channel length and channel area were lost, along with 21% of the primary channel, 41% of side channels, 74% of alcoves, and 80% of island areas.

The banks of the Willamette River have more than 96 miles of revetments; approximately half were constructed by the Corps. Generally, the revetments were placed in the vicinity of roads or on the outside bank of river bends, so that while only 26% of the total length is revetted, 65% of the meander bends are revetted (Gregory *et al*. 2002b). The majority of dynamic sections have been armored, reducing adjustments in channel bed and sediment storage by the river, and thereby diminishing both the complexity and productivity of aquatic habitats (Gregory *et al*. 2002b).

Riparian forests have diminished considerably in the lower reaches of the Willamette River (Gregory *et al*. 2002c). Sedell and Froggatt (1984) noted that agriculture and cutting of streamside trees were major agents of change for riparian vegetation, along with snagging of large wood in the channel. The reduced shoreline, fewer and smaller snags, and reduced riparian forest comprise large functional losses to the river, reducing structural features, inputs of wood and litter, shade, entrained allochthonous materials, and flood flow filtering capacity. Extensive changes began before the major dams were built, with navigational and agricultural demands dominating the early use of the river. The once expansive forests of the Willamette River floodplain provided valuable nutrients and organic matter during flood pulses, food sources for macroinvertebrates, and slow-water refugia for fish during flood events. These forests also cooled river temperatures as the river flowed through its many channels.

Gregory *et al.* (2002c) described the changes in riparian vegetation in river reaches from the mouth to Newberg, from Newberg to Albany, and from Albany to Eugene. They noted that the riparian forests were formerly a mosaic of brush, marsh, and ash tree openings maintained by annual flood inundation. Below the City of Newberg, the most noticeable change was that conifers were almost eliminated. Above Newberg, the formerly hardwood-dominated riparian forests along with mixed forest made up less than half of the riparian vegetation by 1990, while agriculture dominated. This conversion has reduced river shading and the potential for recruitment of wood to the river, reducing channel complexity and the quality of rearing, migration and spawning habitats.

Hyporheic flow in the Willamette River has been examined through discharge measurements and found to be significant in some areas, particularly those with gravel deposits (Fernald *et al*. 2001; Wentz *et al*. 1998). The loss of channel complexity and meandering that fosters creations of gravel deposits decreases the potential for hyporheic flows, as does gravel mining. Hyporheic flow processes water and affects its quality on reemerging into the main channel, stabilizing variations in physical and chemical water characteristics. Hyporheic flow is important for ecological functions, some aspects of water quality (such as temperature and dissolved oxygen), and some benthic invertebrate life stages. Alcove habitat, which has been limited by channelization, combines low hydraulic stress and high food availability with the potential for hyporheic flows across the steep hydraulic gradients in the gravel separating them from the main channel (Fernald *et al*. 2001).

On the mainstem of the Columbia River, hydropower projects, including the Federal Columbia River Hydropower System (FCRPS), have significantly degraded salmon and steelhead habitats (Bottom *et al*. 2005; Fresh *et al*. 2005; NMFS 2011d; NMFS 2013a). The series of dams and reservoirs that make up the FCRPS block an estimated 12 million cubic yards of debris and sediment that would otherwise naturally flow down the Columbia River and replenish shorelines along the Washington and Oregon coasts.

Industrial harbor and port development are also significant influences on the Lower Willamette and Lower Columbia rivers (Bottom *et al*. 2005; Fresh *et al*. 2005; NMFS 2011d; NMFS 2013a). Since 1878, 100 miles of river channel within the mainstem Columbia River, its estuary, and Oregon's Willamette River have been dredged as a navigation channel by the Corps. Originally dredged to a 20-foot minimum depth, the Federal navigation channel of the Lower Columbia River is now maintained at a depth of 43 feet and a width of 600 feet. The Lower Columbia River supports five ports on the Washington State side: Kalama, Longview, Skamania County, Woodland, and Vancouver. In addition to loss of riparian habitat, and disruption of benthic habitat due to dredging, high levels of several sediment chemicals, such as arsenic and polycyclic aromatic hydrocarbons (PAHs), have been identified in Lower Columbia River watersheds in the vicinity of the ports and associated industrial facilities.

The most extensive urban development in the Lower Columbia River subbasin has occurred in the Portland/Vancouver area. Outside of this major urban area, the majority of residences and businesses rely on septic systems. Common water quality issues with urban development and residential septic systems include higher water temperatures, lowered dissolved oxygen, increased fecal coliform bacteria, and increased chemicals associated with pesticides and urban runoff.

The Columbia River estuary has lost a significant amount of the tidal marsh and tidal swamp habitats that are critical to juvenile salmon and steelhead, particularly small or ocean-type species (Bottom *et al*. 2005; Fresh *et al*. 2005; NMFS 2011d; NMFS 2013a). Edges of marsh areas provide sheltered habitats for juvenile salmon and steelhead where food, in the form of amphipods or other small invertebrates which feed on marsh detritus, is plentiful, and larger predatory fish can be avoided. Historically, floodwaters of the Columbia River inundated the margins and floodplains along the estuary, allowing juvenile salmon and steelhead access to a wide expanse of low-velocity marshland and tidal channel habitats. In general, the riverbanks were gently sloping, with riparian and wetland vegetation at the higher elevations of the river floodplain becoming habitat for salmon and steelhead during flooding river discharges or flood tides. Sherwood *et al.* (1990) estimated that the Columbia River estuary lost 20,000 acres of tidal swamps, 10,000 acres of tidal marshes, and 3,000 acres of tidal flats between 1870 and 1970. This study further estimated an 80% reduction in emergent vegetation production and a 15% decline in benthic algal production.

Habitat and food-web changes within the estuary, and other factors affecting salmon population structure and life histories, have altered the estuary's capacity to support juvenile salmon (Bottom *et al*. 2005; Fresh *et al*. 2005; NMFS 2011d; NMFS 2013a). Diking and filling have reduced the tidal prism and eliminated emergent and forested wetlands and floodplain habitats. These changes have likely reduced the estuary's salmon-rearing capacity. Moreover, water and sediment in the Lower Columbia River and its tributaries have toxic contaminants that are harmful to aquatic resources (Johnson *et al*. 2007a, Johnson *et al*. 2007b, Lower Columbia River Estuary Partnership 2007, Spromberg and Johnson 2008, Johnson *et al*. 2010, Sloan *et al*. 2010, Yanagida *et al*. 2012, Johnson *et al*. 2013). Contaminants of concern include polycyclic aromatic hydrocarbons (PAHs), dioxins and furans, heavy metals, PCBs, and organochlorine pesticides such as DDT. Simplification of the population structure and life-history diversity of salmon possibly is yet another important factor affecting juvenile salmon viability. Restoration of estuarine habitats, particularly diked emergent and forested wetlands, reduction of avian predation by terns, and flow manipulations to restore historical flow patterns have likely begun to enhance the estuary's productive capacity for salmon, although historical changes in population structure and salmon life histories may prevent salmon from making full use of the productive capacity of estuarine habitats.

The WLC recovery domain CHART determined that most HUC_5 watersheds with PCEs for salmon or steelhead are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some or a high potential for improvement. Only watersheds in the upper McKenzie River and its tributaries are in good to excellent condition with no potential for improvement (Table 2.2-27).

Table 2.2-27. Willamette-Lower Columbia Recovery Domain: Current and potential quality of HUC_5 watersheds identified as supporting historically independent populations of ESA-listed Chinook salmon (CK), chum salmon (CM), and steelhead (ST) (NOAA Fisheries 2005).[90] Watersheds are ranked primarily by "current quality" and secondly by their "potential for restoration."

Current PCE Condition	Potential PCE Condition
3 = good to excellent	3 = highly functioning, at historical potential
2 = fair to good	2 = high potential for improvement
1 = fair to poor	1 = some potential for improvement
0 = poor	0 = little or no potential for improvement

Watershed Name(s) and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
Columbia Gorge #1707010xxx			
Wind River (511)	CK/ST	2/2	2/2
East Fork Hood (506), & Upper (404) & Lower Cispus (405) rivers	CK/ST	2/2	2/2
Plympton Creek (306)	CK	2	2
Little White Salmon River (510)	CK	2	0
Grays Creek (512) & Eagle Creek (513)	CK/CM/ST	2/1/2	1/1/2
White Salmon River (509)	CK/CM	2/1	1/2
West Fork Hood River (507)	CK/ST	1/2	2/2

[90] On January 14, 2013, NMFS published a proposed rule for the designation of critical habitat for LCR coho salmon (USDC 2013b). We finalized the critical habitat designation on February 24, 2016 (USDC 2016). We also completed a draft biological report on critical habitat (NMFS 2012a). Habitat quality assessments for LCR coho salmon are out for review; therefore, they are not included on this table.

Watershed Name(s) and HUC5 Code(s)	Listed Species	Current Quality	Restoration Potential
Columbia Gorge #1707010xxx			
Hood River (508)	CK/ST	1/1	2/2
Unoccupied habitat: Wind River (511)	Chum conservation value "Possibly High"		
Cascade and Coast Range #1708000xxx			
Lower Gorge Tributaries (107)	CK/CM/ST	2/2/2	2/3/2
Lower Lewis (206) & North Fork Toutle (504) rivers	CK/CM/ST	1/3/1	2/1/2
Salmon (101), Zigzag (102), & Upper Sandy (103) rivers	CK/ST	2/2	2/2
Big Creek (602)	CK/CM	2/2	2/2
Coweeman River (508)	CK/CM/ST	2/2/1	2/1/2
Kalama River (301)	CK/CM/ST	1/2/2	2/1/2
Cowlitz Headwaters (401)	CK/ST	2/2	1/1
Skamokawa/Elochoman (305)	CK/CM	2/1	2
Salmon Creek (109)	CK/CM/ST	1/2/1	2/3/2
Green (505) & South Fork Toutle (506) rivers	CK/CM/ST	1/1/2	2/1/2
Jackson Prairie (503) & East Willapa (507)	CK/CM/ST	1/2/1	1/1/2
Grays Bay (603)	CK/CM	1/2	2/3
Upper Middle Fork Willamette River (101)	CK	2	1
Germany/Abernathy creeks (304)	CK/CM	1/2	2
Mid-Sandy (104), Bull Run (105), & Lower Sandy (108) rivers	CK/ST	1/1	2/2
Washougal (106) & East Fork Lewis (205) rivers	CK/CM/ST	1/1/1	2/1/2
Upper Cowlitz (402) & Tilton rivers (501) & Cowlitz Valley Frontal (403)	CK/ST	1/1	2/1
Clatskanie (303) & Young rivers (601)	CK	1	2
Rifle Reservoir (502)	CK/ST	1	1
Beaver Creek (302)	CK	0	1
Unoccupied Habitat: Upper Lewis (201) & Muddy (202) rivers; Swift (203) & Yale (204) reservoirs	CK & ST Conservation Value "Possibly High"		
Willamette River #1709000xxx			
Upper (401) & South Fork (403) McKenzie rivers; Horse Creek (402); & McKenzie River/Quartz Creek (405)	CK	3	3
Lower McKenzie River (407)	CK	2	3
South Santiam River (606)	CK/ST	2/2	1/3
South Santiam River/Foster Reservoir (607)	CK/ST	2/2	1/2
North Fork of Middle Fork Willamette (106) & Blue (404) rivers	CK	2	1
Upper South Yamhill River (801)	ST	2	1
Little North Santiam River (505)	CK/ST	1/2	3/3
Upper Molalla River (905)	CK/ST	1/2	1/1
Abernethy Creek (704)	CK/ST	1/1	1/2
Luckiamute River (306) & Yamhill (807) Lower Molalla (906) rivers; Middle (504) & Lower (506) North Santiam rivers; Hamilton Creek/South Santiam River (601); Wiley Creek (608); Mill Creek/Willamette River (701); & Willamette River/Chehalem Creek	CK/ST	1	1

(703); Lower South (804) & North (806) Yamhill rivers; & Salt Creek/South Yamhill River (805)			
Hills (102) & Salmon (104) creeks; Salt Creek/Willamette River (103), Hills Creek Reservoir (105), Middle Fork Willamette/Lookout Point (107); Little Fall (108) & Fall (109) creeks; Lower Middle Fork of Willamette (110), Long Tom (301), Marys (305) & Mohawk (406) rivers	CK	1	1
Willamina Creek (802) & Mill Creek/South Yamhill River (803)	ST	1	1
Calapooia River (303); Oak (304) Crabtree (602), Thomas (603) & Rickreall (702) creeks; Abiqua (901), Butte (902) & Rock (903) creeks/Pudding River; & Senecal Creek/Mill Creek (904)	CK/ST	1/1	0/1
Row River (201), Mosby (202) & Muddy (302) creeks, Upper (203) & Lower (205) Coast Fork Willamette River	CK	1	0
Unoccupied habitat in North Santiam (501) & North Fork Breitenbush (502) rivers; Quartzville Creek (604) and Middle Santiam River (605)	CK & ST Conservation Value "Possibly High"		
Unoccupied habitat in Detroit Reservoir/Blowout Divide Creek (503)	Conservation Value: CK "Possibly Medium"; ST Possibly High"		
Lower Willamette #1709001xxx			
Collawash (101), Upper Clackamas (102), & Oak Grove Fork (103) Clackamas rivers	CK/ST	2/2	3/2
Middle Clackamas River (104)	CK/ST	2/1	3/2
Eagle Creek (105)	CK/ST	2/2	1/2
Gales Creek (002)	ST	2	1
Lower Clackamas River (106) & Scappoose Creek (202)	CK/ST	1	2
Dairy (001) & Scoggins (003) creeks; Rock Creek/Tualatin River (004); & Tualatin River (005)	ST	1	1
Johnson Creek (201)	CK/ST	0/1	2/2
Lower Willamette/Columbia Slough (203)	CK/ST	0	2

2.2.2.5 Interior Columbia Recovery Domain

Critical habitat has been designated in the IC recovery domain, which includes the Snake River Basin, for SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, UCR spring-run Chinook salmon, SR sockeye salmon, MCR steelhead, UCR steelhead, and SRB steelhead. Major tributaries in the Oregon portion of the IC recovery domain include the Deschutes, John Day, Umatilla, Walla Walla, Grande Ronde, and Imnaha rivers.

Habitat quality in tributary streams in the IC recovery domain varies from excellent in wilderness and roadless areas to poor in areas subject to heavy agricultural and urban development (NMFS 2009c; Wissmar *et al*. 1994). Critical habitat throughout much of the IC recovery domain has been degraded by intense agriculture, alteration of stream morphology (*i.e*., channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, livestock grazing, dredging, road construction and maintenance, logging, mining, and urbanization. Reduced summer stream flows, impaired water quality, and reduction of habitat complexity are common problems for critical habitat in developed areas.

Migratory habitat quality in this area has been severely affected by the development and operation of the FCRPS dams and reservoirs in the mainstem Columbia River, Bureau of Reclamation tributary projects, and privately owned dams in the Snake and Upper Columbia river basins. For example, construction of Hells Canyon Dam eliminated access to several likely production areas in Oregon and Idaho, including the Burnt, Powder, Weiser, Payette, Malheur, Owyhee, and Boise river basins (Good *et al*. 2005), and Grand Coulee and Chief Joseph dams completely block anadromous fish passage on the upper mainstem Columbia River. Hydroelectric development modified natural flow regimes, resulting in higher water temperatures, changes in fish community structure leading to increased rates of piscivorous and avian predation on juvenile salmon and steelhead, and delayed migration for both adult and juveniles. Physical features of dams such as turbines also kill migrating fish. In-river survival is inversely related to the number of hydropower projects encountered by emigrating juveniles.

Similarly, development and operation of extensive irrigation systems and dams for water withdrawal and storage in tributaries have altered hydrological cycles. A series of large regulating dams on the middle and upper Deschutes River affect flow and block access to upstream habitat, and have extirpated one or more populations from the Cascades Eastern Slope major population group (IC-TRT 2003). Similarly, operation and maintenance of large water reclamation systems such as the Umatilla Basin and Yakima Projects have significantly reduced flows and degraded water quality and physical habitat in this domain.

Many stream reaches designated as critical habitat in the IC recovery domain are over-allocated under state water law, with more allocated water rights than existing streamflow. Withdrawal of water, particularly during low-flow periods that commonly overlap with agricultural withdrawals, often increases summer stream temperatures, blocks fish migration, strands fish, and alters sediment transport (Spence *et al*. 1996). Reduced tributary stream flow has been identified as a major limiting factor for all listed salmon and steelhead species in this recovery domain except SR fall-run Chinook salmon and SR sockeye salmon (NOAA Fisheries 2011).

Many stream reaches designated as critical habitat are listed on the state of Oregon's Clean Water Act section 303(d) list for water temperature. Many areas that were historically suitable rearing and spawning habitat are now unsuitable due to high summer stream temperatures. Removal of riparian vegetation, alteration of natural stream morphology, and withdrawal of water for agricultural or municipal use all contribute to elevated stream temperatures. Contaminants such as insecticides and herbicides from agricultural runoff and heavy metals from mine waste are common in some areas of critical habitat.

The IC recovery domain is a very large and diverse area. The CHART determined that few watersheds with PCEs for Chinook salmon or steelhead are in good to excellent condition with no potential for improvement. Overall, most IC recovery domain watersheds are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some or high potential for improvement. In Washington, the Upper Methow, Lost, White, and Chiwawa watersheds are in good-to-excellent condition with no potential for improvement. In Oregon, only the Lower Deschutes, Minam, Wenaha, and Upper and Lower Imnaha Rivers HUC_5 watersheds are in good-to-excellent condition with no potential for improvement. In Idaho, a number of watersheds with PCEs for steelhead (Upper Middle Salmon, Upper Salmon/Pahsimeroi, Middle Fork

Salmon, Little Salmon, Selway, and Lochsa rivers) are in good-to-excellent condition with no potential for improvement. Additionally, several Lower Snake River watersheds in the Hells Canyon area, straddling Oregon and Idaho, are in good-to-excellent condition with no potential for improvement (Table 2.2-28).

Table 2.2-28. Interior Columbia Recovery Domain: Current and potential quality of HUC_5 watersheds identified as supporting historically independent populations of ESA-listed Chinook salmon (CK) and steelhead (ST) (NOAA Fisheries 2005). Watersheds are ranked primarily by "current quality" and secondly by their "potential for restoration."

Current PCE Condition	Potential PCE Condition
3 = good to excellent	3 = highly functioning, at historical potential
2 = fair to good	2 = high potential for improvement
1 = fair to poor	1 = some potential for improvement
0 = poor	0 = little or no potential for improvement

Watershed Name and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
Upper Columbia # 1702000xxx			
White (101), Chiwawa (102), Lost (801) & Upper Methow (802) rivers	CK/ST	3	3
Upper Chewuch (803) & Twisp rivers (805)	CK/ST	3	2
Lower Chewuch River (804); Middle (806) & Lower (807) Methow rivers	CK/ST	2	2
Salmon Creek (603) & Okanogan River/Omak Creek (604)	ST	2	2
Upper Columbia/Swamp Creek (505)	CK/ST	2	1
Foster Creek (503) & Jordan/Tumwater (504)	CK/ST	1	1
Upper (601) & Lower (602) Okanogan River; Okanogan River/Bonaparte Creek (605); Lower Similkameen River (704); & Lower Lake Chelan (903)	ST	1	1
Unoccupied habitat in Sinlahekin Creek (703)	ST Conservation Value "Possibly High"		
Upper Columbia #1702001xxx			
Entiat River (001); Nason/Tumwater (103); & Lower Wenatchee River (105)	CK/ST	2	2
Lake Entiat (002)	CK/ST	2	1
Columbia River/Lynch Coulee (003); Sand Hollow (004); Yakima/Hansen Creek (604), Middle Columbia/Priest Rapids (605), & Columbia River/Zintel Canyon (606)	ST	2	1
Icicle/Chumstick (104)	CK/ST	1	2
Lower Crab Creek (509)	ST	1	2
Rattlesnake Creek (204)	ST	0	1

Watershed Name and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
Yakima #1703000xxx			
Upper (101) & Middle (102) Yakima rivers; Teanaway (103) & Little Naches (201) rivers; Naches River/Rattlesnake Creek (202); & Ahtanum (301) & Upper Toppenish (303) & Satus (305) creeks	ST	2	2
Umtanum/Wenas (104); Naches River/Tieton River (203); Upper Lower Yakima River (302); & Lower Toppenish Creek (304)	ST	1	2
Yakima River/Spring Creek (306)	ST	1	1
Lower Snake River #1706010xxx			
Snake River/Granite (101), Getta (102), & Divide (104) creeks; Upper (201) & Lower (205) Imnaha River; Snake River/Rogersburg (301); Minam (505) & Wenaha (603) rivers	ST	3	3
Grande Ronde River/Rondowa (601)	ST	3	2
Big (203) & Little (204) Sheep creeks; Asotin River (302); Catherine Creek (405); Lostine River (502); Bear Creek (504); & Upper (706) & Lower (707) Tucannon River	ST	2	3
Middle Imnaha River (202); Snake River/Captain John Creek (303); Upper Grande Ronde River (401); Meadow (402); Beaver (403); Indian (409), Lookingglass (410) & Cabin (411) creeks; Lower Wallowa River (506); Mud (602), Chesnimnus (604) & Upper Joseph (605) creeks	ST	2	2
Ladd Creek (406); Phillips/Willow Creek (408); Upper (501) & Middle (503) Wallowa rivers; & Lower Grande Ronde River/Menatche Creek (607)	ST	1	3
Five Points (404); Lower Joseph (606) & Deadman (703) creeks	ST	1	2
Tucannon/Alpowa Creek (701)	ST	1	1
Mill Creek (407)	ST	0	3
Pataha Creek (705)	ST	0	2
Snake River/Steptoe Canyon (702) & Penawawa Creek (708)	ST	0	1
Flat Creek (704) & Lower Palouse River (808)	ST	0	0
Upper Salmon and Pahsimeroi #1706020xxx			
Germania (111) & Warm Springs (114) creeks; Lower Pahsimeroi River (201); Alturas Lake (120), Redfish Lake (121), Upper Valley (123) & West Fork Yankee (126) creeks	ST	3	3
Basin Creek (124)	ST	3	2
Salmon River/Challis (101); East Fork Salmon River/McDonald Creek (105); Herd Creek (108); Upper East Fork Salmon River (110); Salmon River/Big Casino (115), Fisher (117) & Fourth of July (118) creeks; Upper Salmon River (119); Valley Creek/Iron Creek (122); & Morgan Creek (132)	ST	2	3
Salmon River/Bayhorse Creek (104); Salmon River/Slate Creek (113); Upper Yankee Fork (127) & Squaw Creek (128); Pahsimeroi River/Falls Creek (202)	ST	2	2
Yankee Fork/Jordan Creek (125)	ST	1	3
Salmon River/Kinnikinnick Creek (112); Garden Creek (129); Challis Creek/Mill Creek (130); & Patterson Creek (203)	ST	1	2

Watershed Name and HUC5 Code(s)	Listed Species	Current Quality	Restoration Potential
Road Creek (107)	ST	1	1
Unoccupied habitat in Hawley (410), Eighteenmile (411) & Big Timber (413) creeks	Conservation Value for ST "Possibly High"		
Middle Salmon, Panther and Lemhi #1706020xxx			
Salmon River/Colson (301), Pine (303) & Moose (305) creeks; Indian (304) & Carmen (308) creeks, North Fork Salmon River (306); & Texas Creek (412)	ST	3	3
Deep Creek (318)	ST	3	2
Salmon River/Cow Creek (312) & Hat (313), Iron (314), Upper Panther (315), Moyer (316) & Woodtick (317) creeks; Lemhi River/Whimpey Creek (402); Hayden (414), Big Eight Mile (408), & Canyon (408) creeks	ST	2	3
Salmon River/Tower (307) & Twelvemile (311) creeks; Lemhi River/Kenney Creek (403); Lemhi River/McDevitt (405), Lemhi River/Yearian Creek (406); & Peterson Creek (407)	ST	2	2
Owl (302) & Napias (319) creeks	ST	2	1
Salmon River/Jesse Creek (309); Panther Creek/Trail Creek (322); & Lemhi River/Bohannon Creek (401)	ST	1	3
Salmon River/Williams Creek (310)	ST	1	2
Agency Creek (404)	ST	1	1
Panther Creek/Spring Creek (320) & Clear Creek (323)	ST	0	3
Big Deer Creek (321)	ST	0	1
Mid-Salmon-Chamberlain, South Fork, Lower, and Middle Fork Salmon #1706020xxx			
Lower (501), Upper (503) & Little (504) Loon creeks; Warm Springs (502); Rapid River (505); Middle Fork Salmon River/Soldier (507) & Lower Marble Creek (513); & Sulphur (509), Pistol (510), Indian (511) & Upper Marble (512) creeks; Lower Middle Fork Salmon River (601); Wilson (602), Upper Camas (604), Rush (610), Monumental (611), Beaver (614), Big Ramey (615) & Lower Big (617) creeks; Middle Fork Salmon River/Brush (603) & Sheep (609) creeks; Big Creek/Little Marble (612); Crooked (616), Sheep (704), Bargamin (709), Sabe (711), Horse (714), Cottonwood (716) & Upper Chamberlain Creek (718); Salmon River/Hot Springs (712); Salmon River/Kitchen Creek (715); Lower Chamberlain/McCalla Creek (717); & Slate Creek (911)	ST	3	3
Marsh (506); Bear Valley (508) Yellow Jacket (604); West Fork Camas (607) & Lower Camas (608) creeks; & Salmon River/Disappointment Creek (713) & White Bird Creek (908)	ST	2	3

Upper Big Creek (613); Salmon River/Fall (701), California (703), Trout (708), Crooked (705) & Warren (719) creeks; Lower South Fork Salmon River (801); South Fork Salmon River/Cabin (809), Blackmare (810) & Fitsum (812) creeks; Lower Johnson Creek (805); & Lower (813), Middle (814) & Upper Secesh (815) rivers; Salmon River/China (901), Cottonwood (904), McKenzie (909), John Day (912) & Lake (913) creeks; Eagle (902), Deer (903), Skookumchuck (910), French (915) & Partridge (916) creeks	ST	2	2
Watershed Name and HUC$_5$ Code(s)	**Listed Species**	**Current Quality**	**Restoration Potential**
Wind River (702), Salmon River/Rabbit (706) & Rattlesnake (710) creeks; & Big Mallard Creek (707); Burnt Log (806), Upper Johnson (807) & Buckhorn (811) creeks; Salmon River/Deep (905), Hammer (907) & Van (914) creeks	ST	2	1
Silver Creek (605)	ST	1	3
Lower (803) & Upper (804) East Fork South Fork Salmon River; Rock (906) & Rice (917) creeks	ST	1	2
Little Salmon #176021xxx			
Rapid River (005)	ST	3	3
Hazard Creek (003	ST	3	2
Boulder Creek (004)	ST	2	3
Lower Little Salmon River (001) & Little Salmon River/Hard Creek (002)	ST	2	2
Selway, Lochsa and Clearwater #1706030xxx			
Selway River/Pettibone (101) & Gardner (103) creeks; Bear (102), White Cap (104), Indian (105), Burnt Knob (107), Running (108) & Goat (109) creeks; & Upper Selway River (106); Gedney (202), Upper Three Links (204), Rhoda (205), North Fork Moose (207), Upper East Fork Moose (209) & Martin (210) creeks; Upper (211), Middle (212) & Lower Meadow (213) creeks; Selway River/Three Links Creek (203); & East Fork Moose Creek/Trout Creek (208); Fish (302), Storm (309), Warm Springs (311), Fish Lake (312), Boulder (313) & Old Man (314) creeks; Lochsa River/Stanley (303) & Squaw (304) creeks; Lower Crooked (305), Upper Crooked (306) & Brushy (307) forks; Lower (308), Upper (310) White Sands, Ten Mile (509) & John's (510) creeks	ST	3	3
Selway River/Goddard Creek (201); O'Hara Creek (214) Newsome (505) creeks; American (506), Red (507) & Crooked (508) rivers	ST	2	3
Lower Lochsa River (301); Middle Fork Clearwater River/Maggie Creek (401); South Fork Clearwater River/Meadow (502) & Leggett creeks; Mill (511), Big Bear (604), Upper Big Bear (605), Musselshell (617), Eldorado (619) & Mission (629) creeks, Potlatch River/Pine Creek (606); & Upper Potlatch River (607); Lower (615), Middle (616) & Upper (618) Lolo creeks	ST	2	2
South Fork Clearwater River/Peasley Creek (502)	ST	2	1
Upper Orofino Creek (613)	ST	2	0
Clear Creek (402)	ST	1	3

Three Mile (512), Cottonwood (513), Big Canyon (610), Little Canyon (611) & Jim Ford (614) creeks; Potlatch River/Middle Potlatch Creek (603); Clearwater River/Bedrock (608), Jack's (609) Lower Lawyer (623), Middle Lawyer (624), Cottonwood (627) & Upper Lapwai (628) creeks; & Upper (630) & Lower (631) Sweetwater creeks	ST	1	2
Lower Clearwater River (601) & Clearwater River/Lower Potlatch River (602), Fivemile Creek (620), Sixmile Creek (621) and Tom Taha (622) creeks	ST	1	1
Mid-Columbia #1707010xxx			
Wood Gulch (112); Rock Creek (113); Upper Walla Walla (201), Upper Touchet (203), & Upper Umatilla (301) rivers; Meacham (302) & Birch (306) creeks; Upper (601) & Middle (602) Klickitat River	ST	2	2
Glade (105) & Mill (202) creeks; Lower Klickitat River (604); Mosier Creek (505); White Salmon River (509); Middle Columbia/Grays Creek (512)	ST	2	1
Little White Salmon River (510)	ST	2	0
Middle Touchet River (204); McKay Creek (305); Little Klickitat River (603);Fifteenmile (502) & Fivemile (503) creeks	ST	1	2
Alder (110) & Pine (111) creeks; Lower Touchet River (207), Cottonwood (208), Pine (209) & Dry (210) creeks; Lower Walla Walla River (211); Umatilla River/Mission Creek (303) Wildhorse Creek (304); Umatilla River/Alkali Canyon (307); Lower Butter Creek (310); Upper Middle Columbia/Hood (501); Middle Columbia/Mill Creek (504)	ST	1	1
Stage Gulch (308) & Lower Umatilla River (313)	ST	0	1
John Day #170702xxx			
Middle (103) & Lower (105) South Fork John Day rivers; Murderers (104) & Canyon (107) creeks; Upper John Day (106) & Upper North Fork John Day (201) rivers; & Desolation Creek (204)	ST	2	2
North Fork John Day/Big Creek (203); Cottonwood Creek (209) & Lower NF John Day River (210)	ST	2	1
Strawberry (108), Beech (109), Laycock (110), Fields (111), Mountain (113) & Rock (114) creeks; Upper Middle John Day River (112); Granite (202) & Wall (208) creeks; Upper (205) & Lower (206) Camas creeks; North Fork John Day/Potamus Creek (207); Upper Middle Fork John Day River (301) & Camp (302), Big (303) & Long (304) creeks; Bridge (403) & Upper Rock (411) creeks; & Pine Hollow (407)	ST	1	2
John Day/Johnson Creek (115); Lower Middle Fork John Day River (305); Lower John Day River/Kahler Creek (401), Service (402) & Muddy (404) creeks; Lower John Day River/Clarno (405); Butte (406), Thirtymile (408) & Lower Rock (412) creeks; Lower John Day River/Ferry (409) & Scott (410) canyons; & Lower John Day River/McDonald Ferry (414)	ST	1	1
Deschutes #1707030xxx			
Lower Deschutes River (612)	ST	3	3
Middle Deschutes River (607)	ST	3	2

Upper Deschutes River (603)	ST	2	1
Mill Creek (605) & Warm Springs River (606)	ST	2	1
Bakeoven (608) & Buck Hollow (611) creeks; Upper (701) & Lower (705) Trout Creek	ST	1	2
Beaver (605) & Antelope (702) creeks	ST	1	1
White River (610) & Mud Springs Creek (704)	ST	1	0
Unoccupied habitat in Deschutes River/McKenzie Canyon (107) & Haystack (311); Squaw Creek (108); Lower Metolius River (110), Headwaters Deschutes River (601)	ST Conservation Value "Possibly High"		

2.2.2.6 Oregon Coast Recovery Domain

In this recovery domain, critical habitat has been designated for OC coho salmon, Southern green sturgeon, and Southern eulachon. Many large and small rivers supporting significant populations of coho salmon flow through this domain, including the Nehalem, Nestucca, Siletz, Yaquina, Alsea, Siuslaw, Umpqua, Coos, and Coquille.

The historical disturbance regime in the central Oregon Coast Range was dominated by a mixture of high and low-severity fires, with a natural rotation of approximately 271 years. Old-growth forest coverage in the Oregon Coast Range varied from 25 to 75% during the past 3,000 years, with a mean of 47%, and never fell below 5% (Wimberly *et al*. 2000). Currently, the Coast Range has approximately 5% old-growth, almost all of it on Federal lands. The dominant disturbance now is logging on a cycle of approximately 30 to 100 years, with fires suppressed.

Oregon's assessment of OC coho salmon (Nicholas *et al*. 2005) mapped how streams with high intrinsic potential for rearing are distributed by land ownership categories. Agricultural lands and private industrial forests have by far the highest percentage of land ownership in high intrinsic potential areas and along all coho salmon stream miles. Federal lands have only about 20% of coho salmon stream miles and 10% of high intrinsic potential stream reaches. Because of this distribution, activities in lowland areas are particularly important to the conservation of OC coho salmon.

> Projections of future land use and land cover in Oregon's coastal mountains show increasing rural residential and urban development within 328 foot (100 m) buffers surrounding high quality coho and steelhead habitat, with more rapid development projected for coho habitat (Burnett *et al*. 2007). [as cited in Stout *et al*. 2012, p. 96]

The OC coho salmon assessment concluded that at the scale of the entire domain, pools are generally abundant, although slow-water and off-channel habitat (which are important refugia for coho salmon during high winter flows) are limited in the majority of streams when compared to reference streams in minimally-disturbed areas. Amounts of large wood in streams are low in all four ODFW monitoring areas and land-use types relative to reference conditions. Amounts of fine sediment are high in three of the four monitoring areas, and were comparable to reference conditions only on public lands. Approximately 62 to 91% of tidal wetland acres (depending on estimation procedures) have been lost for functionally and potentially independent populations of coho salmon. Approximately 43,672 acres of estuary wetlands have been converted to other uses, of which freshwater wetlands and salt marshes comprise the majority of habitat type lost (Stout *et al*. 2012, p. 102). Wetland loss continues to occur. While wetland restoration activities have made gains in some locations, the ability of restoration to keep pace with loss is uncertain.

As part of the coastal coho salmon assessment, the Oregon Department of Environmental Quality analyzed the status and trends of water quality in the range of OC coho salmon using the Oregon water quality index, which is based on a combination of temperature, dissolved oxygen, biological oxygen demand, pH, total solids, nitrogen, total phosphates, and bacteria. Using the index at the species scale, 42% of monitored sites had excellent to good water quality, and 29% show poor to very poor water quality. Within the four monitoring areas, the North Coast had the best overall conditions (six sites in excellent or good condition out of nine sites), and the Mid-South coast had the poorest conditions (no excellent condition sites, and two out of eight sites in good condition). For the 10-year period monitored between 1992 and 2002, no sites showed a declining trend in water quality. The area with the most improving trends was the North Coast, where 66% of the sites (six out of nine) had a significant improvement in index scores. The Umpqua River basin, with one out of nine sites (11%) showing an improving trend, had the lowest number of improving sites.

2.2.2.7 Southern Oregon/Northern California Coasts Recovery Domain

In this recovery domain critical habitat has been designated for SONCC coho salmon, Southern green sturgeon, and Southern eulachon. Many large and small rivers supporting significant populations of coho salmon flow through this area, including the Elk, Rogue, Chetco, Smith and Klamath. The following summary of critical habitat information in the Elk, Rogue, and Chetco rivers is also applicable to habitat characteristics and limiting factors in other basins in this area.

The Elk River flows through Curry County, and drains approximately 92 square miles (or 58,678 acres) (Maguire 2001). Historical logging, mining, and road building have degraded stream and riparian habitats in the Elk River basin. Limiting factors identified for salmon and steelhead production in this basin include sparse riparian cover, especially in the lower reaches, excessive fine sediment, high water temperatures, and noxious weed invasions (Maguire 2001).

The Rogue River drains approximately 5,160 square miles within Curry, Jackson, and Josephine counties in southwest Oregon. The mainstem is about 200 miles long and traverses the coastal mountain range into the Cascades. The Rogue River estuary has been modified from its historical condition. Jetties were built by the Corps in 1960, which stabilized and deepened the mouth of the river. A dike that extends from the south shore near Highway 101 to the south jetty was completed in 1973. This dike created a backwater for the large shallow area that existed here, which has been developed into a boat basin and marina, eliminating most of the tidal marsh. The quantity of estuary habitat is naturally limited in the Rogue River. The Rogue River has a drainage area of 5,160 square miles, but the estuary at 1,880 acres is one of the smallest in Oregon. Between 1960 and 1972, approximately 13 acres of intertidal and 14 acres of subtidal land were filled in to build the boat basin dike, the marina, north shore riprap, and the other north shore developments (Hicks 2005). Jetties constructed in 1960 to stabilize the mouth of the river and prevent shoaling have altered the Rogue River, which historically formed a sill during summer months (Hicks 2005).

The Lower Rogue Watershed Council's watershed analysis (Hicks 2005) lists factors limiting fish production in tributaries to the Lower Rogue River watershed. The list includes water temperatures, low stream flows, riparian forest conditions, fish passage and over-wintering habitat. Limiting factors identified for the Upper Rogue River basin include fish passage barriers, high water temperatures, insufficient water quantity, lack of large wood, low habitat complexity, and excessive fine sediment (Rogue Basin Coordinating Council 2006).

The Chetco River estuary has been significantly modified from its historical condition. Jetties were erected by the Corps in 1957, which stabilized and deepened the mouth of the river. These jetties have greatly altered the mouth of the Chetco River and how the estuary functions as habitat for salmon migrating to the ocean. A boat basin and marina were built in the late 1950s and eliminated most of the functional tidal marsh. The structures eliminated shallow water habitats and vegetation in favor of banks stabilized with riprap. Since then, nearly all remaining bank habitat in the estuary has been stabilized with riprap. The factors limiting fish production in the Chetco River appear to be high water temperature caused by lack of shade, especially in tributaries, high rates of sedimentation due to roads, poor over-wintering habitat due to a lack of large wood in tributaries and the mainstem, and poor quality estuary habitat (Maguire 2001).

2.2.2.8 Marine Domain

Southern Resident Killer Whale Critical Habitat. The action area for the implementation of the NFIP in Oregon does not include that area designated as critical habitat for SRKWs.

2.3 Environmental Baseline

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

2.3.1 Baseline for Anadromous Fishes

As described above in the Status of the Species and Critical Habitat sections, factors that limit the recovery of anadromous species considered in this opinion vary with the overall condition of aquatic habitats on private, state, and Federal lands. Within the action area, many stream and riparian areas have been degraded by the effects of land and water use, including urbanization, road construction, forest management, agriculture, mining, transportation, and water development. Some streams have suffered little disturbance and maintain good habitat quality but are subject to the risk of new development in the floodplain. Other streams with high habitat quality are on Federal lands and are not subject to industrial, commercial, or residential development.

Development activities have contributed to a myriad of interrelated factors causing the decline of species considered in this opinion. Among the most important of these are changes in stream channel morphology; reduced instream roughness and cover; loss and degradation of off-channel areas, refugia, estuarine rearing habitats, riparian areas, spawning areas, and wetlands; degradation of water quality (*e.g.*, temperature, sediment, dissolved oxygen, contaminants); and blocked fish passage.

Anadromous fish species have been greatly affected by land conversion due to urban and agricultural development. Dikes and levees constructed to protect infrastructure and agriculture have isolated floodplains from their river channels and restricted fish access. Development (*e.g.*, urbanization, roads, agriculture) and their associated actions (*e.g.*, shipping, dredging, roads, water withdrawals) have reduced and degraded anadromous fish habitat in numerous ways:

- filling floodplains and wetlands,[91]
- straightening and armoring rivers,
- reducing available in- and off-channel habitat,
- simplifying remaining habitat,
- restricting lateral channel movement,
- accelerating flow velocities,
- increasing erosion,
- decreasing cover,
- reducing prey sources,
- modifying stormwater runoff pathways,
- reducing groundwater infiltration,
- modifying subsurface flows,
- increasing flood elevations,
- contributing contaminants,
- increasing water temperatures,
- degrading water quality,
- reducing water quantity,
- removing riparian vegetation,
- modifying floodplain forest development, and
- reducing quantity and quality of in-channel shade and wood.

The existing transportation system contributes to a poor environmental baseline condition in several ways. Many miles of roads and rail lines parallel streams, which has degraded stream bank conditions by encouraging bank armoring with rip rap, degraded floodplain connectivity by adding fill to floodplains, and discharge of untreated or marginally treated stormwater runoff to streams. Culvert and bridge stream crossings have similar effects and create additional problems for fish when they act as physical or hydraulic barriers that prevent fish access to spawning or

[91] FEMA does not have data on the amount or area of floodplain fill added since implementation of the NFIP. Therefore, it is difficult to know directly what change in floodplain size and flood storage capacity has occurred under the program.

rearing habitat, or contribute to adverse stream morphological changes upstream and downstream of the crossing itself.

In the interior Columbia River basin, floodplain conversion to urban and agricultural land use has occurred in nearly half of all floodplain areas (Fullerton *et al*. 2006, as cited in Hall *et al*. 2007, p. 793), predominately by leveeing and channel filling. In the Columbia River estuary, approximately 24,000 acres of estuarine habitat was converted to developed floodplain between 1870 and 1983 (Thomas 1983, as cited in Fresh *et al*. 2005, p. 48). In the Willamette Valley, the Willamette River between Eugene and Albany lost 45% of its primary channel length, between 10,000 and 17,000 acres of river channel and island habitat, and more than half of all small floodplain tributaries and alcoves between 1850 and 1995 (Gregory *et al*. 2002a, p. 21). In the Tillamook Bay lowlands, at least 6,000 acres had been converted by 1950 (Coulton *et al*. 1996, p. 18). In Coos Bay, an estimated 80% of tidal wetlands and 90% of salt marshes have been lost since the 1850s predominately due to filling for development and hydrologic alterations to constrain tidal fluctuation (Coos Watershed Association 2010, p. 3).

In addition to habitat loss, development has modified fluvial processes like channel migration, which has ecological consequences. “The natural ecological functioning of rivers is related to hydromorphological complexity through provision of habitat,” and “most natural benefits increase with physical complexity, peaking in streams featuring network channels (*i.e*., with anabranching or anastromosing network planforms)” (Cluer and Thorne 2013, *internal citations omitted*). Dykaar and Wigington, Jr. (2000, p. 101) note that human impacts in the Willamette River floodplain are limiting riparian forest renewal by disrupting the fluvial geomorphic regime and have modified the Willamette River from a multichannel river to a more single-channel configuration. Consequently, cottonwood regeneration is occurring at a fraction of historic levels, and is insufficient to replace existing mature stands. The loss of mature riparian forest will result in a reduction in riparian functions and aquatic habitat quality due to decreases in habitat complexity (*e.g*., overhang banks, large wood), bank stability (*i.e*., increased erosion), shading (*i.e*., increased temperature), and prey sources.

Dam development and operations have also affected anadromous fish. Dams without adequate fish passage systems have extirpated anadromous fish from their pre-development spawning and rearing habitats. For example, impassable dams in the Upper Willamette River Basin prevent UWR Chinook salmon access to more than 209 miles of historic habitat (NMFS 2008d, p. 7-5). Dams and reservoirs, within the currently accessible migratory corridor, have greatly altered the river environment and have affected fish passage. The operation of water storage projects has altered the natural hydrograph of many rivers modifying the frequency, timing, and magnitude of flood flows. Water impoundment and dam operations also affect downstream water quality characteristics, vital components to anadromous fish survival. Within the habitat currently accessible by species considered in this opinion, dams have negatively affected spawning and rearing habitat. Floodplains have been reduced, off-channel habitat features have been eliminated or disconnected from the main channel, and the amount of large woody debris in the mainstem has been greatly reduced. Remaining habitats often are affected by flow fluctuations associated with reservoir water management for power peaking, flood control, and other operations.

The development of hydropower and water storage projects within the Columbia River basin has resulted in the inundation of many mainstem spawning and shallow-water rearing areas (loss of spawning gravels and access to spawning and rearing areas); altered water quality (reduced spring turbidity levels), water quantity (seasonal changes in flows and consumptive losses resulting from use of stored water for agricultural, industrial, or municipal purposes), water temperature (including generally warmer minimum winter temperatures and cooler maximum summer temperatures), water velocity (reduced spring flows and increased cross-sectional areas of the river channel), food (alteration of food webs, including the type and availability of prey species), and safe passage (increased mortality rates of migrating juveniles) (Ferguson *et al*. 2005; Williams *et al*. 2005).

Anadromous fish species considered in this opinion are exposed to high rates of natural predation during all life stages. Fish, birds, and marine mammals, including harbor seals, sea lions, and killer whales all prey on juvenile and adult salmon. The Columbia River Basin has a diverse assemblage of native and introduced fish species, some of which prey on salmon, steelhead, green sturgeon, or eulachon. The primary resident fish predators of salmonids in many areas of the State of Oregon inhabited by anadromous salmon are northern pikeminnow (native), smallmouth bass (introduced), and walleye (introduced). Other predatory resident fish include channel catfish (introduced), Pacific lamprey (native), yellow perch (introduced), largemouth bass (introduced), and bull trout (native).

Avian predation is another factor limiting salmonid recovery in the Columbia River Basin. Throughout the basin, piscivorous birds congregate near hydroelectric dams and in the estuary near man-made islands and structures. Avian predation has been exacerbated by environmental changes associated with river developments. Water clarity caused by suspended sediments settling in impoundments increases the vulnerability of migrating smolts. Delay in project reservoirs, particularly immediately upstream from the dams, increases smolt exposure to avian predators, and juvenile bypass systems concentrate smolts, creating potential feeding stations for birds. Dredge spoil islands, associated with maintaining the Columbia River navigation channel, provide habitat for nesting Caspian terns and other piscivorous birds. Caspian terns, double-crested cormorants, glaucous-winged/western gull hybrids, California gulls, and ring-billed gulls are the principal avian predators in the basin.

In recent years, restoration actions have worked to improve fish passage and habitat degraded by past abuses and to ameliorate the effects of continued development. Floodplain connectivity is being restored through channel reconstruction and dike (and levee) breaching. Tidegates are being modified to provide fish access to isolated tributaries and off-channel areas. Riverbanks are being pulled back and revegetated to increase channel complexity and restore riparian functions. Fish passage is being restored through improvements to existing fish passage facilities or through dam removal (*e.g*., Marmot Dam on the Sandy River and Powerdale Dam on the Hood River). Flows are being released from dams to emulate natural seasonal flow patterns, facilitate downstream fish migration, and maintain channel morphology and ecological processes. Improved water withdrawal methods are being used to reduce fish mortality. Water conservation is occurring, which allows more water to remain in the channel. Gravel mining operations are moving out of channels and functional floodplains.

In Oregon, developed land use (*i.e.*, rural residential and urban) continues to increase (Figure 2.3-1). Between 1974 and 2009, developed land use accounted for 73% the land use change (Lettman *et al*. 2011, p. 11). Rural residential and urban land use increased 58 and 53%, respectively (Lettman *et al*. 2011, p. 12). The change resulted predominately from the conversion of resource land use (*i.e.*, forest, range, and agricultural) to developed use. In rural residential areas the average number of structures per square mile increased from 61.3 to 106.6 structures (Lettman *et al*. 2011, p. 29). With the exception of the Bend area, western Oregon has been developed faster than eastern Oregon.[92]

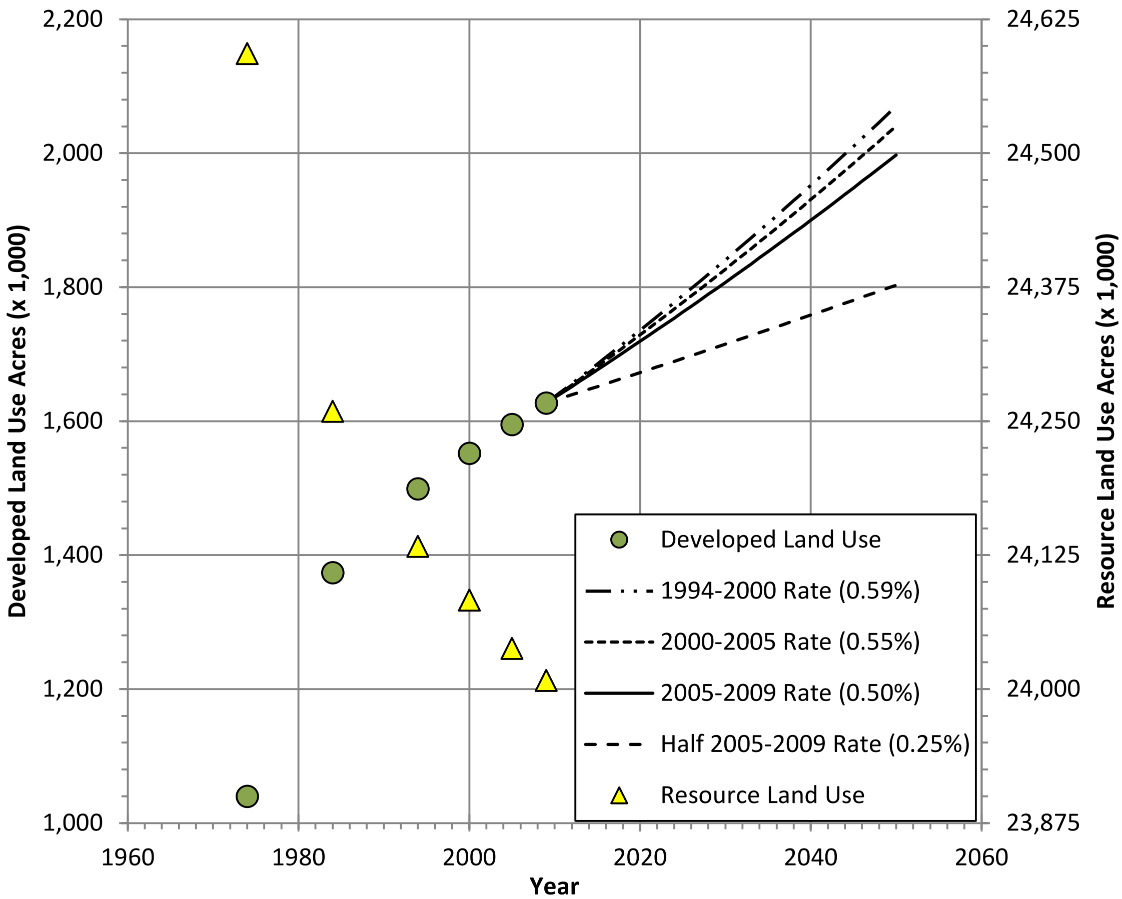

Figure 2.3-1. Developed and resource land use acreages in Oregon from 1973-2010 (Table 1 in Lettman *et al*. 2011), and projected future change in developed use based on select past rates of change.

Development rates, and land use conversion, declined following Oregon's implementation of land use planning (after 1984) and during the recent recession. Since 1974, the developed use acreage has increased by 587,000 acres to 1,627,000 acres (Table 1 in Lettman *et al*. 2011). The

[92] Lettman *et al*. (2011) included central Oregon as part of the area categorized as eastern Oregon (see Figure 3 on p. 8 of Lettman *et al*. 2011).

majority of the acreage increase occurred during the 1974 to 1984 period (57%). However, during the most recent period from 2000 to 2009, the developed use acreage has continued to increase (75,000 acres), albeit at a slower rate than before the implementation of land use planning. Based on data from Lettman *et al*. (2011), the average annual rate of change in acreage from 1974 to 1984 was 3.2%. However, the average annual rate of change has gradually declined since 1984 to a current rate of 0.5% (2005 to 2009).
Developable zones currently in resource uses (*e.g.*, forest, range, agriculture) are likely to be converted to more developed land uses in the future (Lettman *et al*. 2011). If the current annual rate of change is maintained (0.5%), an additional 370,000 acres of land will be in developed use by 2050, or approximately 9,025 acres per year (Figure 2.3-1). If the rate declined to half of the current rate (0.25%), developed land use would still increase on average approximately 4,300 acres each year.

Most development is likely to occur in lands zoned for this purpose, including floodplains. Conversion to developed land use is most dramatic in areas near existing developed areas. While land use planning allowed for the zoning of non-developable areas, these areas are not protected from development. This is because laws and zoning that govern land use planning allow some development in lands zoned for non-development. For the period following implementation of land use planning (after 1984), non-developable zoned lands have continued to be converted from resource land uses to low-density residential use (98,000 acres) (Lettman *et al*. 2011, p. 36).

FEMA has mapped 1% annual-chance flood areas (floodplains) in many areas of Oregon (Table 2.3-1, Figure 2.3-2). Among the counties containing anadromous ESA-listed species, five counties (Curry, Clatsop, Tillamook, Columbia, Douglas Counties) have the greatest amount of mapped floodplain area, with more than 150 acres of floodplain per linear mile of stream. Seven counties have less than 50 acres per linear mile of mapped floodplain (Jefferson, Gilliam, Morrow, Wasco, Wheeler, Sherman, and Wallowa counties).

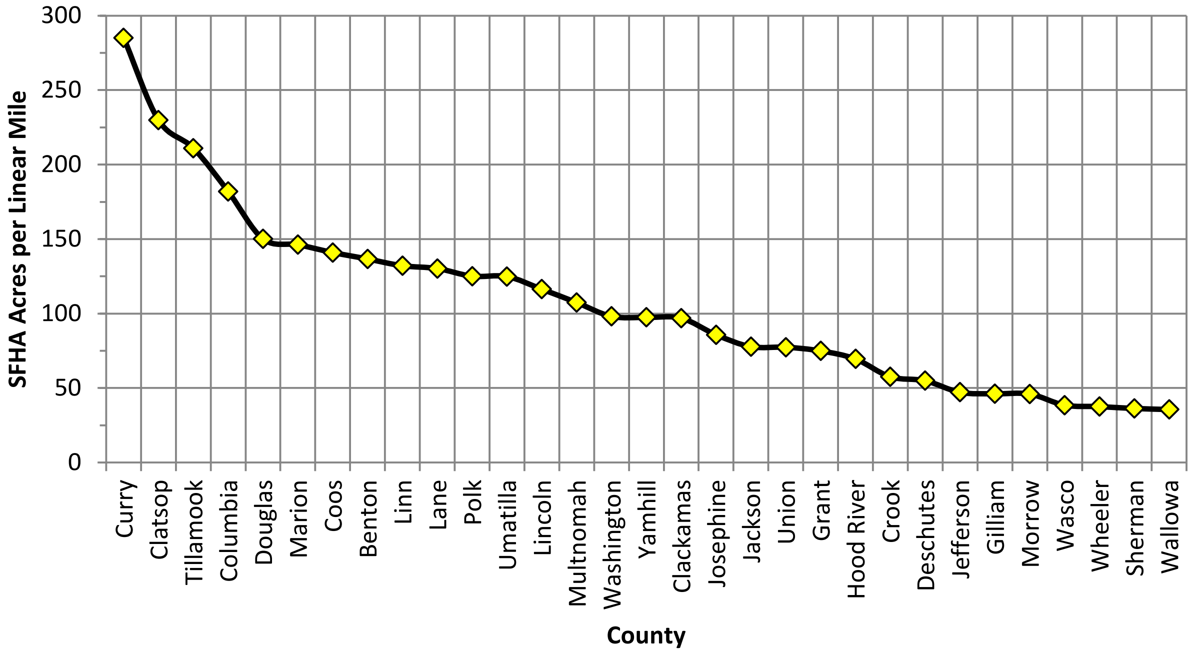

Figure 2.3-2. FEMA mapped acres of SFHA per linear mile of stream for counties with ESA-listed anadromous fish, Oregon. Source: DLCD, May 2012.

Table 2.3-1. FEMA mapped SFHA and floodway by county in Oregon. Gray denotes counties not containing ESA-listed anadromous species. Maps of eastern counties have not been modernized, except for Deschutes, Morrow, and Umatilla Counties. Therefore, most data for eastern Oregon is estimated. "Action Area Total" excludes counties not containing ESA-listed anadromous species. "Adjusted Total" excludes SFHA data where floodway data was not available, and concurrently excludes counties not containing ESA-listed anadromous species. Source: DLCD, May 2012.

	Area (mi^2)			Length (linear miles)		
County	SFHA (mi^2)	Floodway (mi^2)	SFHA w/o Floodway (%)	SFHA (miles)	SFHA w/o Floodway (miles)	SFHA w/o Floodway (%)
Baker	92.3	n/a	n/a	723.3	n/a	n/a
Benton	91.8	3.4	96.1	429.9	402.9	93.7
Clackamas	36.0	16.3	54.7	237.6	67.8	28.5
Clatsop	49.9	4.5	91.0	138.9	64.1	46.1
Columbia	88.4	17.5	80.2	310.9	270.0	86.8
Coos	115.3	6.1	94.7	523.3	504.2	96.4
Crook	37.0	0.4	99.0	411.0	397.0	96.6
Curry	60.9	5.7	90.6	136.7	87.5	64.0
Deschutes	18.4	4.3	76.6	214.1	118.8	55.5
Douglas	92.3	37.7	59.2	393.5	130.0	33.0
Grant	18.0	n/a	n/a	153.6	n/a	n/a
Gilliam	42.0	n/a	n/a	581.6	n/a	n/a
Harney	549.1	n/a	n/a	290.2	n/a	n/a

County	Area (mi^2) SFHA (mi^2)	Floodway (mi^2)	SFHA w/o Floodway (%)	Length (linear miles) SFHA (miles)	SFHA w/o Floodway (miles)	SFHA w/o Floodway (%)
Hood River	15.6	n/a	n/a	143.5	n/a	n/a
Jackson	61.3	9.6	84.3	504.1	382.3	75.8
Jefferson	22.8	n/a	n/a	309.0	305.0	98.7
Josephine	35.5	9.3	73.8	264.7	189.6	71.6
Klamath	464.1	n/a	n/a	1112.9	n/a	n/a
Lake	331.2	n/a	n/a	1018.5	n/a	n/a
Lane	215.4	26.2	87.8	1058.2	840.5	79.4
Lincoln	59.4	5.6	90.6	326.6	233.3	71.4
Linn	176.9	8.2	95.4	856.9	791.4	92.3
Malheur	91.0	n/a	n/a	777.4	n/a	n/a
Marion	85.7	23.6	72.5	375.1	214.5	57.2
Morrow	41.8	0.5	98.8	580.5	569.5	98.1
Multnomah	38.5	14.4	37.4	229.3	113.7	49.6
Polk	62.6	4.7	92.5	320.2	270.5	84.5
Sherman	16.5	n/a	n/a	290.2	n/a	n/a
Tillamook	61.9	19.9	30.7	187.7	74.8	39.9
Umatilla	32.0	11.0	65.6	164.0	70.6	43.0
Union	63.2	n/a	n/a	522.1	518.0	99.2
Wallowa	17.7	n/a	n/a	317.4	286.8	90.4
Wasco	24.0	n/a	n/a	397.8	n/a	n/a
Washington	64.8	14.7	77.3	422.5	233.7	55.3
Wheeler	26.2	n/a	n/a	445.5	n/a	n/a
Yamhill	66.2	26.5	57.2	434.7	292.0	67.2
Totals	3,365.7	270.1	8.0	15,603.4	7,428.5	47.6
Action Area Total	1,838.0			11,681.1		
Adjusted Total	1,592.0	270.1	17.0	9,668.9	7,428.5	76.8

As of January 31, 2013, there were 5,232 flood damage claims filed and over $91 million paid out under the NFIP in Oregon (Table 2.3-2). Based on the number of claims, approximately 0.9% of flood claims occurred in coastal flood zones (*i.e.*, V or VE zones), 63.9% occurred in non-coastal flood zones (*e.g.*, A zones), and 35.2% occurred in non-floodprone identified zones (*i.e.*, blank, D, emergency, X zones). FEMA data indicates that approximately 34% of NFIP claims in Oregon are paid for damages outside of the SFHA.

Table 2.3-2. Flood damage claims and payments under the NFIP in Oregon as of January 31, 2013. Source: FEMA.[93]

Flood Zone	Claims #	Claims % Total	Payments $	Payments % Total
A	845		12,954,600	
AE	2,373		45,615,600	
AH	30		502,800	
AO	95	63.9	769,700	65.7

[93] National Flood Insurance Program, BureauNet (http://bsa.nfipstat.fema.gov/reports/reports.html). Claims by Occupancy Type/State, January 31, 2013. Accessed on March 13, 2013.

Flood Zone	Claims #	Claims % Total	Payments $	Payments % Total
V	4		-	
VE	44	0.9	504,800	0.6
BLANK	6		34,700	
D	12		148,700	
Emergency	393		1,401,500	
X	1,430	35.2	29,165,500	33.8
TOTAL	5,232	100.0	91,097,900	100.0

Data on claims, as indicated by closed claims, by county indicate the top ten counties with flood damages in Oregon are Clackamas, Tillamook, Columbia, Lincoln, Washington, Lane, Multnomah, Jackson, Marion, and Douglas Counties (Table 2.3-3). Grouped by NMFS' recovery domains, closed claims were greatest in the Upper Willamette, Oregon Coast, and Lower Columbia recovery domains (Figure 2.3-3).

Table 2.3-3. Closed claims paid by FEMA under the NFIP, January 1978 to September 2011. "OTH" means that the zone was not reported by the insurance company. Source: FEMA.[94]

	Total Claims		Outside SFHA (X, D, OTH)		SFHA (A, V)	
County	Number	Ranking	#	%	#	%
Clackamas	534	1	177	33%	357	67%
Tillamook	530	2	77	15%	453	85%
Columbia	340	3	104	31%	236	69%
Lincoln	287	4	54	19%	233	81%
Washington	253	5	84	33%	169	67%
Lane	248	6	61	25%	187	75%
Multnomah	195	7	104	53%	91	47%
Jackson	190	8	65	34%	125	66%
Marion	183	9	85	46%	98	54%
Douglas	178	10	40	22%	138	78%
Coos	113	11	62	55%	51	45%
Clatsop	87	12	35	40%	52	60%
Yamhill	77	13	16	21%	61	79%
Linn	72	14	28	39%	44	61%
Harney	57	15	42	74%	15	26%
Crook	48	16	8	17%	40	83%
Josephine	42	17	13	31%	29	69%
Benton	36	18	8	22%	28	78%
Polk	34	19	10	29%	24	71%
Curry	29	20	14	48%	15	52%
Umatilla	29	20	15	52%	14	48%
Malheur	24	22	21	88%	3	13%
Union	13	23	11	85%	2	15%
Wasco	12	24	9	75%	3	25%
Lake	10	25	7	70%	3	30%
Klamath	9	26	4	44%	5	56%
Grant	7	27	0	0%	7	100%
Jefferson	7	27	7	100%	0	0%
Deschutes	5	29	3	60%	2	40%
Morrow	4	30	4	100%	0	0%
Baker	3	31	2	67%	1	33%
Hood River	3	31	3	100%	0	0%
Wallowa	3	31	2	67%	1	33%
Wheeler	3	31	3	100%	0	0%
Gilliam	1	35	1	100%	0	0%
Sherman	0	36	0		0	
Totals	3,666		1,179	32%	2,487	68%

[94] Data provide by Mark Eberlein (FEMA) to Robert Markle (NMFS) via e-mail (December 13, 2011).

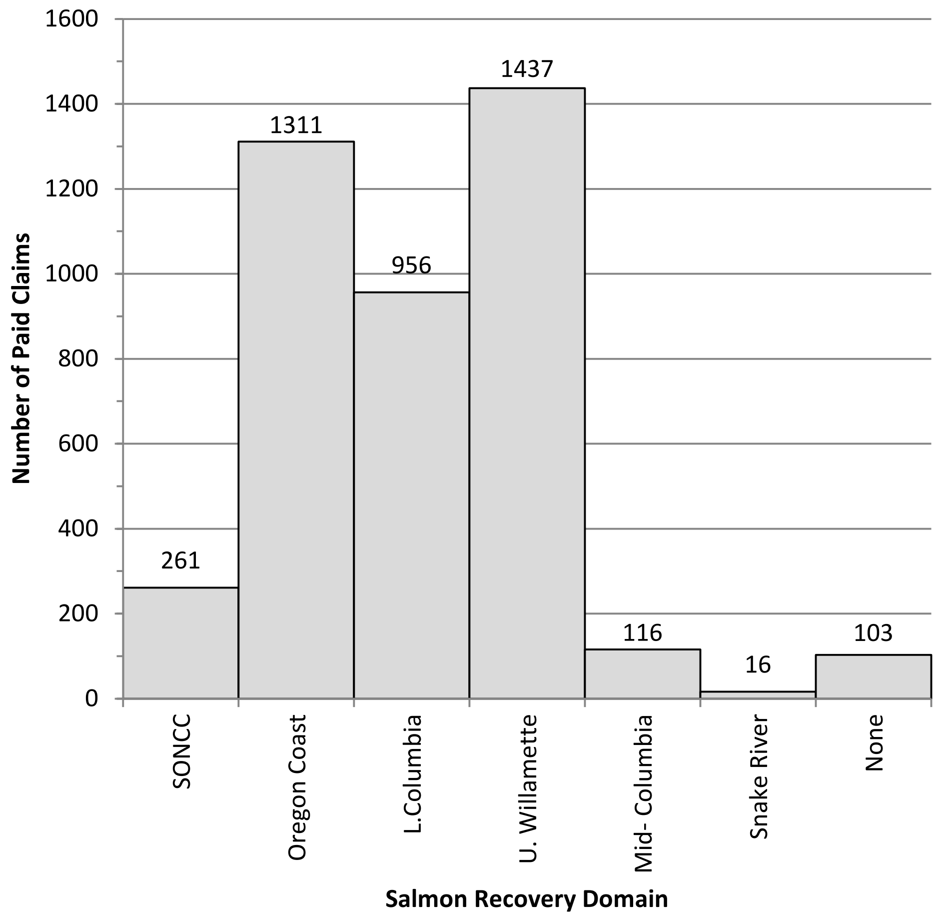

Figure 2.3-3. Closed claims paid by FEMA under the NFIP, January 1978 to September 2011. Domain grouping is based on the location of county's dominant developed area. Clackamas County is repeated because of domain overlap in Clackamas River basin. Vernonia is included in Oregon Coast domain.

The environmental baseline includes the anticipated impacts of all Federal actions in the action area that have already undergone formal consultation. Given that the action area for this consultation includes all areas of the regulated SFHA throughout the State of Oregon, these previously consulted on actions are likely to have had effects that overlap with the NFIP action area. Impacts to the environmental baseline from these previous actions include a wide range of short and long-term effects that may be adverse or beneficial, with determinations that each Federal action will avaoid jeopardy to listed species and adverse modification of critical habitat.

From 2001 through 2011, the Corps authorized about 428 transportation projects and 132 restoration actions in Oregon under programmatic consultations (NMFS 2008i; NMFS 2008j). The U.S. Bureau of Indian Affairs (BIA), U.S. Bureau of Land Management (BLM), and the U.S. Forest Service (USFS) have consulted on Federal land management throughout Oregon, including restoration actions, forest management, livestock grazing, and special use permits. The

Bonneville Power Administration (BPA), NOAA Restoration Center, and USFWS have also consulted on large restoration programs that consist of actions designed to address species limiting factors or make contributions that would aid in species recovery. The Corps, BPA, and Bureau of Reclamation have consulted on large water management actions, such as operation of the Federal Columbia River Power System, Willamette River Basin Flood Control Project, the Umatilla Basin Project, and the Deschutes Project. Within the action area are several completed consultations that concluded the proposed actions would jeopardize the ESA-listed species and/or destroy or adversely modify designated critical habitat (Table 2.3-4
). All of these consultations included reasonable and prudent alternatives that could be taken to avoid the jeopardy and/or adverse modification. For example, in the case of the FCRPS opinion, the net effect of that project's operation and implementation of mitigation actions is to effect a positive growth trend for certain affected salmonid species, while considering the effects of an environemental baseline that includes past floodplain development. That analysis did not include the effects of future NFIP implementation and related development that is considered in this opinion.

Table 2.3-4. Jeopardy and/or adverse modification consultations completed in Oregon (1995-2012). Source: NMFS Public Consultation Tracking System

Action Title	Consultation Number	Issuance Date	Conclusion
Reinitiation of consultation on 1994-1998 Operation of the Federal Columbia River Power System (FCRPS) and Juvenile Transportation Program in 1995 and Future Years (BOR)	NWR-1994-93	1995-03-02	Jeopardy & Adverse Modification
Reinitiation of consultation on 1994-1998 Operation of the Federal Columbia River Power System (FCRPS) and Juvenile Transportation Program in 1995 and Future Years (Corps)	NWR-1994-92	1995-03-02	Jeopardy & Adverse Modification
Reinitiation of consultation on 1994-1998 Operation of the Federal Columbia River Power System (FCRPS) and Juvenile Transportation Program in 1995 and Future Years (BPA)	NWR-1994-91	1995-03-02	Jeopardy & Adverse Modification
Inland Land Inc. Pumping Facility on the Columbia River	NWR-1996-130	1997-05-16	Jeopardy & Adverse Modification
Proposed Milltown Hill Dam, Umpqua River	NWR-1996-131	1997-12-18	Jeopardy & Adverse Modification
Stewart Mining Operation affecting Umpqua River cutthroat trout, City Creek Drainage, Steamboat Creek Watershed, Umpqua National Forest	NWR-1997-1308	1998-08-19	Jeopardy & Adverse Modification
Coos Bay North Bend Water Board Water Supply Expansion Project, Upper Pony Creek Dam and Joe Ney Reservoir	NWR-1999-33	1999-12-14	Jeopardy & Adverse Modification
Operation of the Federal Columbia River Power System (FCRPS) Including the Juvenile Fish Transportation Program: A Supplement to the Biological Opinions Signed on March 2, 1995, and May 14, 1998, For the Same Projects (Corps)	NWR-1999-884	2000-02-04	Jeopardy & Adverse Modification

Action Title	Consultation Number	Issuance Date	Conclusion
Operation of the Federal Columbia River Power System (FCRPS) Including the Juvenile Fish Transportation Program: A Supplement to the Biological Opinions Signed on March 2, 1995, and May 14, 1998, For the Same Projects (BOR)	NWR-1999-1911	2000-02-04	Jeopardy & Adverse Modification
Operation of the Federal Columbia River Power System (FCRPS) Including the Juvenile Fish Transportation Program: A Supplement to the Biological Opinions Signed on March 2, 1995, and May 14, 1998, For the Same Projects (BPA)	NWR-1999-1910	2000-02-04	Jeopardy & Adverse Modification
Treaty Indian and Non-Indian Year 2000 Winter, Spring, and Summer Season Fisheries	NWR-2000-356	2000-02-29	Jeopardy, No Adverse Modification
Impacts of Treaty Indian and Non-Indian Fisheries in the Snake River Basin in 2000	NWR-2000-911	2000-06-30	Jeopardy, No Adverse Modification
Reinitiation of Operation of the Federal Columbia River Power System (FCRPS), Including the Juvenile Fish Transportation System, and 19 Bureau of Reclamation Projects in the Columbia Basin (BPA)	NWR-1999-1909	2000-12-21	Jeopardy & Adverse Modification
Reinitiation of Operation of the Federal Columbia River Power System (FCRPS), Including the Juvenile Fish Transportation System, and 19 Bureau of Reclamation Projects in the Columbia Basin (BOR)	NWR-1999-1902	2000-12-21	Jeopardy & Adverse Modification
Reinitiation of Operation of the Federal Columbia River Power System (FCRPS), Including the Juvenile Fish Transportation System, and 19 Bureau of Reclamation Projects in the Columbia Basin (Corps)	NWR-1999-1901	2000-12-21	Jeopardy & Adverse Modification
Impacts of Treaty Indian and Non-Indian Fisheries in the Snake River Basin in Year 2001 on Listed Salmon	NWR-2001-830	2001-07-03	Jeopardy, No Adverse Modification
LTM, Inc. Instream Sand and Gravel Mining Project, Umpqua River, Douglas County	NWR-2003-1665	2004-08-06	Jeopardy & Adverse Modification
K-D Sand and Gravel, Gravel Removal Project, Willamette River, Polk County	NWR-2001-932	2005-08-23	Jeopardy & Adverse Modification
Remand of 2004 Biological Opinion on the Federal Columbia River Power System (FCRPS) including 19 Bureau of Reclamation Projects in the Columbia Basin (Revised pursuant to court order, NWF v. NMFS, Civ. No. CV 01-640-RE (D. Oregon)	NWR-2005-5883	2008-05-05	Jeopardy & Adverse Modification
Continued Operation of 13 Dams & Maintenance of 43 Miles of Revetments in the Willamette Basin, OR	NWR-2000-2117	2008-07-11	Jeopardy & Adverse Modification
Pesticide Use of Chlorpyrifos	FPR-2003-428	2008-11-18	Jeopardy & Adverse Modification

Action Title	Consultation Number	Issuance Date	Conclusion
Pesticide Use of Malathion	FPR-2002-2724	2008-11-18	Jeopardy & Adverse Modification
Pesticide Use of Diazinon	FPR-2002-1905	2008-11-18	Jeopardy & Adverse Modification
Pesticide use of carbofuran	FPR-2004-2637	2009-04-20	Jeopardy & Adverse Modification
Pesticide Use of Methomyl	FPR-2003-430	2009-04-20	Jeopardy & Adverse Modification
Pesticide use of carbaryl	FPR-2003-2430	2009-04-20	Jeopardy & Adverse Modification
Pesticide use of Phorate	FPR-2004-2643	2010-08-31	Jeopardy & Adverse Modification
Pesticide Use of Methidathion	FPR-2004-2641	2010-08-31	Jeopardy & Adverse Modification
Pesticide Use of Dimethoate	FPR-2004-2639	2010-08-31	Jeopardy & Adverse Modification
Pesticide use of Phosmet	FPR-2003-2436	2010-08-31	Jeopardy & Adverse Modification
Pesticide Use of Naled	FPR-2003-2435	2010-08-31	Jeopardy & Adverse Modification
Pesticide Use of Fenamiphos	FPR-2003-2434	2010-08-31	Jeopardy & Adverse Modification
Pesticide Use of Ethoprop	FPR-2003-2433	2010-08-31	Jeopardy & Adverse Modification
Pesticide Use of Disulfoton	FPR-2003-2432	2010-08-31	Jeopardy & Adverse Modification
Environmental Protection Agency’s Registration of Oryzalin	FPR-2003-427	2012-05-31	Jeopardy & Adverse Modification
Diversions Located on National Forest Lands in the Upper Salmon River (Morgan/Challis) Watershed	NWR-2004-1982	2012-08-10	Jeopardy & Adverse Modification

Action Title	Consultation Number	Issuance Date	Conclusion
Biological Opinion for the Environmental Protection Agency's Proposed Approval of Certain Oregon Administrative Rules Related to Revised Water Quality for Toxic Pollutants	NWR-2008-148	2012-08-14	Jeopardy & Adverse Modification

NMFS also consulted on the effects of the long-term operations of the Central Valley Project (CVP) and State Water Project (SWP) (NMFS 2009b). The NMFS found that the long-term operations of the CVP and SWP, as proposed, were likely to jeopardize the continued existence of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, Southern green sturgeon, and SRKW. Similarly, NMFS consulted on the Environmental Protection Agency's proposed approval of certain Oregon administrative rules related to revised water quality criteria for toxic pollutants (NMFS 2012c), and found that the revised water quality criteria were likely to jeopardize LCR Chinook salmon, UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, CR chum salmon, LCR coho salmon, SONCC coho salmon, OC coho salmon, SR sockeye salmon, LCR steelhead, UWR steelhead, MCR steelhead, UCR steelhead, SRB steelhead, Southern green sturgeon, Southern eulachon, and SRKW. The increased risk of extinction of Chinook salmon as a long-term consequence of the proposed actions each diminished the potential for Southern Residents to survive and recover. In both consultations (NMFS 2009b, NMFS 2012c), the involved action agencies are implementing actions identified as part of the respective reasonable and prudent alternative over specified time periods starting from issuance of the biological opinion.

NMFS conducted additional consultations on the effects of hydro-power dams and flood control programs on Southern Residents (NMFS 2008g; NMFS 2008d; NMFS 2010b; NMFS 2014b). As part of the proposed action for the Federal Columbia River Power System and the Willamette Flood Control Program, action agencies proposed funding hatchery programs in addition to their proposals for dam operations and maintenance. For both programs, the proposed actions did not result in a net decrease in Chinook salmon prey for Southern Residents in the short term. To mitigate for the harmful effects of hatchery production on long-term Chinook salmon viability (and thus killer whale prey availability) the action agencies committed to a schedule of future hatchery reforms.

NMFS conducted a consultation on the implementation of the NFIP in Puget Sound on Southern Residents (NMFS 2008c). The NMFS found that the National Flood Insurance Program was likely to jeopardize the continued existence of Puget Sound Chinook salmon, Hood Canal summer chum salmon, Puget Sound steelhead, and Southern Resident killer whales. NMFS also found that the proposed action would adversely modify designated critical habitat for Puget Sound Chinook salmon, Hood Canal summer chum salmon, and Southern Resident killer whales. The increased risk of extinction of Puget Sound Chinook salmon and other Southern Resident prey species as a long-term consequence of the proposed action diminished the potential for Southern Residents to survive and recover. FEMA is implementing actions identified as part of the reasonable and prudent alternative from issuance of the biological opinion.

2.3.2.2 Quality of Prey

As introduced in the above sections, contaminants enter marine waters from numerous sources throughout the action area, but are typically concentrated near populated areas of high human activity and industrialization. The majority of growth in salmon occurs while feeding in saltwater (Quinn 2005). Therefore, the majority (>96%) of persistent pollutants in adult salmon are accumulated while feeding in the marine environment (Cullon *et al.* 2009, O'Neill and West 2009). Freshwater contamination is also a concern because it may contaminate salmon that are later consumed by the whales in marine waters. Only limited information is available for contaminant levels of Chinook salmon in Oregon rivers; however, in general Chinook salmon contain higher levels of some contaminants than other salmon species. As discussed in the Status of the Species section, the marine distribution is an important factor affecting pollutant accumulation as is evident across the different salmon populations. For example, Chinook salmon populations feeding in close proximity to land-based sources of contaminants have higher concentrations (O'Neill *et al.* 2006).

2.3.2.3 Vessel Activity and Sound

Commercial, military, recreational, and fishing vessels traverse the coastal range of Southern Residents. Vessels may affect foraging efficiency, communication, and/or energy expenditure by their physical presence and by creating underwater sound (Williams *et al.* 2006a, Holt 2008). Collisions of killer whales with vessels are rare, but remain a potential source of serious injury and mortality. Large ships that traverse coastal waters of the whales' range move at relatively slow speeds and are likely detected and avoided by Southern Residents.

Vessel sounds in coastal waters are most likely from large ships, tankers, and tugs. Sound generated by large vessels is a source of low frequency (5 to 500 Hz) human-generated sound in the world's oceans (NRC 2003). While larger ships generate some broadband noise in the hearing range of whales, the majority of energy is below their peak hearing sensitivity. At close range large vessels can still be a significant source of background noise at frequencies important to the whales (Holt 2008). Commercial sonar systems designed for fish finding, depth sounding, and sub-bottom profiling are widely used on recreational and commercial vessels and are often characterized by high operating frequencies, low power, narrow beam patterns, and short pulse length (NRC 2003). Frequencies fall between 1 and 500 kHz, which is within the hearing range of some marine mammals, including killer whales, and may have masking effects.

2.3.2.4 Non-Vessel 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 Corps under section 404 of the CWA and section 10 of the Rivers and Harbors Act of 1899. Consultations on these permits have been conducted and conservation measures have been included to minimize or avoid potential effects of in-water activities, such as pile driving, on marine mammals.

2.3.2.5 Oil Spills

Oil spills have occurred in the coastal 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, at refineries and associated production facilities, and pipelines. The magnitude of risk posed by oil discharges in the action area is difficult to precisely quantify, but improvements in oil spill prevention procedures since the 1980s likely provide some reduced risk of spill.

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, neurological damage (Geraci and St. Aubin 1990), potentially death, and long-term effects on population viability (Matkin *et al.* 2008). 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.

2.3.2.6 Scientific Research

Although research activities are typically conducted between May and October in inland waters, some permits include authorization to conduct research in coastal waters. In general, the primary objective of this research is population monitoring or data gathering for behavioral and ecological studies. NMFS has issued several scientific research permits to investigators who intend to study Southern Residents (NMFS 2006, NMFS 2008h, NMFS 2012d). In the biological opinions NMFS prepared to assess the impact of issuing the permits, we determined that the effects of these disturbances on Southern Residents were likely to adversely affect, but not likely to jeopardize the continued existence of, the Southern Residents (NMFS 2006, 2008h, 2012d). A small portion of the authorized take would occur in the coastal range of Southern Residents.

2.3.2.7 Summary of Southern Residents Environmental Baseline

Southern Residents are exposed to a wide variety of past and present state, Federal, or private actions and other human activities in the coastal waters that comprise the action area, 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 the action area.

No single threat has been directly linked to or identified as the cause of the recent decline of the Southern Residents, although the three primary threats are identified as prey availability, environmental contaminants, and vessel effects and sound (Krahn *et al.* 2002). Researchers are unsure about which threats are most significant. There is limited information on how these factors or additional unknown factors may be affecting Southern Residents when in coastal waters. 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).

2.4 Effects of the Action on Species and Designated Critical Habitat

"Effects of the action" means the direct and indirect effects of an action on the 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). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. We have not identified any interrelated or interdependent effects for this consultation.

2.4.1 Introduction to Effects Analysis

An initial question for our analysis is whether FEMA's implementation of the NFIP can be said to "cause" floodplain development, which affects habitat functions and features relied on by salmonids to complete their life cycles. We considered this question in our previous opinion on the NFIP as implemented in Puget Sound, Washington, and concluded that that NFIP both facilitates floodplain development and establishes the land-use and construction standards pursuant to which such development may occur. We incorporate that discussion here by reference (NMFS 2008c, pp. 3-5).

While Wetmore *et al*. (2006, p. 12) state that the NFIP has likely reduced the rate of floodplain development at the national scale, they also indicate that floodplain development continues to occur. A contrary evaluation also exists: the NFIP was identified as enabling or encouraging development among more than half of floodplain administrators surveyed in 18 communities (Rosenbaum and Boulware 2006). Rosenbaum and Boulware (2006) also report that the letter of map change process can discourage floodplain conservation. Between 1997 and 2022, the estimated number of structures in the SFHA is expected to increase from 6.6 million to 8.7 million (32%) (Wetmore *et al*. 2006, p. 12). Rosenbaum (2005) and Cross (1989) support the fact that the NFIP contributes to development of areas at risk of flooding (Merrick Burden, Economist, NMFS June 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).

Also, we note that Congress, in the NFIA, recognized the close connection between the availability of Federal assistance, as provided through the NFIP, and floodplain development: "the availability of Federal loans, grants, guaranties, 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)). Additional discussion regarding the causal connection between the NFIP and floodplain development is provided in Section 2.4.4 below, Effect of the National Flood Insurance Program on Floodplain Development. In this effects analysis we find that the implementation of the NFIP in Oregon, as proposed, would directly and indirectly affect anadromous species and their designated critical habitat, and that the effects would be predominantly adverse.

Floodplains are an important component of the aquatic habitat that supports healthy populations of fish, including anadromous species. Floodplains are well recognized as having high levels of biologically diversity and productivity. The “greater availability of floodplain habitats enhances fish recruitment and species diversity” in low-land rivers of North America (Winemiller 2004). Periodically inundated floodplains (*i.e*., active floodplains), generally have a higher yield of fish per unit area than do rivers with inactive floodplains. Within their distribution, anadromous fish occupy floodplains during periods of inundation, particularly juvenile salmonids.

Floodplains are vital to the health of anadromous fish because they provide important habitat during the freshwater phase of the anadromous life cycle. Use of floodplains by anadromous fish is well documented (Swales and Levings 1989; Sommer *et al*. 2001a; Solazzi *et al*. 2000, as cited in Pess *et al*. 2005; Henning *et al*. 2006; Roni *et al*. 2006; Baker 2008; Nickelson 2012; Sheeran and Hesselgrave 2012). In addition to providing off-channel fish habitat, floodplains also influence the quality and quantity of in-channel fish habitat.

Healthy floodplains contribute to the habitat processes necessary for anadromous fish survival, particularly salmonids, by:

- allowing the river to naturally migrate and form a diversity of habitat types critical to different species of salmon at various life stages;
- facilitating exchange of nutrients and organic material between land and water, thus increasing habitat complexity via food subsidies and large woody debris;
- providing off-channel areas with a high abundance of terrestrial and aquatic food sources for juvenile salmonids;
- creating shallow habitat with cover for small salmonids to hide from larger predators;
- improving riparian habitat for species such as aquatic insects, beaver, and bear that are important elements of salmon ecology;
- providing slow-water refuge for juvenile salmon to avoid high flow volume, allowing them to rear as long as necessary and conserve energy for their entry to the ocean;
- providing coarse beds of sediment through which water flows, filtering excess nutrients and other chemicals to maintain high water quality; and
- providing an expanded area for depositing and storing excess sediment, particularly fine sediment. This reduces the negative effects of turbidity on fish.

Additionally, the water storage and recharge function of floodplains ensures a source of cooler water in summer months and warmer water during winter months. Water seeps into the groundwater table during floods, recharging wetlands, off-channel areas, and shallow aquifers. In turn, these areas release water to the stream during the summer months. Without this recharge, flows are typically lower in the summer and water is warmer. Finally, the groundwater storage/ recharge process reduces the likelihood of high-energy flood events that can scour away salmon nests during the winter months.

When rivers are connected to their floodplains, the channel is able to migrate naturally. This process creates side channels, back-water sloughs, and other off-channel habitats that are important refuge for salmon. During high flow events, water is distributed across floodplain habitats—dissipating hydraulic energy and increasing the exchange of nutrients and organic material between aquatic and riparian habitats.

"Surface waters, their floodplains and their watersheds must be viewed as parts of one ecological system. This system exists in a state of dynamic equilibrium. If one of the parts of the system is disturbed, the entire system will readjust toward a new equilibrium. This is true of coastal, river, and lake systems. The geological and biological effects of the system's readjustments toward its new equilibrium are often felt far from the original site of the distrubance and can last for decades. For this reason, if for no other, floodplain development and modification should be viewed with caution and with careful assessment of the potential adverse impacts on natural values" (FEMA 1986). Floodplain development has numerous short-term and long-term adverse effects on anadromous fishes and the natural processes and habitat functions that are important to their survival and recovery. Large portions of Oregon floodplains no longer function in their natural form because they have been restructured to meet urban and agricultural needs. Development affects floodplains by altering the natural ecological, geomorphological, and hydrological processes that allow complex habitats to form and be maintained. There is a direct relationship between this loss of floodplain function and trends in declining anadromous salmonid runs.

Floodplain development results in the degradation and loss of in-channel and off-channel habitat by clearing vegetation, placing fill, covering with impervious surfaces, rerouting stormwater, providing sources of pollution, and channelizing rivers. These actions have direct and indirect detrimental effects on the quantity and quality of aquatic habitats used by fish. The effects of development on in-channel areas include:

- reduced channel length and area,
- reduced habitat complexity,
- reduced prey availability and modified food web,
- modified hydrology,
- increased peak flow volumes and velocities,
- decreased low flow volumes,
- reduced cover,
- reduced bank stability,
- increased erosion,
- increased suspended sediment and turbidity,
- modified sediment loads,
- reduced levels of large wood,
- increased pollution,
- increased water temperature,
- decreased dissolved oxygen,
- increased bed coarsening,
- increased substrate embeddedness,
- increased risk of downstream fish displacement,

- increased risk of egg scour
- increased predation, and
- modified salinity gradients in tidally influenced reaches.

The effects of development on off-channel areas include:

- reduced habitat complexity,
- reduced cover,
- reduced access to small tributary and off-channel areas,
- increased exposure to pollution,
- reduced prey availability,
- reduced refuge from high velocities,
- reduced refuge from high water temperatures, and
- increased risk of entrapment and impingement.

Floodplains not only serve an important role in the freshwater phase of the anadromous fish life cycle, but they also contribute to the health of the larger ecosystem. Salmon, for instance, are the primary food source for numerous other species, including killer whales. Nutrients released from the bodies of adult salmonids after spawning also fertilize the aquatic and riparian environment, thus maintaining biological productivity for the next generation of salmonids.

The NFIP, through the three described discretionary elements, leads to development in the floodplain environment. The reduction in floodplain habitat function is constant, incremental, permanent, and self-propagating. Once development occurs in an area, subsequent development follows. For example, an analysis of Lane County land use decisions in the McKenzie River Basin found that "once a development is approved, it usually results in additional development activity" (CPW 2009, p. 29). As part of the analysis, CPW (2009) reviewed development activity on 17 tax lots that posed the greatest potential risk to water quality and found that approved development often leads to multiple land use impacts later in time, such as increased construction, damage and loss of riparian vegetation, and bank revetment. In addition, a permit review of the 1980-2008 period indicated that 97% of the requests (36 of 37 requests) for modification of the riparian setback (50 feet, in most instances) were approved including four modifications in the floodway (CPW 2009, p. 23).

FEMA proposes to implement the NFIP in Oregon consistent with FEMA's regulatory program with some modifications intended to address concerns regarding ESA-listed salmonids. However, the proposed action has several weaknesses:

- The accuracy of floodplain mapping remains problematic.
- The proposed conservation measures do not appear to be mandatory.
- The regulatory floodplain management criteria are inadequate to limit the adverse effects of floodplain development. [95]

[95] "There are several ways of regulating the use of flood plains. For example, to avoid flood damage from a 100-year flood level, one of the following techniques could be used: – eliminate construction in the 100-year flood area; – restrict land use to functions, such as recreation and farming, that will not be severly damaged by floods..." (Comptroller General 1975).

- The CRS program fails to require minimum credits for beneficial floodplain functions for the lower six ratings classes.
- The CRS program continues to provide credits to structural development and other floodplain management practices that are detrimental to natural floodplain functions.
- The proposed action relies on communities to meet FEMA's ESA obligation even though the duty to comply with ESA section 7 lies with FEMA not state or local governments.
- The proposed action does not include sufficient program oversight.
- The proposed action does not provide measurable performance standards or development limits.
- The proposed action provides only infrequent program monitoring.

Consequently, the effects of implementing the NFIP in Oregon are likely to increase mortality and decrease fitness of anadromous fishes that occupy floodplains and the adjacent stream or river, both within the associated river reach and downstream. FEMA's proposed action does not provide the necessary assurances that the effects of NFIP implementation will not appreciably reduce the likelihood of both the survival and recovery of the affected species. A more detailed explanation of our findings follows.

2.4.2 Floodplains as Fish Habitat

Floodplains are important to fish production (Welcomme 1979; Bayley 1991; Junk *et al*. 1989; Littlejohn *et al.* 1985; Bravard *et al.* 1986; and Dutterer *et al*. 2012). In the past, the river channel was considered to be distinct from the associated floodplain (Junk *et al*. 1989). Today, we understand that a floodplain is more appropriately considered part of the river ecosystem (Ellis-Sugai and Godwin 2002). Both the river and floodplain are important for the growth and survival of fish stocks (Welcomme 1979; Junk *et al*. 1989; Bayley 1991; Sommer *et al*. 2001b and 2005; Moyle *et al*. 2007, Jeffres *et al*. 2008; Naiman *et al*. 2010; Burgess *et al*. 2012; Bellmore *et al*. 2013). Ward *et al.* (2002b, p. 447) state that "it is essential to include the shifting mosaic of lotic, lentic, and riparian habitats of fringing flood plains, as well as contiguous alluvial aquifers, as integral parts of the total river ecosystem." Current ecological theory recognizes the "major interactive role between fluvial dynamics and geomorphic structure in sustaining ecological processes and biodiversity patterns in river corridors" (Ward *et al.* 2002b, p 449).

Main channel habitats support large fisheries, but "the highest yields are associated with adjoining floodplains and most of their production is derived from floodplain habitats" (Junk *et al*. 1989, p. 112, *internal citations omitted*). "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" (Junk *et al*. 1989, p. 116). In large temperate river systems, development has "substantially modified the hydrograph and separated floodplains from main channels," which impedes the access of river biota to the floodplain (Junk *et al*. 1989, p. 116).

In the Pacific Northwest, anadromous salmonids occur in inundated floodplains and their associated rivers and streams within their area of distribution (Swales and Levings 1989; Frissell 1992; Sommer *et al*. 2001a; Solazzi *et al*. 2000, as cited in Pess *et al*. 2005; Henning *et al*. 2006; Roni *et al*. 2006; Baker 2008; Teel *et al.* 2009; Nickelson 2012). Flooding can result in adverse effects to anadromous salmonids (*e.g.*, scouring of redds, burying of redds, injury of juveniles seeking cover in the substrate, downstream displacement), but the significance of the effect can be mediated by the presence of functioning floodplains (Pess *et al*. 2005, Greene *et al*. 2005, Waples *et al*. 2008, Waples *et al*. 2009). Floodplain inundation substantially increases the total habitat availability, particularly shallow water area. Shallow areas with low velocity flow are particularly favored by overwintering juvenile salmonids (Everest and Chapman 1972, Bustard and Narver 1975a, Beechie *et al*. 2001, Collins and Montgomery 2002, Pess *et al*. 2002, Sommer *et al.* 2005, Bottom *et al.* 2005, Lestelle 2007). Floodplain inundation greatly increases the amount of aquatic habitat available for fish use and provides large areas of shallow (typically <2 m), inundated vegetation (Sommer *et al.* 2001b). Inundated floodplains provide an enhanced food supply and reduce competition for prey. Bottom *et al.* (2005, p. 83) state that "floodplain inundation greatly increases the surface area of tidal estuarine and riverine habitats available to salmonids" and "may relax competitive interactions by reducing fish densities." "Sommer *et al.* (2001a) reported that multiple trophic levels are stimulated by floodplain inundation, increasing the availability of invertebrates to young fish" (Sommer 2004, p. 121).

In Oregon, channelization, which limits over-bank flooding and channel migration by confiing streamflow within a single channel with rigid banks, has isolated western Oregon rivers and streams from the surrounding landscape, and drastically altered the ecological function of lowland systems (IMST 2002). The "decline in salmonid productivity in Oregon can be attributed to a combination of confounding factors, including over-harvest, habitat alteration, migration barriers, variable ocean conditions, and hatchery practices (Nehlsen et al. 1991). However, the magnitude and duration of the decrease implicates area relationships with decreases in spawning and rearing habitat quality in lowland rivers since EuroAmerican settlement. Approximately 90% of the declines in Pacific salmon stocks are thought to be related to habitat degradation (Nelsen et al. 1991, Gregory and Bisson 1997). Two major lowland land uses, agriculture and urbanization, have been associated with less healthy salmonid stocks of coho, winter steelhead, and summer chinook (Mrakovcich 1998)" (IMST 2002).

Chinook salmon juveniles use inundated floodplains for rearing, including estuarine areas (Swales and Levings 1989, Healey 1991, Sommer *et al*. 2001b, Brown 2002, Sommer *et al*. 2005, Henning *et al*. 2006, Lestelle 2007, Moyle *et al*. 2007, Baker 2008, Jeffres *et al*. 2008, Bottom *et al*. 2009, Colvin *et al*. 2009, Teel *et al*. 2009). Sub-yearling Chinook salmon have been found to occur in higher densities in side channel and backwater habitats than in mainstem habitat (Beamer and Henderson 1998, Beechie *et al.* 2005, Lestelle 2007). In a study of seasonal floodplain wetlands that included coastal Oregon, the upper Columbia River estuary, and eastern Oregon/Washington, Baker (2008, p. 52) found Chinook salmon in all three regions of the state. Characterizing expected habitat use for ocean-type Chinook salmon, Lestelle (2007, p. 97) identified seasonally flooded wetlands (and side channels) as having high spring use and moderate summer use by sub-yearling juveniles. Colvin *et al*. (2009) and Teel *et al*. (2009) found juvenile Chinook salmon in seasonal floodplains of the upper and lower Willamette River, respectively. Using genetic information, they concluded that the floodplains were used by spring and fall run fish from the upper Willamette River and lower Columbia River, and summer-fall run fish from the middle and upper Columbia River (Teel *et al*. 2009). Furthermore, Bellmore *et al*. (2013) demonstrated the importance of complex floodplain habitats in food webs used by juvenile Chinook salmon and steelhead in the interior Columbia Basin. Additionally, functional floodplains and floodplain connectivity may be increasingly important as climate change shifts flood patterns and frequency: "[a]ctions that may buffer increasing flow variability in the Pacific Northwest include reconnection of floodplains that can enhance flood storage capacity and provide refugia habitat for juvenile fish, increasing lateral connectivity to floodplain aquifers, and reducing delivery of runoff from impervious surfaces into streams (Battin et al., 2007; Beechie et al., 2013)" (Ward *et al.* 2015).

Coho salmon in particular rely heavily on floodplain habitat for rearing (Bustard and Narver 1975, Hartman and Brown 1987, Beechie *et al*. 1994, Henning 2004, Henning *et al*. 2006, Nickelson 2012). Juvenile coho salmon show strong preference for pools and woody debris cover in the summer months and for side-channel and pond habitats in the winter months (Pess *et al*. 2002, Beechie *et al*. 2005, Drucker 2006). Spawning coho salmon prefer groundwater channels next to floodplains (Lestelle 2007). Juvenile coho salmon have been observed to relocate during fall to low gradient, side channel areas that are more favorable to over-winter survival (Lestelle 2007, Stout *et al*. 2012). Characterizing expected habitat use for coho salmon, Lestelle (2007, p. 96) identified seasonally flooded wetlands (and side channels) as having moderate spring use, low summer use, and high use during fall and winter by juveniles. Bustard and Narver (1975a, p. 679) found higher overwinter survival of juvenile coho salmon that used flooded habitats. Lestelle (2007, p. 69) reported average overwinter survival of juvenile coho salmon in small floodplain tributaries of the Wilson River (Oregon) of 72% over a ten-year period, with a range of 46% to 91%. The lack of overwintering habitat is considered a major limitation to coho salmon and other species in the Pacific Northwest (Solazzi *et al.* 2000, Brown 2002, Lestelle 2007). Also, summer use of floodplains for coho salmon rearing is provided by beaver ponds that inundate the floodplain during non-flood periods (Pollock *et al*. 2004). Baker (2008, p. 52) found coho salmon in seasonal floodplain wetlands in coastal Oregon and the upper Columbia River estuary. Juvenile coho salmon, including individuals fulfilling the less frequent sub-yearling migrant life history strategy, use estuarine and tidal freshwater wetlands in coastal Oregon for migration, foraging, and rearing (Stout *et al*. 2012, p. 101). "Coastal floodplains are widely recognized for their value to many estuarine and marine fisheries. Here also floodplains, both riverine and coastal, provide much of the nutrients and energy for aquatic estuarine environments. Estuarine wetlands serve as breeding, nursery, and feeding grounds for estuarine and marine fisheries" (FEMA 1986).

Steelhead also use floodplains for rearing, though likely to a lesser extent than Chinook and coho salmon. Generally, steelhead are more abundant in the main channel sites, but are seen in seasonal floodplains. Several studies in Washington have observed floodplain use by juvenile steelhead (Beechie *et al*. 2005, Pess *et al*. 2002). In Oregon, Baker (2008, p. 52) found juvenile steelhead in seasonal floodplains in the upper Columbia River estuary and eastern Oregon, although in the upper Columbia River estuary, they were found in considerably lower quantities than Chinook and coho salmon. However, in eastern Oregon, where sampling was limited to one site, the sampling effort was less, and salmonid catch was considerably lower than elsewhere, steelhead outnumbered Chinook salmon 10 to 1 in seasonal floodplains. Also in eastern Oregon, Pollock *et al*. (2007) found a higher abundance of juvenile steelhead in reaches with beavers and better floodplain connectivity. As mentioned above, Bellmore *et al*. (2013) demonstrated the importance of complex floodplain habitats in food webs used by juvenile Chinook salmon and steelhead in the interior Columbia Basin.

Chum salmon use of floodplain habitats for rearing and spawning has been observed (Bonnell 1991; Groot and Margolis (*eds*.) 1991, p. 254; Drucker 2006; Henning *et al*. 2006), but to a lesser extent than other anadromous salmonids. Historical accounts suggest a correlation between floodplain channels and chum salmon spawning areas.[96] This may be because floodplain channels frequently contain areas of clean sorted substrate and upwelling that provide suitable habitat for egg incubation. Drucker (2006) observed high-densities of chum salmon redds in seasonal side channels of the Skykomish River, Washington, and Bonnell (1991) observed spawning in floodplain channels in British Columbia. Also, an attraction to submerged vegetation by juvenile chum salmon has been observed (Groot and Margolis (*eds*.) 1991, p. 254). Consistent with that observation, Henning *et al*. (2006) observed juvenile chum salmon in floodplain wetlands. However, chum salmon fry display both passive displacement and active downstream movement (Groot and Margolis (*eds*.) 1991, p. 252). Therefore, non-estuarine floodplain use by juveniles may be circumstantial and more a function of distribution by current than intentional occupancy.

Regardless of whether they have a dependence on floodplain use or not, chum salmon still are dependent on suitable in-channel habitats. Chum salmon spawning success can be impaired when stream complexity is lost or landscape conditions further up in the floodplain (decreasing natural vegetation and increasing impervious surface) increase flow volume and velocity that 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. “Chum salmon are second only to Chinook salmon in dependence upon estuaries, and they may choose either the upper or lower estuaries, depending on the relative productivity of each” (Salo 1991, as cited in Groot and Margolis 1991). Access to shallow water estuarine areas where food and cover are plentiful is 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.

Sockeye salmon presence in Oregon is limited to the use of the Columbia River and Snake River as a migratory corridor. While use of floodplain habitats for spawning has been noted (Lorenz and Eiler 1989), direct floodplain use by individuals during migration is not well documented. We are unaware of data that indicate adults or juveniles have been observed in floodplains during their migrations. Incidental presence is likely in side-channels when inundated. Regardless, direct use and dependency on floodplain habitat is generally not recognized. Therefore, changes to channel habitat functions used for migration are of particular concern to this species, including changes in the food web and water quality.

Green sturgeon use of floodplains is unknown (Israel and Klimley 2008), and is likely incidental. It is possible that individuals, if present during overbank flows, occupy floodplains either volitionally or non-volitionally. Regardless, direct use and dependency on floodplain habitat is generally not recognized. Sub-adult and adult Southern green sturgeon are known to use pool, off-channel cove, and shallow water habitats, particularly in estuaries (Erickson *et al.* 2002,

[96] E-mail correspondence between Bill McMillan and Robert Markle (NMFS) regarding chum salmon use of floodplains (May 11, 2013).

Dumbauld *et al.* 2008). Therefore, changes to channel habitat functions below the ordinary high water elevation used by rearing and migrating Southern green sturgeon (*i.e.*, deep holding areas, off-channel coves, shallow water feeding areas) are of particular concern to this species.

Eulachon use of floodplains is also unknown and likely incidental. If present during overbank flows, individuals likely occupy floodplains either volitionally or non-volitionally. Eulachon eggs are non-motile and, if unanchored, move passively with river and tidal currents. Eulachon larvae have limited motility and largely are transported by river and tidal currents. As smaller fish, eulachon adults have limited swimming ability in high velocity currents and may actively seek out low velocity areas as refugia or be washed into inundated areas. Regardless, direct use and dependency on floodplain habitat is generally not recognized. Therefore, changes to channel habitat functions used for migration, spawning, and larval rearing are of particular concern to this species.

2.4.3 Floodplain Development Effects to Fish Habitat

Floodplains have a wide range of aquatic habitats that contain a diversity of habitat characteristics (*e.g.*, water permanence, vegetation, and river connectivity) (Ward *et al.* 2002b, Winemiller 2004, Wohl 2013). Modification of those characteristics can change fish use and presence. For example, modifications that reduce the inundation frequency of floodplains reduce fish access to the floodplain. “Flooding provides fishes with almost unlimited access to a range of habitats” (Winemiller 2004, p. 296). The removal of floodplain forests and channel confinement may alter a channel’s geomorphic form and reduce the availability of off-channel habitat. Disconnecting the river channel from the floodplain has negative impacts on nutrient cycling, system productivity, and biodiversity (Winemiller 2004, p. 298). The magnitude of these impacts are likely greater for temperate-seasonal rivers (Winemiller 2004, p. 298) like those that occur in Oregon.

Floodplain development diminishes the functional condition of floodplain processes that create and maintain salmonid off-channel and in-channel fish habitat (Bisson *et al*. 2009). Ward *et al.* (2002a) concluded that even fairly modest changes in development levels “could cause channel instability and should be avoided by limiting floodplain encroachment and providing adequate landscape measures and stormwater management strategies.” Floodplain development eliminates wetlands and wetland and riparian vegetation, limits channel dynamics, and reduces infiltration and modifies sub-surface flow pathways. Small increases in urbanization may result in large changes in bed load transport potential causing channel incision and streambed coarsening (Ward *et al.* 2002a, p. 16). 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 anadromous fish species and their habitat.

2.4.3.1 Floodplain Encroachment

"The NFIP anticipates and allows encroachment into the floodplain. Within specific limits, flood fringe areas may be filled and developed. As this happens, floodplain storage, which tends to attenuate downstream flood peaks, is lost, flood water travels downstream faster and creates higher downstream flood peaks. In the worst cases, the fill placed in floodplains may be 'protected' by concrete or other impervious material, further reducing the infiltration of floodwater and further increasing flood peaks. The encroachment allowed by the NFIP regulations allows a building built on the encroachment to be flooded by up to 1.0 feet as a result of the encroachment." (ASFPM 2004). Floodplain encroachment incrementally confines and channelizes rivers, converting diverse and complex habitat mosaics into a homogeneous system characterized by laminar flow in a smooth uniform channel. Lack of spatial and textural diversity in a river eliminates numerous species dependent on a physically diverse substrate for shelter, reproduction, or food. This affects all trophic levels (Mount 1995, p. 308). Straight channels are less biologically diverse than meandering or braided channels (Beechie *et al.* 2006).

Figure 2.4-1. Salmon crossing East Devils Lake Road, Lincoln County, Oregon (photo from The News Guard)

Floodplain encroachment can be caused by more than just placing fill in the floodplain. It can also be caused by structures that displace natural habitat functions and occupy otherwise available space that would be used by fish during periods of inundation. Most types of development involve occupying available space in the floodplain. Consequently, any activity that causes space to be occupied in the floodplain would have similar ecological effects (*e.g.*, constructing a new or expanding an existing structure). For example, whether an area is "filled" with compacted rock or a new garage with an upstairs apartment, modification of the existing floodplain functions would occur and the space in the floodplain available for providing habitat functions similarly reduced.

Fill (*e.g.,* levees, fill placed to elevate structures) is particularly harmful because it decreases the frequency of inundation, effectively converting seasonal aquatic areas to uplands. The argument that floodplains are not lost with filling because floodwaters are merely displaced to different locations along the river system fails to recognize the consequence of shifting flooding to other areas. Rather than inundating high quality riparian areas, wetlands, oxbows, and other off-channel habitats, floodplain development increasingly displaces floodwater to areas that include infrastructure such as roads, homes, and businesses. This infrastructure may have been built outside of the floodplain when originally constructed, but those locations can become part of the floodplain when development elsewhere in the watershed displaces flood waters to the site. FEMA specifically stated in its 1976 EIS that "[t]o the extent that fill is used to elevate strutures in flood hazard areas in compliance with the required [NFIP] performance standards, wetlands may be negatively impacted, and valley storage capacity reduced." (FEMA 1976).
In areas containing infrastructure, inundation creates secondary issues for fish. Such areas generally contain contaminants from industrial and household use including insecticides, herbicides, fertilizers, and petroleum products that, when inundated, expose fish to these hazardous materials. Another potential source of contamination is the practice of disposing of dredged materials in the floodplain, which are frequently regulated as uplands (*e.g.*, by the Corps). Materials unsuitable for in-water disposal, may be disposed of in floodplains if they are not sufficiently contaminated that hazardous material disposal is necessitated. Furthermore, inundation of developed areas increases the risk of fish entrapment in structures and artificial depressions.

Encroachment can also have significant indirect effects on water temperature and habitat suitability for salmonids. In temperate climate zones, like Oregon, floodplain inundation recharges groundwater aquifers with cold water that can return to the surface later in time and provide a cooling source (Poole and Berman 2001). Fill, dikes, levees, impervious surfaces, and other types of development that limit connections between surface water and groundwater aquifers or prevent lateral geomorphological changes that create good conditions for hyporheic exchange reduce the opportunities for hyporheic cooling (Poole and Berman 2001) that provide thermal refugia to rearing juveniles during summer. "Removing levees or re-meandering channels can ameliorate temperature increases by increasing length of hyporheic flow paths beneath the floodplain" (Beechie *et al*. 2012). This hyporheic flow can also provide warmer water during the winter that aids salmonid egg development.

Thus, whether or not the floodplain is being filled and converted to upland, floodplain development converts open floodplains into urban areas. As this conversion progresses, the development incrementally degrades the ecological, geomorphological, and hydrological processes and their associated functions that occur there.

2.4.3.2 Changes to Natural Processes and Functions

"Ecological and physical linkages among riparian forests, rivers, and their floodplains are critical to the processes that maintain their many functions" (Boyer *et al*. 2003, p. 408). "Management of the freshwater habitat of Pacific salmon should focus on natural processes and variability rather than attempt to maintain or engineer a desired set of conditions" (Bisson *et al*. 2009). There are numerous natural ecological, geomorphological, and hydrological processes that are responsible for creating, modifying, and maintaining the complex and interconnected habitats that are a healthy floodplain.

Development in the floodplain includes the placement of fill and constructing and maintaining flood control structures (*e.g.*, levees, floodwalls, bulkheads) and other infrastructure (*e.g.*, roads, utility corridors), which can confine river channels. Confinement of the channel alters the shifting habitat mosaic of dynamic floodplains and eliminates off-channel flood storage and off-channel habitat relied on by juvenile salmonids for refuge from high flows in winter/spring and high temperatures during summer. Confinement disconnects the side channels, oxbows, and off-channel areas that store floodwaters and provide refuge for juvenile salmon during floods. Confining a channel typically straightens and shortens the channel, which results in the channel needing to carry more water because the channel capacity is reduced. Channel straightening also increases channel slope much like a short-cut on a switchback trail, which results in an increase in water velocity in the reach (Ellis-Sugai and Godwin 2002). When the flood storage capacity within the floodplain itself is reduced, additional increases in peak flow and flood velocity result. These increases in flow and velocity exacerbate downstream erosion and scour. Reductions in floodplain inundation reduce the volume of groundwater recharge, which is important for maintaining instream flow and water temperature during periods of low flow and high temperature (Poole and Berman 2001).

Channel armoring and straightening, large-scale removal of riparian vegetation, and adding embankments and levees are common human modifications implemented in response to flooding that lead to direct and indirect 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, p. 297). However, changing channels and filling in floodplains are destabilizing. During periods of high water, the water confined to main channels has greater erosive force.

Dredging is frequently an indirect effect of floodplain development that contributes to channelization. Dredging is a commonly conducted activity that occurs as a "later in time" consequence of floodplain development, intended to protect structures located in developed river reaches – a method of flood control by increasing downstream conveyance. Some channels are dredged for non-flood control purposes, such as to maintain vessel access to commercial and recreational docks and wharfs. Dredging, regardless of purpose, suspends large amounts of silt and clay within the river, increasing turbidity downstream, and upstream in tidal reaches. Dredging for flood conveyance also often extracts substrates that otherwise are ideal materials for spawning (*e.g.,* cobbles and gravels). 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, p. 309). Sediment particles, along with pesticides, herbicides, fertilizers, and petroleum products, contaminate drainage waters and destroy aquatic life necessary for salmonid survival.

Hydrology. The distribution of large floods over time reflects the precipitation and runoff within a watershed, and large floods naturally occur and are necessary for the drainage of the watershed and maintenance of the river channel. The loss of floodplain habitats, including wetlands and riparian areas, and the frequently associated confinement of channels, has dramatically changed the hydrology of many Oregon streams.

Floodplain development often includes covering areas with impervious surfaces (*e.g.*, buildings, roads), which decreases stormwater infiltration and the time it takes precipitation falling on upland areas to be conveyed to stream channels. Urbanization has resulted in the loss of historical land cover in exchange for large areas of impervious surface (*e.g.*, buildings, roads, parking lots, compacted soils). Between 1780 and 1980, wetlands in Oregon declined 38% from 2.26 million acres to an estimated 1.39 million acres (Dahl 1990). In areas that have predominately subsurface flows such as western Oregon, urbanization can significantly re-route subsurface flow to predominately surface flow (Knutson and Naef 1997, p. 68). Booth and Jackson (1997) found in western Washington that when a watershed contained approximately 10% impervious area that "demonstrable and probably irreversible, loss of aquatic-system function" resulted (as cited in Ward *et al.* 2002a, p. 16). The decrease in infiltration and subsurface flow results in increased peak flow volumes, which increase the occurrence of downstream flooding and channel erosion leading to increases in channel size (Ellis-Sugai and Godwin 2002). The increased frequency of high flows also results in the scour of spawning gravels, injury of young-of-the-year salmonids that seek cover in the interstitial spaces of coarse substrates, and downstream displacement of juveniles.

The change in flow routing also impacts groundwater. With the decrease in infiltration, groundwater elevations are lower. A reduction in groundwater elevation can impact the health and composition of riparian vegetation and reduce summer base flows (Moscrip and Montgomery 1997, Poole and Berman 2001, Booth *et al.* 2002), both to the detriment of fish (Ellis-Sugai and Godwin 2002).

Floodplain development that prevents channel migration also increases water velocities in another way. By restricting the channel to a narrower migration corridor, the channel has less area available to meander across the floodplain and dissipate energy. Frequently, the result is a straightened channel with fewer bends, fewer channels, increased slope, increased flows, and increased velocity, which increases erosion and conveys flows more quickly contributing to downstream flooding.

These hydrology changes in flow and velocity will contribute to predicted baseline increases associated with development, predominately upland development, and climate change. With flood depths predicted to increase by more than 100% by 2100 in some areas in the region (AECOM 2013, p. 6-1), associated increases in river flow, velocity, and erosion are likely to increase too. These predicted flood increases are largely associated with climate change (70%), but human population growth is also a significant factor (30%) (AECOM 2013, p. ES-6).

Sediment Routing. Bank erosion is a natural geomorphic process important to maintaining functioning floodplains, and, where incised channels exist, critical to the reestablishment of river connection to floodplains. Natural bank processes and functions:

- provide a sediment source that creates riparian habitat;
- create and maintain diverse structure and habitat functions;
- promote riparian vegetation that creates bank stability and contributes large woody debris; and
- modulate changes in channel morphology and pattern (Florsheim *et al.* 2008).

Streambank erosion generally occurs during periods of high flow, typically at the outside of active meander bends. Natural rates of erosion tend to be slow and are scaled to the size of the stream system. Similarly, natural streambanks in floodplain systems tend to be low, and thus sediment inputs into the stream from the bank are moderated.

While streambank erosion is a natural process, accelerated rates of erosion or more widespread erosion due to human impacts (increased peak flow, channel incision, channel constriction, loss of floodplain connectivity, loss of floodplain forest) can cause detrimental impacts to the stream system. This is particularly true when streams are incised and banks are relatively high.

Bank hardening to prevent bank erosion is associated with the loss of geomorphic processes and riparian forest connectivity, including loss of access to off-channel habitat. Preventing bank erosion and lateral channel movement has profound impacts on the sustainability of ecological systems associated with aquatic habitats (Florsheim *et al.* 2008).

If not constructed at the time of area development, bank stabilization is a frequent indirect effect of near-channel development. This is particularly true in floodplain reaches where lateral channel movement is likely to occur. The short-term benefit achieved from protecting development by bank hardening “may come with relatively high long-term environmental costs” (Florsheim *et al.* 2008). For example, projects that rely on riprap cause damage to riparian and instream habitats (Florsheim *et al.* 2008, Fischenich 2003, Schmetterling *et al.* 2001, Beamer and Henderson 1998).

Natural banks provide complex habitat, including well rooted vegetation, undercut banks, and bank irregularities that reduce velocities and provide micro-habitat structure for aquatic species (Fischenich 2001), including juvenile salmonids and their prey. In combination with complex bank margins, riparian vegetation provides refuge from predation, and allows fish to hold in lower velocity areas, thus allowing them to expend more energy to forage, rather than to simply hold position within the water column. Channelized reaches do not provide well-established riparian vegetation or complex bank structure. Bustard and Narver (1975a) indicated that channelization “could severely alter the salmonid winter habitats” and “would probably result in reduced overwinter survival.”

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. In developed areas, riparian banks above riprap river banks frequently 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, sediment supply and deposition, and delivery of organic matter and other nutrients to the river, are all greatly diminished or lost (Boyer *et al*. 2003, Florsheim *et al.* 2008, Segura and Booth 2010). Riprap is generally uniform and lacks bank irregularities needed to provide velocity refuge for fish and their prey (Fischenich 2003). Bank hardening, even when incorporating vegetation into the design, impedes geomorphic adjustment processes like channel migration and leads to "more damaging erosion events locally or in downstream reaches" (Henderson 1986 and Arnaud-Fassetta *et al.* 2005, as cited in Florsheim *et al.* 2008). Hardening initiates "a cycle in which the increased flow strength, in combination with reduced sediment supply, leads to channel deepening" (Florsheim *et al.* 2008). A deepening channel has reduced floodplain connectivity and accelerates erosion that destabilizes the bank stabilizing infrastructure itself (Florsheim *et al.* 2008). The redirection and acceleration of erosional forces provided by hardened bank structures create a chain reaction of erosion and stabilization responses that result in the establishment of channelized river systems (Florsheim *et al.* 2008). In addition, the existence of bank infrastructure makes future restoration of a site challenging (Florsheim *et al.* 2008).

Process effects are not often considered when flood control structures (*e.g.*, levees and floodwalls) and armored banks (*e.g.*, riprap and bulkheads) are constructed or rehabilitated (Mount 1995, Bolton and Shellberg 2001). River systems are dynamic and in the absence of constraints, natural or artificial, they reach a dynamic equilibrium in which channels move in response to sediment and water volume transport (Bolton and Shellberg 2001). Natural floodplain reaches, while dynamic, tend to retain the same proportional physical features over long periods (*e.g.*, channel, bar, islands, and floodplains) (Naiman *et al*. 2010). Flood structures prevent site level habitat formation needed to maintain the diverse and complex habitats used by anadromous salmonids. The installation of these structures affects bank erosion, lateral migration, and riparian succession. They preclude floodplain connectivity, forage, and natural cover that are derived by undercut banks and backwaters. Therefore, floodplain development prevents the sediment routing processes that help to create and maintain complex and diverse habitats used by anadromous fishes.

Fluvial sorting of sediments often creates a pattern where a cap of fine sediment lays over larger-sized bed sediments (Naiman *et al*. 2010, p. 8). As channels migrate across the floodplain, gravel and cobble is stored and old gravel and cobble is recruited back to the channel where it is cleaned, deposited, and remains available for use as spawning substrate, cover for young-of-the-year anadromous fishes, or the development of invertebrate prey species.

Floodplain development increases the amount of fine sediment in river channels. This occurs as a result of upland transport of sediment to the channel, the prevention of floodplain deposition from disconnected or lost floodplains, and through increases of erosion from increased peak flows. Increased sediment alters a river's sediment load and water quality in the affected reach, including increasing turbidity. Where floodplain forests are absent, the erosion rate is frequently increased and the recruitment of in-stream wood is reduced. Reductions in in-stream wood accumulations in turn influence channel roughness, which influences fine sediment and gravel deposition in rivers and floodplains (Boyer *et al*. 2003, p. 408). Anadromous fish exposed to increased suspended sediments, under certain circumstances, sustain injury. Increased fines can reduce interstitial cover and alter the availability of aquatic prey species. The deposition of fine sediments may result in decreased salmonid growth and survival. One study found the relationship was linear with "no threshold below which exacerbation of fine-sediment delivery and storage in gravel bedded rivers will be harmless" (Suttle *et al.* 2004). Furthermore, this sediment increase may result in changes in channel form from gravel bar growth, aggradation, channel braiding, and channel avulsion.

Floodplain Connectivity. Floodplain connectivity influences the "hydrological benefits provided by floods: benefits that are central to the productivity of aquatic, riparian, and floodplain ecosystems" (Cluer and Thorne 2013). 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 juvenile salmonids. These areas feature reduced river velocities, particularly during flood events, which enable juvenile salmonids to reside and grow prior to movement downstream. Floodplain connection and unrestricted channel movement are required to create and maintain complex floodplain habitat for fish.

Anadromous fish use of floodplains requires that the fish have access to the habitat. Floodplain filling and diking directly prevent fish access to floodplains. Indirect effects of floodplain development include beaver removal and habitat loss, channel incision, and the restriction of lateral channel movement, all of which reduce the floodplain connection between the floodplain and its channel. "Unimpeded lateral connections between main channels, secondary channels, and floodplains" are essential for maintaining habitat dynamics and species responses, including fulfillment of anadromous salmonid lifecycle requirements (Bisson *et al*. 2009).

Beaver (*Castor canadensis*) enhance the connection between the floodplain and its channel. They have been found to provide a good method of restoring the floodplain connection of incised channels and of providing both winter and summer rearing areas for salmon and steelhead (Pollock *et al*. 2004, Pollock *et al*. 2007). Pollock *et al*. (2007) observed that beavers increased the active floodplain area of incised channels in eastern Oregon by five times over reaches without beavers. As valley bottom lands, particularly floodplains, are converted to developed use, beaver presence declines. Beaver dams also directly affect sediment transport by reducing water velocities and decreasing the transport capacity of the reach, which benefit the establishment of emergent and riparian vegetation (Pollock *et al*. 2007). Where beaver play an important role in the creation and maintenance of floodplains (*e.g.*, where natural floodplains have been lost to diking or fill), a decline in their presence can result in a reduction of floodplain habitat available for use by anadromous fishes.

Floodplain connectivity is also more directly influenced by land use. Channel incision is a common response to land use changes and "reduces the frequency and duration of flooding onto the adjacent floodplain" (Pollock *et al*. 2007). Incised and channelized reaches concentrate flows and prevent fish from taking refuge in the floodplain to escape high velocity currents. Channel incision also results in reductions in the height of groundwater that can cause the loss of riparian vegetation, drying up of perennial streams, and increased low-flow water temperatures (Poole and Berman 2001). The cascading effects of the loss of riparian vegetation include an increase in bank erosion due to the reduction in root structure of banks and a reduction in shade and organic inputs, further reducing the quality and quantity of available habitat.

In terms of providing salmonid habitat, all river miles are not equal. Floodplains and lateral migrating channels provide a disproportionate amount of salmon habitat. A study of the Columbia River basin concluded that, on average, laterally migrating channels have more salmon populations than confined or nonmigrating channels (Hall *et al.* 2007). Anadromous salmonid densities were highest in low to moderate gradient streams (*i.e.*, 4% or less slope over a 200-meter reach). Of the reaches with a gradient of 4% or less, Hall *et al.* (2007) found that the vast majority, 92% by river length, was classified as floodplain habitat. Furthermore, while migrating reaches comprised only 14% of the total river length, they represented more than 50% of the basin's salmonid habitat.

Laterally migrating channels in floodplains create complex habitats that are important to salmon productivity (Naiman *et al*. 2010). Channels free to move across the floodplains create a "high diversity of habitat types, a higher density of complex boundaries between environments, and greater habitat length" (Hall *et al.* 2007, p. 793, *internal citations omitted*). This habitat diversity supports a "higher diversity of species (Ward *et al.* 1999, 2002; Beechie *et al.* 2006), and increased length contributes to greater abundance and diversity of spawning and rearing niches" (Hall *et al.* 2007, p. 793).

Historically, unconfined river reaches often provided the highest quality and most diverse freshwater and estuarine habitats available for salmonid use. In these reaches, the channel migration zones (CMZs) and their associated forests were important in providing a dynamic mosaic of complex habitats. This diverse assemblage of complex habitats is created, modified, and maintained by lateral channel erosion, and the presence of large trees. Numerous beneficial functions crucial to successful salmonid rearing, migration, and spawning are provided by unconfined laterally migrating channels, in part:

- maintaining floodplain connectivity and fish access that provide velocity refugia for juvenile salmon during high flows;
- allowing fine sediment deposition on the floodplain and sediment sorting in the channel that enhance the substrate suitability for spawning salmon, invertebrate prey species, interstitial cover for young of year fish, and reduces channel and estuary aggradation;
- moderating flow velocities that reduce streambed and bank erosion, channel incision, and spawning redd scour;
- creating side channels and off-channel areas that shelter rearing juvenile salmon;
- maintaining riparian vegetation patterns that provide shade, large wood, nutrients, and prey items for fish to the channel;
- providing the recruitment of large wood and spawning gravels to the channel;
- creating conditions that support hyporheic flow pathways that provide thermal refugia during low water periods; and

- contributing to the nutrient regime and food web that support rearing and migrating juvenile salmon in the associated mainstem river channels and near-shore river plumes.

In contrast, an artificially confined river can no longer move across the floodplain and support the natural processes responsible for creating and maintaining the complex and diverse floodplain habitats that historically supported abundant and healthy salmonid populations. Channel confinement due to human alteration leads to channel incision, reduced channel connection with the floodplain, simplified riparian and aquatic habitats, floodplain habitat loss from reduced floodplain access and channel straightening, and increased deleterious effects downstream. Artificial confinement is closely correlated with development. Many of Oregon's floodplains have been lost and channels confined.

Historically the river reach between Eugene and Albany "contained the most complex river channels" of the Willamette River, having as much as 1,590 acres of river channel and 11 miles of channel length per mile of floodplain distance (Gregory *et al.* 2002d). For the period of 1850 to 1995, that reach has been greatly changed (Gregory *et al.* 2002a):

- The length of the primary channel was reduced 45% (95.8 miles).
- The total area of river channels and islands decreased 40 to 67% (9,916 to 16,682 acres).
- The area of islands and side channels decreased 70 to 80%.
- More than half of all the small floodplain tributaries and alcoves/sloughs were lost.

In the interior Columbia River basin, floodplain conversion to agricultural and urban land use has occurred in nearly half of all floodplain areas (Fullerton *et al.* 2006, as cited in Hall *et al.* 2007). These land uses "are typically associated with substantial loss of salmon habitats by leveeing and channel filling" (Hall *et al.* 2007, p. 794, *internal citations omitted*). Habitat alteration from floodplain management practices has contributed to salmon population declines. (For more information on floodplain loss in Oregon, refer to the *Environmental Baseline*, Section 2.3.)

Understanding the role of floodplain management in that decline is critical in "identifying recovery actions for these species" (Hall *et al.* 2007, p. 794). A literature review by Beechie *et al.* (2012) found restoration of floodplain connectivity, restoring stream flow regimes, and re-aggrading incised channels were the restoration activities "most likely to ameliorate stream flow and temperature changes" associated with climate change to "increase habitat diversity and population resilience." With flood heights in the region estimated to increase by up to 100% by 2100 (AECOM 2013, p. 6-1), these actions are critical to species recovery.

The impacts of even small-scale developments in floodplains have cumulative adverse effects. Imprecision in FEMA flood modeling supports assertions that each incremental increase in flood levels will be negligible. Thus, project permits are issued on an individual basis, each one resulting in another 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 salmonids to survive conditions with faster currents.

Segura and Booth (2010), studying the interrelationships between urbanization, the riparian zone, and channel morphology in western Washington, found habitat elements important to salmonid use have a strong inverse relationship with channel confinement and a strong positive relationship with riparian vegetation. The presence of bank stabilizing structures (*e.g.*, riprap) resulted in reduced large woody debris, fewer pools, less sediment storage, and a higher channel incision potential. Urbanized reaches had structures that restricted lateral movement and floodplain interaction.

Riparian Function. The existence and persistence of vegetation in proximity to streams and rivers, including floodplains, is essential to the development and maintenance of functioning riparian habitats (Boyer *et al*. 2003). Intact riparian habitat performs many functions essential to fish survival and productivity, and is critical in supporting suitable instream conditions necessary for the survival and recovery of imperiled native salmonid stocks. Vegetated riparian areas:

- Shade channels maintaining cool water temperatures and retaining dissolved oxygen levels.
- Stabilize channel banks and control bank erosion and sedimentation.
- Provide overhead cover and refuge for juvenile salmonids that reduce predation.
- Reduce current velocities along channel margins preferred by newly emerged fry and yearling salmonids.
- Contribute small organic matter (*e.g.*, leaves, twigs, grasses, and insects) to channels and support primary and secondary production.
- Capture organic matter and wood from upstream sources, increasing surface areas for primary and secondary production.
- Provide trees that fall into channels and influence river geomorphology, creating complex habitats, including pools, riffles, debris collections, backwater, and off-channel habitat that are necessary to fish for cover, holding, spawning, rearing, and protection from predators.
- Filter stormwater runoff, capturing sediments and pollutants from upslope areas and thereby assisting in water quality maintenance.
- Provide low velocity areas that allow deposition of fine sediments during overbank flows.
- Reduce flood flow velocities and create microcurrents that provide fish near-channel holding areas to rest and maintain their position in a stream reach during flooding.

Each of these functions supports the ability of a reach to contribute to the salmonid life histories expressed in those reaches.

Furthermore, riparian vegetation is both influenced by and influences its environment (Gregory *et al*. 1991, Boyer *et al*. 2003, Montgomery *et al*. 2003). While riparian functions are dependent on maintaining flow and channel dynamics associated with a healthy floodplain ecosystem (Naiman *et al.* 2010, Collins *et al.* 2012), in lowland reaches of the Pacific Northwest, mature riparian forests are integral to maintaining an anastomosing channel pattern[97] and a dynamic

[97] "Anastomosing channels are a subcategory of the island-braided channel pattern with interconnected, coexisting channels separated by terraces or floodplain islands, with erosion-resistant cohesive banks, gentle gradient, and relatively low width-depth ratios of individual channels. The distinguishing feature of anastomosing

channel-floodplain connection (Collins and Montgomery 2002, Montgomery *et al*. 2003, Wohl 2013).

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 provides 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 (Fischenich 2001).

A riparian buffer is typically recommended along waterbodies to conserve the existing and potential habitat functions provided by riparian vegetation. Generally speaking, the greatest potential occurs nearest the channel, and as one moves further away, that potential diminishes (McDade *et al.* 1990, Van Sickle and Gregory 1990, Benda *et al.* 2003). Riparian buffer recommendations vary, but some recommended buffer widths extend from the channel to a distance equal to the maximum tree height (*i.e.*, site-potential tree height), the outer edge of the 100-year floodplain, the channel migration zone (CMZ), and the small valley areas potentially flooded by beaver dams (FEMAT 1993, Knutson and Naef 1997, Pollock and Kennard 1998). As cited in Hall *et al.* (2007, p. 794):

> Restoration or conservation of riparian buffers in floodplains within laterally migrating channels should consider the potential for channel movement within the buffer area (Beechie *et al.* 2000, Stromberg 2001). Newly established riparian areas along floodplain channels may be significantly eroded during floods, and failure to anticipate lateral migration could result in loss of riparian functions if insufficient buffer width is restored or preserved (Bisson *et al.* 1997, WDNR 2002, Rapp and Abbe 2003).

Riparian vegetation removal and the frequently associated placement of fill in the floodplain affect channel and floodplain dynamics. Vegetation removal destabilizes streambanks making them more vulnerable to erosion (Ellis-Sugai and Godwin 2002). Floodplain fill reduces the area available for flood water storage and reduces the cross-sectional area of a floodplain. Due to channel and floodplain dynamics, this means more water must travel through a smaller opening. Therefore, flow volume and height increase, which means other areas in the impacted reach and downstream flood more often, and sites that would not have previously flooded are vulnerable to inundation.

The removal of riparian vegetation facilitates changes in channel form and modifies in-channel processes. The loss of the bank root structure reduces the ability of the bank to resist the erosive

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channels is that hydraulic and sediment transport dynamics of each channel are independent of the other channels. Anastomosing channels are generally stable in the short term with cohesive banks, low width to depth ratio channels, and gentle channel gradient that exhibit little or no lateral migration. The dominant channel migration process is avulsion." (Washington Department of Ecology, *http://www.ecy.wa.gov/programs/sea/sma/cma/page17_appendix.html*.)

forces of existing water velocities and thus destabilizes the bank. Consequently, often channel widening occurs following vegetation removal as banks are eroded. This in turn increases the channel capacity and reduces the ability of water in the channel to transport larger particles. As a result "coarse and relatively immobile mid-channel bars tend to force flow against the banks, further increasing erosion and channel widening" (Cramer *ed*. 2012, p. 2-22).

As channel capacity increases due to a widening channel, the channel becomes increasing more disconnected from the floodplain. In channels where banks remain naturally or artificially stable, channel incision occurs, disconnecting channels further from their floodplains (Cramer *ed*. 2012, p. 4-4). These disconnected channels result in associated increases in water velocity that exacerbate channel erosion.

Riparian vegetation is also at risk of being lost when groundwater elevations decline due to reduced aquifer recharge or channel incision. When groundwater declines to below the root zone of riparian vegetation, the riparian community is lost and typically replaced by a community structure that provides less value to fish.

Channel changes that result from riparian vegetation removal are further complicated when considering future flow changes that result from floodplain development. The increasing flow volume and height that result from floodplain development may contribute to bank erosion facilitated by vegetation removal. This velocity increase, either independently or in combination with increases associated with widening channels, leads to chronic and widespread erosion of streambanks. The increasing high flows and velocities can remove riparian vegetation outright, or cause vegetation removal as a result of bank erosion. The loss of riparian vegetation is particularly a concern where land use practices have retained only narrow riparian corridors. The Marys River is an example where the river migrated through a narrow riparian buffer leaving the sections of the bank devoid of vegetation (Ellis-Sugai and Godwin 2002).

Furthermore, as part of development activities, riparian vegetation is often not replaced. Instead, immature trees, non-native landscaping, structures, and impervious surface frequently replace the previously existing vegetation. In cases where removal involves non-native or invasive vegetation that provide a lower value to habitat function, replacement with native vegetation may be beneficial in the long term. However, regardless of whether existing vegetation is native or non-native, removal and replanting often delays development of certain habitat functions. Such temporal effects are common when longer lived woody plants, such as trees, are removed and replanted. For example, the removal of a 30-year old cottonwood tree and planting a 5-year old sapling constitutes a 25-year delay in the development of habitat functions provided by a mature tree (*e.g.*, shade, LWD). Maintenance of certified levees often requires removal of riparian vegetation. In these ways, development degrades riparian functions (Bolton and Shellberg 2001).

Flooding is needed to maintain riparian ecosystems (Richter and Richter 2000, Dykaar and Wigington, Jr. 2000). Studying cottonwood colonization patterns in the Willamette River valley, Dykaar and Wigington, Jr. (2000) noted that human impacts in the floodplain were limiting riparian forest renewal. These human impacts disrupt the fluvial geomorphic regime, "the principal organizing force creating and maintaining floodplain and riverine habitat," and have modified the Willamette River from a multichannel river to a more single-channel configuration

(Dykaar and Wigington, Jr. 2000, p. 101). The outcome of these changes to the geomorphic regime is that cottonwood regeneration is occurring at a fraction of historic levels, and is insufficient to replace existing mature stands. Riparian forest regeneration is more than a function of planting or reconnecting old river channels. Riparian forest sustainability necessitates undertaking actions that re-establish, conserve, and maintain a dynamic river channel within the floodplain. A dynamic channel provides the mosaic of habitat conditions that allow cottonwood colonization. Consequently, the degraded condition of the Willamette Valley's riparian function is likely to continue to degrade in the foreseeable future.

While development pressure likely elevates the risk to riparian function in the Willamette Valley, floodplain development in other regions of Oregon similarly threaten riparian function because development tends to occur in broad, low-gradient areas where floodplains and migrating river channels are found. In these same areas, riparian forests have evolved in conjunction with the periodic inundation and disturbance associated with migrating channels in the floodplain. Therefore, artificially maintaining a static channel (*e.g.*, levees, riprap, fill, infrastructure development) will modify the environmental conditions that allow dynamic floodplain forests to survive and result in the degradation of riparian function in the affected floodplains.

Forage. 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 (Fischenich 2001, Florsheim *et al.* 2008). Roots uptake elements from the soil and bedrock, then deliver them to the stream through the process of decay (Fischenich and Copeland 2001).

Roots, stems, logs, and organic debris such as leaves provide colonization sites through increased surface area, and velocity refuge for algae and macro invertebrates (Fischenich 2001, Florsheim *et al.* 2008). Aquatic macroinvertebrate diversity and density are higher in streams with wider riparian areas (Newbold *et al*. 1980, as cited in Florsheim *et al.* 2008). Organic matter delivered from site-level riparian areas, or accumulated within edge habitat from upstream sources, is a food source for macro-invertebrates (Fischenich 2001). In floodplain channels, which frequently have a high fluvial transport potential, floodplain forests are an important source of immobile wood that provide, among other functions, forage species colonization sites. In the lower Elwha River, Pess *et al.* (2008) found mature floodplain forests were the primary source of large, immobile wood in floodplain channels. Riparian vegetation is a vital source of energy for invertebrates and fish (Fischenich 2001). The abundance of aquatic invertebrate species that support salmonid growth and maturation, is reduced by placing fill in floodplains, removing riparian vegetation, and confining channels.

Floodplain disconnection also affects the aquatic food web, including the estuary (Winemiller 2004). The inundation of vegetated floodplains provides macrodetritus to estuaries, a base-level food source. The reduction or elimination of floodplain inundation results in a corresponding reduction in macrodetrital inputs. This reduction in floodplain inundation and macrodetrital inputs has been associated with reductions in flow, the loss of floodplains (*e.g.*, fill, revetments and levees), and habitat simplification (NMFS 2011d, p. 3-12). In the Columbia River estuary, floodplain disconnection has reduced macrodetrital inputs by approximately 84% (NMFS 2011d, p. ES-4). The reduction reduces the food sources in the estuary for juvenile salmonids, which may result in their "reduced growth, lipid content, and fitness prior to ocean migration" or their "need to reside longer in the estuary" (NMFS 2011d, p. 3-12).

Concurrent with reducing macrodetrital inputs, development (*e.g*., urban and agricultural) also contributes to increasing microdetrital inputs (*e.g.*, phytoplankton) (NMFS 2011d). This substitution of a macrodetrital food web for microdetrital food web can alter estuary productivity (NMFS 2011d, 3-13). In the Columbia River estuary, the food web was historically well distributed throughout the estuary, including shallow areas. Now the food web is concentrated in the in the middle of the river, which is less accessible to fish that use edge habitats (*e.g*., ocean-type juvenile salmonids) and favors pelagic fish (*e.g.*, shad) (NMFS 2011d, 3-13).

Water Quantity. Human development increases the need for water and increases the volume of stormwater runoff resulting in lower low flows and higher peak flows. The degree to which floodplain development is responsible for increased water withdrawals is relative to a community's total development, including whether the community has a growing or declining population. Other factors include the particular water source and whether the development is on a municipal water system. Regardless of the details, over time, floodplain development is likely to equate to an increased need for water, which will result in a corresponding reduction in water quantity either directly from surface waters or indirectly from groundwater sources. The significance of the reduction in quantity is dependent on the specifics in each case and cannot be described exactly, but reductions in water quantity during low flow periods are likely to further reduce flows and adversely affect water quantity by increasing water temperatures and reducing areas of hyporheic flow (Poole and Berman 2001), which function as thermal refugia for rearing fish. High water temperatures typically also result in lower dissolved oxygen levels, further degrading refuge habitat.

In addition to reducing low flows, development converts permeable lands into impermeable lands, reducing infiltration and increasing stormwater runoff to surface waters, thus creating a greater flood hazard (Leopold 1968, Knutson and Naef 1997, Booth *et al.* 2002). Another significant issue regarding stormwater routing is that development of floodplains frequently increases the hydrologic connection between developed upland areas and surface waters, meaning that more runoff from upland is directly conveyed to area waterways much more often. Consequently, development in both uplands and in floodplains contributes to increases in water quantities during peak flows, which increases the height and frequency of flood events.

Water Quality. Floodplain development affects water quality. In part, because development removes vegetation, confines channels and prevents lateral channel migration, increases stormwater runoff, and provides pollutant sources.

A variety of water quality changes are associated with vegetation removal and channel confinement. Removal of riparian vegetation increases water temperatures and increases turbidity (Poole and Berman 2001). Channelization that occurs as a result of the channel being confined by fill placed in the floodplain results in increased chronic erosion of stream channels and banks. The eroded sediment particles cause turbidity in the stream that impacts salmonid prey species and the ability of salmonids to detect predators. In spawning reaches, the deposition of suspended sediments adversely affects substrate porosity. Hyporheic processes that provide cold water refugia for adult and juvenile anadromous fishes during low-flow periods are lost when impervious surfaces intercept stormwater and reduce summer groundwater elevations. Development that prevents lateral channel movement and sediment sorting processes also results in the loss of habitat forming processes that create and maintain hyporheic connections that provide summer cold-water refuge in alcoves (Poole and Berman 2001).

Development in the floodplain, and elsewhere, creates point source and nonpoint source pollution pathways throughout the watershed. Proximity of the floodplain to systems supporting anadromous fishes heightens the effects of degraded water quality on fish and fish habitat. Sediments washed from the urban areas and deposited in surface waters include trace metals such as copper, cadmium, zinc, and lead (NMFS 1996).

Pollutant loading in surface water is widely attributable to stormwater runoff (Pew Oceans Commission 2003, U.S. Commission on Ocean Policy 2004, McCarthy *et al*. 2008). "While progress has been made in reducing point sources of pollution, nonpoint source pollution has increased and is the primary cause of nutrient enrichment, hypoxia, harmful algal blooms, toxic contamination, and other problems that plague coastal waters" (U.S. Commission on Ocean Policy 2004, p. xxxiii). The increasing amount of nonpoint pollution from urban, suburban, and agricultural areas has been identified as the "greatest pollution threat to our oceans and coasts" (Pew Oceans Commission 2003, p. 60) and "one of the most serious impacts on oceans and coastal areas" (U.S. Commission on Ocean Policy 2004, p. 110). It has been estimated that oil running off streets and driveways and transported to the oceans equals 10.9 million gallons every eight months (NRC 2002a, as cited in Pew Oceans Commission 2003, p. 4). Coastal rivers transport these pollutants from source areas, like developed floodplains, to the ocean.

EPA (2002) identified a wide range of pollutants associated with urbanization which contribute to the degradation of receiving waters. Floodplain development is essentially the progressive conversion of an area from a natural to an urbanized state. The EPA-identified pollutants associated with urbanization 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 anadromous fishes. 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, recent occurrences of pre-spawn mortality (PSM) in coho salmon have heightened our concern about the effects of stormwater quality on salmonids. Beginning in the late 1990s, researchers began conducting fall spawner surveys to evaluate the effectiveness of urban stream restoration efforts. These surveys detected a surprisingly high rate of pre-spawn mortality among migratory adult coho salmon over multiple years and across several drainages (20% to 90%) (Spromberg and Scholz 2011). Although the precise cause of PSM in urban streams is unknown, the current weight-of-evidence suggests that coho salmon pre-spawn mortality is "caused by toxic urban stormwater runoff" (Spromberg and Scholz 2011). Spromberg and Scholz (2011) constructed life history models to estimate the impact of pre-spawn mortality on coho salmon and found localized population extinctions between 8 and 115 years. They went on to state that while other population sources reduced the extinction risk, as more populations become affected the source population productivity would decline. Spromberg and Scholz (2011) concluded that "the models demonstrate the potential for rapid losses from coho populations in urbanized watersheds" and that the models "likely underestimate the cumulative impacts of nonpoint source pollution on wild populations." Carrying this analysis forward, a recent study notes that "if urban run-off is killing adult coho, ongoing regional development pressures may present an important obstacle to the recovery of coho ESUs, including those designated as threated (Lower Columbia River) or a species of concern (Puget Sound) under the US Endangered Species Act" (Spromberg et al 2015).

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 salmonids). When benthic invertebrates are exposed to and assimilate many of these pollutants, they can become sources of contamination for salmonids that prey on them. Perhaps more importantly, declining numbers and diversity of invertebrates provide less food for salmonids at critical times in their lives. Anadromous fishes are exposed directly, and indirectly, to stormwater runoff discharging from parts of the floodplain that are developed. In most instances, this stormwater contains various pollutants that are detrimental to fish. The exposure to some pollutants may not result in adverse effects. In other cases, exposure results in injury or death. More commonly, the result is a sub-lethal effect that causes some type of impairment or reduction in health or fitness. 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 floodplain development, floodwaters are increasingly displaced to areas that include infrastructure such as roads, homes, and businesses, which increase the pollutant loading in streams. Whether the source is stormwater runoff, direct inundation during a flood, or both, the resultant contamination likely consists of many different pollutants, many of which have as yet undetermined synergistic effects among juvenile and adult anadromous fishes.

Septic systems are frequently associated with development in areas lacking municipal sewer systems. While FEMA's floodplain regulations include restrictions regarding siting and design of buildings, they do not regulate the siting of septic systems. Flooding of septic systems releases untreated effluent to surface and ground waters (CPW 2009). Also, the EPA indicates that up to 25% of septic systems fail, releasing their contents into the soils and eventually leaching into nearby surface waters (CPW 2009). Septic system effluent contains numerous contaminants that are detrimental to water quality (*e.g.*, pharmaceuticals, synthetic hormones, metals, cleaning agents, detergents).

2.4.3.3 Summary of Floodplain Development Effects on Fish Habitat

In summary, floodplain development directly and indirectly affects the quantity and quality of off-channel and in-channel anadromous fish habitat used for migration, spawning, and rearing. Floodplain development incrementally confines and channelizes the river, which reduces the amount of both off-channel and in-channel habitat available for use by anadromous fishes.

Development also alters the natural processes and functions that support the freshwater and estuarine life stages of anadromous fishes. Hydrology, sediment, floodplain connectivity, riparian, forage, water quantity, and water quality are adversely affected by floodplain development. FEMA's 1976 EIS acknowledges that "[a]s man-made development is introduced into the natural flood plain, it may so encroach upon the watercourse as to retard its capacity to pass flood flows. The effects…will be to increase flood crests, decrease velocities, and subject additional areas to flooding" (FEMA 1976).

2.4.4 Effect of the NFIP on Floodplain Development

The ESA requires that FEMA use its authorities to further the conservation of listed species (section 7(a)(1)) and ensure its actions are not likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat (section 7(a)(2)). Many parts of the action as proposed by FEMA in its BA seem to shift the obligation to comply with section 7(a)(2) from FEMA onto communities participating in the NFIP. Although cooperation of participating communities is essential to implementing the NFIP in a way that avoids jeopardy to listed species, it is ultimately FEMA's responsibility under section 7(a)(2) to exercise its NFIA authority in a manner that protects listed species and their habitats. This consultation focuses extensively on the effects of FEMA's mapping program and regulatory floodplain management criteria, because FEMA has broad discretion in carrying out its mapping functions and in establishing the criteria. Moreover NMFS finds persuasive the reasoning of the Eleventh Circuit Court of Appeals in its decision in *Florida Key Deer v. Paulison*, 522 F.3d 1113 (11th Cir. 2008): "Here, FEMA has the authority in its administration of the NFIP, as discussed above, 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." By way of example, information provided by DLCD analyzing potential floodplain development in Benton County, relying on existing code provisions that comply with FEMA's regulatory floodplain management criteria, indicates that over the course of 20 years a "high rate" of development would result in a total of 591 acres of floodplain loss.

Table 2.4-1. Estimate of potential floodplain loss for Benton County

	20-year estimate of potential floodplain loss for Benton County in acres
Rural residential (With allowed partitions based on zone, no lot line adjustments)	115
Rural industrial (all)	60
Rural Commercial (all)	3
Farm structures	38
Urban (65% of all incorporated floodplain area)	375
Total	591
1% loss benchmark	587.5

Source: Amanda Puntun, DLCD, by email dated December 3, 2014. 1% loss benchmark per estimate of take, September, 2013 draft.

"While the NFIP is widely perceived to encourage safer floodplain construction, it is seldom perceived to inhibit floodplain development, particularly in coastal areas and high-growth communities. In these locations, especially, the NFIP is often perceived to remove economic barriers to development" (Rosenbaum and Boulware 2006). In fact, merely delineating the regulatory floodplain likely encourages development in the topographical or "actual" floodplain. "Floodplain regions just outside of the Special Flood Hazard Area (SFHA) may be unregulated, even though their flood risk is only marginally less than their neighbors in the SFHA. Floodplain managers should be aware that the 1%-chance flood is an arbitrary criterion and its estimate is uncertain, particularly with climatic change. Uncertainty in the estimate of the 1%-chance flood could mean that residents outside of the SFHA actually live in an area where flood risk is higher than a probability of 1% in any year" (Olsen, 2006). "Most flood inundation maps are developed by computer modeling, involving hydrologic simulation to estimate the 100-year flow, hydraulic simulation to estimate water surface elevations, and terrain analysis to estimate the inundation area (internal citations omitted). Despite the recent advancements in the form of better computational techniques and the availability of high resolution topography data, this flood inundation modeling approach has several limitations. For example, while a detailed hydrologic model can be developed to estimate the 100-year design flow, the uncertainty in the rainfall and discharge data (internal citations omitted) is generally ignored when calibrating a hydrologic model" (Sagwan and Merwade 2015). A related concern is identified by the National Academy of Sciences: "current NFIP methods for setting risk-based rates do not accurately and precisely describe critical hazard and vulnerability conditions that affect flood risk for negatively elevated structures, including very frequent flooding, a longer duration of flooding, and a higher proportion of damage from small flood events. In addition, the PELV and DELV curves [water surface elevation probablility function, and depth percentage damage function, respectively] have not been updated with modern data." (NAS 2015).

In addition, the hard demarcation of an SFHA imparts a false sense of security that developing outside of the SFHA will ensure flooding will not occur. Because development outside of the SFHA is not subject to FEMA's regulatory criteria or the mandate to purchase flood insurance, development clusters around the edge of the SFHA boundary (ASFPM 2004). The fact that approximately 35% of NFIP damage claims in Oregon occur outside of the SFHA suggests that development is occurring in areas that actually are within the 100-year floodplain, but were not mapped as such. This is likely due both to an increase in flood risk for areas outside the mapped SFHA as a result of development or climate change (*e.g.*, when flood waters are displaced due to floodplain development, when flood elevations increase due to changes in hydrology or stormwater routing), and to errors in the SFHA delineation (*e.g.*, inaccuracies in elevation modeling or mapping).

Furthermore, when people want to develop within the SFHA, FEMA provides a safety net by offering insurance and guidance on how to elevate development to the estimated flood elevation. FEMA requires the raising of development (structural elevation) to or above the estimated base flood elevation, and the state of Oregon requires structural elevation 1 foot above the base flood elevation. Because the floodplain delineation is not precise and is retrospective, and flood elevations are known to be increasing substantially due to development in watersheds and climate change (AECOM 2013), a large proportion of new development along the floodplain edge and elevated within the floodplain is likely to experience a flood.[98] The Government Acountability Office also noted has that "flood insurance policyholders who build to NFIP standards–which are based on current flood risk and not on long-term risks–may unintentionally increase their vulnerability to climate change as sea-level rises" (GAO 2014). FEMA, while it maps the 500 year floodplain, has not established regulatory standards for these locations, meanwhile "[f]lood losses are increasing because more people are living in harm's way; more expensive homes are being built in the floodplain [Michel-Kerjan, 2010]; and development in watersheds and climate changes, such as sea level rise and more frequent heavy rainstorms [IPCC, 2012; Melillo et al., 2014], are increasing flood risk (the likelihood and consequence of flooding) in some areas" (NAS 2015). In this manner, the NFIP as administered by FEMA contributes to: (1) the loss of periodically occupied anadromous fish habitat; (2) the exposure of listed fish directly to the adverse effects associated with that development during flooding (*e.g.*, contaminants, entrapment, impingement, reduced refugia); and (3) degradation of in-channel and off-channel habitat quantity and quality during both flood and non-flood periods.

In 2004, the Association of State Floodplain Managers (ASFPM) issued a report identifying numerous shortcomings with FEMA's use of the 1% annual-chance flood standard. In part, these shortcomings included (ASFPM 2004):

- "Flood losses are rising, perhaps for reasons related to the 1% annual chance standard."
- "Because of the standard, in many parts of the country development has tended to cluster just outside of the 1% floodplain boundary, an area not free from flood risk and possibly subject to considerable risk now that watersheds have been urbanized and runoff thereby increased."
- "Natural floodplain resources and functions are ignored in the delineation of the 1% chance floodplain."
- "There is a 'gray area' of uncertainty surrounding the calculation and the mapped floodprone zone, resulting from inadequate data, lack of consideration of changing and future conditions within watersheds, and oversimplified assumptions. Because of this uncertainty, there is considerable doubt whether management practices are actually being applied to the entire 1% floodplain."
- "The 1% annual chance standard has not lent itself to ready integration with water-related programs based on other types of standards, such as those for water quality or resource management."
- "The 1% annual chance standard is inadequate when applied to levees."

The report also offered recommendations for addressing these shortcomings. In particular, one recommendation included enhancing the 1% standard approach to improve:

> policies, regulations, and implementation of the 1% annual chance standard to make it more accurate and effective at achieving its goals. The most badly needed [*improvements*] are integrating the protection of natural resources and functions;

[98] Despite the purpose of the NFIA to provide insurance as a complement to preventive and protective measures (42 U.S.C. 4001(a)(3)), "the number of flood disaster declarations has increased over the past 60 years, from an average of about 8 per year in the 1950s to a record high of 51 in 2008 and 2010"(NAS 2015).

> eliminating the 1-foot rise allowed in the floodway; using future-conditions hydrology; and establishing a new levee standard.

(ASFPM 2004, italicized text added.). It is also useful to consider how local communities understand the role of the NFIP. A recent environmental impact statement provides some insight:

> Floodplain policies are set at a national level and implemented through national, state, and local regulations. Fill and development in floodplains is generally allowed as a matter of national policy, not policy created by the City of Monroe. Administered by FEMA, the National Flood Protection Insurance Program (NFIP) implements the National Flood Insurance Act which sets regulation frameworks for state and local governments to follow. Currently, development within floodplains is allowed if the development is raised at least one foot above base flood elevation, applicable permits/regulations are acquired and any required mitigation is achieved. The requirements of 44CFR 60.3 are used in evaluation of the subject proposal [City of Monroe 2013].

The three discretionary elements of the NFIP (floodplain mapping, regulatory floodplain management criteria, and the CRS) directly and indirectly lead to floodplain development and change in floodplain environments. Current implementation of the NFIP contributes to the reduction and elimination of ecological processes and habitat functions important to ESA-listed salmonids (NMFS 2008c). Acknowledging this point, FEMA has proposed to modify implementation of the NFIP in Oregon to reduce program impacts to ESA-listed species and their designated critical habitats. The following sections describe how FEMA's proposed action is likely to continue to lead to the environmental outcomes described above and how these outcomes adversely affect ESA-listed species and their designated critical habitat in Oregon.

2.4.4.1 Effects of the Flood Mapping Program

FEMA has promulgated regulations governing the production and revision of flood maps. These flood maps delineate the approximate spatial extent of the 1% annual-chance floodplain (*i.e.*, SFHA). This delineation in turn identifies FEMA's jurisdiction regarding floodplains and the area where FEMA's regulatory floodplain management criteria apply (44 CFR 60.3). The mapping regulations also provide for the revision of SFHA boundaries following human alterations. Alterations may include, among others, the placement of fill to elevate property above the base flood elevation, habitat restoration that reconnects rivers to the floodplain, and the construction, operation, and maintenance of levees. Activities that modify the SFHA boundaries trigger the map revision process. With the exception of map amendments that correct mapping errors and habitat restoration activities that can increase the floodplain area, map revisions typically remove land 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. 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, FEMA's NFIP mapping process, especially the map revising activities, contribute to human alteration of the floodplain by incentivizing the addition of fill to create "uplands" where development can occur without triggering the NFIP's building standards or insurance requirements. This in turn adversely affects the habitat and habitat forming processes that would otherwise 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 development (Task Force on the Natural and Beneficial Functions of the Floodplain 2002, as cited in NMFS 2008c).

Mapping Accuracy. FEMA's floodplain mapping serves to identify the spatial extent of the fluvial system and the area of periodic aquatic habitat. This area is likely to have significant influence on the quantity and quality of aquatic habitat on site and downstream during both flood and non-flood periods. The mapped floodplain also identifies the off-channel area periodically occupied by anadromous fishes. FEMA's Flood Insurance Rate Maps (FIRM) are also "used to determine flood insurance requirements for residents and where floodplain development regulations apply in a community" (FEMA 2015). Consequently, in many communities, floodplain mapping identifies both the spatial extent of fish habitat and the development activities that may occur there.

Flood mapping influences how and where development occurs. As indicated earlier in this document, development that occurs in the SFHA is required to adhere to the regulatory floodplain management criteria and development outside the SFHA is not. When flood maps, and the flood insurance studies upon which they are based, indicate that areas lay outside of the 1% annual-chance floodplain (or the 0.2% annual-chance floodplain in terms of critical infrastructure), it conveys a sense of safety from inundation, and development often will cluster along the margins, including upland areas at risk of recruitment into the floodplain by flood-related erosion (*e.g.*, lateral channel migration). This clustering of development along the floodplain margin may be particularly pronounced where FEMA has delineated a floodway. In this situation, FEMA allows the flood fringe, the floodplain area that is outside of the floodway, to be completely developed. FEMA's regulatory floodplain management criteria only require the development be elevated to the estimated base flood elevation.[99] Thus, whether developing in the floodplain and elevating a structure, or developing on the margin of the delineated floodplain, the estimated base flood elevation needs to be extremely accurate to avoid structural inundation at the time of construction and in the future.

Consequently, accurate flood elevations and associated flood maps are important to anadromous fishes because they influence development both inside and outside of the floodplain, which has direct and indirect effects on the quantity and quality of fish habitat. FEMA generally does not map flooding sources with contributing drainage areas less then 1 square mile and/or with an average flood depth of less than one foot (FEMA 2015b), which omits from the SFHA areas that may have significant habitat values that derive in part from the patterns of inundation. Furthermore, as noted by L. Douglas James of the National Science Foundation, "the 1% flood at any location is a moving target. Its magnitude changes with climate, tributary land use, upstream channelization, altered detention or retention storage, levee conditions, etc. However, once it has

[99] The State of Oregon requires structural elevation to base flood elevation plus 1 foot.

been used to determine a peak flow or a peak stage as a basis for regulation, the numbers are not easily changed. The result is that information on the 1% flood available to floodplain occupants is based on conditions at some prior time when a study was made and, for reasons given above, likely to underestimate risks" (ASFPM 2004). Adding to overall concerns of flood mapping accuracy is this finding by the National Academy of Sciences in 2009: "The largest effect by far on the accuracy of the base flood elevation is the accuracy of the topographic data. The USGS National Elevation Dataset (NED), developed from airborne and land surveys, is commonly used in flood map production, even though the elevation uncertainties of the NED are about 10 times greater than those defined by FEMA as acceptable for floodplain mapping" (NAS 2009).

FEMA data indicates that approximately 35% of NFIP claims in Oregon are paid for damages outside of the SFHA.[100] The high percentage of non-SFHA claims has been explained by FEMA as predominately a factor of inaccurate delineations of the 1% annual-chance floodplain, or SFHA. This means that floodplain habitat has frequently not been accurately identified. The inaccuracy of floodplain delineations has several potential causal factors:

- the base flood elevation is an estimated value;
- steady state models over simplify conditions in most overbank events;
- many existing floodplain maps are based on imprecise topographic data;
- ongoing development is continually changing the 1% annual-chance flood elevation;
- floodplain maps typically do not capture reasonably anticipated future conditions; and
- floodplain maps for non-coastal zones only reflect the area of inundation and omit eroision-prone areas.[101]

Base Flood Elevation. The base flood elevation (BFE) is not the actual 1% annual-chance flood elevation. It is "a hypothetical construct derived from a statistical analysis of infrequent hydrologic events" (Galloway *et al.* 2006, p. 130). Among the statistical limitations encountered when estimating the flood height are the availability of water level data and the length of the data record (Ellis-Sugai and Godwin 2002). In many instances, the 100-year flood elevation is based on data from a much shorter period of time (*e.g*., decades). For example, a 25-year gage record might have an 85% confidence level, which would mean the FEMA-designated flood height may be off by 15% (Ellis-Sugai and Godwin 2002).

Our understanding is that, as a statistical estimate, FEMA's modeling selects the average modeled base flood elevation value (Wetmore *et al*. (2006, p. 18). While it is also our understanding that at least some model outputs (*e.g.*, HEC-RAS) include a range, the FIS does not provide range information. The actual 1% annual-chance flood elevation could be anywhere within the range. Without providing range information (or a confidence interval), the appropriate level of confidence with that estimate is poorly understood. Consequently, the mean value becomes a hard line where it is assumed that on one side flooding will occur and on the other it will not. Such a clear distinction is seldom the case and in some instances a greater degree of caution may be warranted (*e.g.*, considering effects to ESA-listed species). Depending on the vertical relief of a particular site, if the elevation range is narrow, then there can be relatively

[100] National Flood Insurance Program, BureauNet (*http://bsa.nfipstat.fema.gov/reports/reports.html*). Claims by Occupancy Type/State, as of January 31, 2013. Accessed on March 13, 2013.

[101] Coastal flood zone mapping considers inundation and erosion.

high assurance about where floodplain habitat occurs in the area. However, if the range is large, then there may be considerable uncertainty about whether the development site is actually outside of the floodplain and whether the development should be subject to FEMA's regulatory floodplain management criteria.

Roughness Coefficient. Roughness coefficients are hydraulic modeling parameters that estimate the relative level of flow impedance and vary with surface roughness, changes in vegetation, channel size, shape, alignment and irregularity, erosion and deposition, obstructions, and stage and discharge (Wright 2007). Floodplain roughness, a component of a roughness coefficient, is a factor that directly affects velocities of flood flows, which in turn affects duration and elevation of floods. Due to the infrequency of FEMA's flood map updates, riparian and floodplain vegetation conditions can change considerably over the time that a map is in effect, particularly in areas that have been disturbed, or which have young plantings, such as mitigation or restoration areas. For this reason, inundation modeling which does not incorporate maximum potential roughness associated with maturation of vegetation is likely to underestimate both the flood depth and the areal extent of the base flood, thus reducing potential regulatory protections for these areas.

Hydraulic Modeling. To reduce mapping error, FEMA proposes to issue modeling guidance, including the use of unsteady state and multidimensional modeling when delineating flood zones. However, steady state modeling would remain an acceptable approach where flows are assumed to only travel downstream. This approach uses a simplified model that does not capture complex overbank flow process (FEMA 2010b). Knight and Shiono (1996), as cited in Ward *et al.* (2002a, p. 9), state:

> Whereas inbank flows may be treated as if they were predominately one-dimensional flows in the streamwise direction, despite known three-dimensional mechanisms being present in all flows, overbank flows must be treated differently as certain three dimensional processes begin to be especially important, particularly the main channel/floodplain interaction.

Steady-state models that rely on simple resistance equations "at best provide useful discharge and flow stage estimates for uniform flow in straight main channels" (Ward *et al.* 2002a, p. 9). Therefore, it appears flows that overtop the bank should not rely on steady-state models. Applying steady-state models to more complex situations such as overbank flows in floodplains is problematic. In part, this is because overbank flows exhibit a large relative spatial increase with little change in cross-sectional area, which results in slower over-bank flows relative to the channel (Ward *et al.* 2002a).

Use of the steady state model has been identified as a "significant" shortcoming that, together with use of the existing discharge rate, likely underestimates the base flood elevation and the extent of the SFHA (Galloway *et al.* 2006). Other than the criterion that "flows are assumed to only travel downstream," we are unclear under what circumstances FEMA proposes to apply steady-state modeling to delineate floodplains. Flows that overtop their banks would appear in many instances to require more than one-dimensional, steady state modeling. Therefore, we are concerned that floodplain habitat will not be accurately delineated and development could occur in areas that are below the actual base flood elevation without being subject to FEMA's regulatory floodplain management criteria. To the degree the floodplain management criteria and the cost associated with the insurance mandate discourages development in the floodplain, lack of these criteria and costs, together with an erroneous sense that the lands are "safe from flooding," would result in development and corollary adverse effects to fish and their habitat as explained in the previous section.

***Vertical Data*.** Many floodplain maps were created using imprecise vertical information (*i.e.*, topographic data). Flood maps based on 30-meter Digital Elevation Model (DEM) topographic data are "about an order of magnitude less accurate than is needed for floodplain mapping" (Maidment 2009, p. 4884). Map accuracy is greatly improved when lidar data is used. In North Carolina, a study concluded that the range of uncertainty using lidar data was approximately 1 to 3 feet. That same study concluded that even a 1-foot vertical uncertainty translated to "a horizontal uncertainty for determining the base flood elevation in the location of the floodplain boundary of from 8 feet in the mountains to approximately 40 feet in a flat coastal plain area" (Maidment 2009, p. 4884). Improved topographic data improves floodplain mapping accuracy, but even with improved data (*e.g.*, lidar) the lack of vertical precision can translate into substantial differences in the lateral extent of the SFHA.
Recently FEMA has taken steps to incorporate more accurate topographic information (*e.g.*, lidar) when revising FIRMs, but it is our understanding that such information is not required even when available. Consequently, in many instances new FIRMs may continue to perpetuate the use of imprecise topographic information, particularly in areas with less development. In many instances, these less developed areas likely support remnant floodplain habitat functions important to salmonids. This means development may occur without accurately identifying the extent of floodplain habitat and accounting for the functions that habitat provides to listed fish species.

***Future Conditions*.** The models currently used by FEMA do not account for anticipated future changes in the base flood elevation and do not consider increased runoff from developing watersheds, floodplain encroachment that occurs under the current regulations, changes in sea level, changes in wave height, or climate change (Larson and Plasencia 2001, Ruggiero 2013). This despite FEMA's documented understanding that ongoing development is continually changing the 1% annual-chance flood elevation, usually increasing the height. FEMA's future conditions final report, entitled "Modernizing FEMA's Flood Hazard Mapping Program: Recommendations for Using Future-Conditions Hydrology for the National Flood Insurance Program," prepared in November 2001, states that "[w]atershed development can include hydrologic as well as hydraulic modifications. The changes in the watershed that can influence the hydrology and flood discharges are the increase in impervious area and the improvements in the drainage network that accompany urbanization. For example, as buildings and parking lots are constructed, the amount of impervious land within the watershed increases, which increases the amount or volume of direct runoff. The construction of storm sewers and curb and gutter streets usually cause an increase in the peak rate of direct runoff. These modifications can have dramatic effects on the flood frequency characterstics of a watershed, resulting in significantly increased base flood discharges and elevations. For example, Sauer and others (1983) indicate that if a watershed is fully developed, the 1-percent-annual-chance (base) flood discharge is about 2.5 times the baseflood discharge under rural or undeveloped conditions." (FEMA 2001a.)

Existing floodplain maps do not reflect current development changes that have occurred since the maps were created. For example, a floodplain development study in Mecklenburg County, North Carolina, concluded that updating the FEMA map computer models to reflect current land use conditions indicated a 2- to 3-foot increase in the existing base flood elevation (Larson and Plasencia 2001, p. 179). Meaning, in this particular case, property owners that had elevated their structures to base flood elevation, or even as much as nearly 3 feet above base flood elevation, were still at risk of flooding. Furthermore, owners outside of the SFHA were actually at risk of inundation during a 1% annual-chance flood.

Similarly, floodplain maps are always behind the development curve because FEMA does not map the SFHA with consideration of future conditions (FEMA 2010b, p. 3). Consequently, modeling is based on the existing discharge rate. With significant increases in flood heights predicted for the Pacific Northwest (AECOM 2013), those discharge rates will increase. Looking again at the Mecklenburg County study, they concluded that considering the future built-out condition would increase the base flood elevation another 2 to 3 feet above the 2- to 3-foot increase already found from updating the existing map (Larson and Plasencia 2001, p. 179). Therefore, in this case, development built to FEMA minimum standards prior to the year 2000 could be up to 6 feet below future flood heights, and current development could be up to 3 feet below future flood heights, not considering climate change. Also, the spatial extent of the SFHA is not large enough and floodplain development regulations are not applied to areas that are actually at risk of inundation during a 1% annual-chance flood.

Also, other future conditions are not accounted for in FEMA's floodplain mapping. In many coastal areas, predicted changes in sea level are expected to change the 1% annual-chance flood elevation. Where tidally-influenced reaches extend well inland, sea level changes could similarly affect flood elevations far upriver. In addition to changes in sea level due to climate change, sea level and flood frequency are affected by changes in climate forcings, tides, and waves. Climate forcings such as El Nino Southern Oscillation (ENSO) and multi-decadal Pacific Decadal Oscillation (PDO) influence coastal flooding. Along the U.S. West Coast, the effects of climate forcing are most common in winter. Sea levels may rise for months at a time during warm El Nino conditions and decrease during cool La Nina conditions (Sweet *et al*. 2014). The spring-tide range is also important. Near the times of perigean spring tides during the winter and summer solstices, the tide cycle increases (Sweet *et al*. 2014). Furthermore, during the period of 1985 to 2007, extreme wave heights along the Pacific Northwest increased at a rate of 2-3 cm/year (Ruggiero 2013). Continued increases are anticipated. Increasing wave heights may pose a greater risk of coastal flooding and erosion than sea-level rise (Ruggiero 2013). Along the Pacific Northwest coast, winter flooding is often exacerbated when El Nino conditions and elevated perigean-spring tides (also known as "King" tides) occur (Sweet *et al*. 2014, p. 21).

In some instances, changes in hydrology due to climate change are likely to influence flood elevations too, although specific estimates are seldom available. While it is FEMA's interpretation that it is prohibited from considering future conditions when mapping the SFHA, FEMA can display the future conditions floodplain for informational purposes on a FIRM when a community specifically requests so (FEMA 2010b, p. 3). Also, the Biggert-Waters Flood Insurance Reform Act of 2012 requires the development of recommendations for future condition mapping, including risks due to sea level rise, climate change, and future development.

Riverine Erosion. In non-coastal areas, FEMA only maps the risk of inundation as if the landscape has a static topography, like a concrete-lined swimming pool. This is not a realistic scenario. Floodplains are typically comprised of a deformable stream bed and banks, and stream channels often move laterally and vertically within their floodplains. Laterally moving channels erode their banks and may jump to a previous or new channel alignment. This jump to a new channel alignment is termed a channel avulsion (Rapp and Abbe 2003). Benda *et al*. (2003) identified channel avulsions in floodplains as a major wood source in large rivers.

Erosion during these channel movements may alter the elevation of an area or change the local elevation of the 1% annual-chance flood level. As such, areas previously above the base flood elevation are actively recruited into the floodplain (*e.g.*, lateral channel migration of Sandy River in January 2011). Channels may also erode vertically, particularly channelized reaches. This may reduce the base flood elevation within the incised reach, but increase the flood elevation downstream. When FEMA maps incised channels and restricts the lateral extent of the floodplain in those reaches due to an artificially reduced base flood elevation, they are delineating an artificially narrow floodplain and may be diminishing the floodplain restoration potential in that reach because development may now occur within the natural floodplain unrestricted by any floodplain management requirements. While FEMA has the ability to include these erosion hazard areas on floodplain maps,[102] we understand that FEMA has only incorporated erosion concerns in coastal flood zone mapping (FEMA 2005).

In summary, for various reasons, and as demonstrated by the high percentage of NFIP payments for damages that occur outside of the SFHA (35.2%, Table 2.3-2), many floodplain maps are not particularly accurate. Furthermore, they currently do not identify all areas at risk of flooding. Riverine erosion and mudslide hazard areas, either inside or outside of the SFHA, are not mapped to include areas vulnerable to channel migration. This can result in a failure to accurately identify floodplain habitat, which is often the same habitat that is directly used by ESA-listed anadromous fishes when inundated and that indirectly benefits in-channel habitat during non-flood periods. Inaccurate floodplain mapping results in development occurring in the floodplain without accurately identifying and accounting for the functions that habitat provides listed fish species, causing the adverse effects described in the previous section.

Floodway Mapping. FEMA has mapped approximately 11,681 miles of waterways and delineated approximately 1,838 square miles (1.2 million acres) of SFHA in the action area (Table 2.3-1). However, not all waterways or all reaches of a waterway have been mapped for the SFHA and floodway. There are many areas where FEMA has not delineated an SFHA. Typically, these are reaches that have limited development and consequently are likely to have better functioning floodplain habitats than more developed reaches. Elsewhere, the SFHA has been delineated, but a floodway has not. Based on available data of the linear distance of

[102] Either by recognizing that these areas are in the flood-prone area and therefore should be included under 44 CFR 60.3 as areas at risk of flooding due to erosion, or as provided by 44 CFR 60.5, which provides for the inclusion of flood-related erosion hazards (Zone E) on floodplain maps.

delineated SFHAs (Table 2.3-1), floodways have not been delineated on approximately 77% of the mapped reaches in Oregon with a range by county of 29% to 99%.[103]

The NFIA allows FEMA to define the term “floodway.” FEMA has defined it by regulation as the active portion of the floodplain, presumably the area with the greatest water velocities and depths, which must be reserved to convey the base flood without cumulatively increasing the water surface elevation by more than 1 vertical foot above the base flood elevation. When delineating a floodway, FEMA’s protocols separate the SFHA into two components, the floodway and the remaining portion of the floodplain, also known as the flood fringe. The flood fringe comprises the rest of the SFHA on both sides of the floodway, and generally stores water, at shallower depths and lower velocities, during a flood. When establishing a floodway line, hydraulic engineers consider continuous floodplain encroachments until, on average, the flood levels increase 1 foot. As we have previously presented, a 1-foot vertical increase can reflect a significant increase in the lateral extent of the SFHA, but FEMA does not add the increase to the base flood elevation for the affected reach, nor does it appear to account for it during subsequent floodway delineations in a river basin – so “while NFIP regulatory floodway limits the cumulative impacts of encroachments to one foot, the associated base flood elevations (BFEs) are not raised to reflect that increase.” (ASFPM 2013a.)

Furthermore, except for considering the full build-out scenario in the encroachment scenario, FEMA does not consider future conditions (*e.g.*, changes in sea level, wave height, or climate) in its modeling unless a community specifically requests that FEMA do so. Consequently, when delineating the floodway, FEMA does not adjust the base flood elevation to reflect future conditions in the reach, including flood fringe encroachment used to model the floodway limits. Therefore, FEMA is again likely underestimating the extent of floodplain habitat and allowing development to occur along the margins of the SFHA without being subject to floodplain management requirements. “Impacts associated with the federal minimum standard for mapping floodways based upon the one-foot rise criterion include: new development is allowed within the Special Flood Hazard Area that will increase flooding on existing development; BFEs are not increased to avoid new development also being placed at risk; and encroachments are allowed that can be detrimental to the natural and beneficial functions of the floodplain.” (ASFPM 2013a.)

Juvenile salmonids often occupy lower water velocity areas (*e.g.*, the channel edge along complex banks) where they are able to maintain their position near higher velocity currents delivering prey (*e.g.*, invertebrate drift) and minimize their energy use. During flows where high velocities fully occupy the channel, non-migrating juveniles likely seek low velocity areas off channel. Consequently, in this consultation we consider the floodway to be the area in which juvenile salmonids will be subjected to velocities sufficient to displace individuals downstream during a 100-year flood, and the flood fringe to be the area available for velocity refuge. In reaches where the floodway fully, or nearly fully, spans the floodplain width, fish can be swept downstream during a flood. Therefore, where development encroaches on the floodplain,

[103] This excludes floodways in eleven counties where data was not available: Baker, Grant, Gilliam, Harney, Hood River, Klamath, Lake, Malheur, Sherman, Wasco, and Wheeler. Grant, Gillian, Hood River, Sherman, Wasco, and Wheeler counties are in the action area.

velocity refuge habitat is lost and fish displacement is increased, particularly in channelized or incised channels.

The effects of downstream displacement range from none to reduced health to death. Fish displaced to an area that provides adequate habitat functions for the number of fish residing in that reach may not experience any adverse effects. Fish displaced to an area that is unable to fully support the needs of an individual fish (*e.g.*, overcrowded) may adversely affect that individual's health (*e.g.*, increased stress, reduced rate of growth, increased susceptibility to disease). Fish displaced to an area lacking habitat functions critically needed for an individual's survival (*e.g.*, excessive salinity, elevated temperature, lack of cover) may result in death (*e.g.*, physiological failure, predation).

Under FEMA's regulatory floodplain management criteria (44 CFR Part 60), the NFIP limits development in the floodway only if one is designated. On average, only 23% of delineated SFHAs in Oregon also have a floodway delineated. In some instances, by the time a floodway is designated, the area already contains development and its habitat value is diminished. Once a floodway is designated, the NFIP does not restrict 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 1% chance of occurring in any year) or protected by levees with at least 100-year protection (Pinter 2005). However, *development in a floodway can occur* if the development would not increase the base flood elevation, or if the flood fringe has not yet been fully developed. Furthermore, the floodway is not a static delineation. While once rare, recently floodway development is more common (Wetmore *et al*. 2006, p. 14). FEMA's regulations allow the location of the floodway to be revised within the SFHA when the flood fringe remains unfilled. This can result in the complete loss of the flood fringe to development and the establishment of channelized river reaches that restrict lateral channel movement and fail to provide other ecological processes and habitat functions (*e.g.*, flood storage, groundwater recharge, riparian functions) important to anadromous fishes.

Also, since the floodway is simply a cross-sectional area reserved for a particular estimated discharge rate and not an area meeting a particular flow criterion identified using a validated flow model, some developed areas may be exposed to hydrodynamic forces (*i.e.*, water velocities) capable of eroding supporting fill or protective levees, or exerting lateral forces in excess of their structural design limits. Which means these areas may pollute the associated waterway or require the addition of protective structures (*e.g*., riprap, bulkheads, levees) that are detrimental to the ecological processes and habitat functions that support healthy populations of anadromous fishes.

Placement of Fill. Floodplain fill that raises an area above the base flood elevation is recognized by FEMA through a letter of map revision-fill (LOMR-F), which removes the property from the SFHA. Because property within the SFHA can be "mapped out" of the floodplain, and thereby removed from the jurisdiction of the NFIP's insurance requirements, there is an incentive for property owners to place sufficient fill to elevate their buildings above the base flood elevation (Wetmore *et al*. 2006, p. 15). This incentive is likely to increase as flood insurance rates increase in coming years as a result of the Biggert-Waters Act of 2012, which seeks to reestablish the solvency of the NFIP. As the cost of remaining in the floodplain increases, the incentive to elevate above the estimated base flood elevation will increase. While structures can be elevated on piles or by other open foundations, FEMA only allows properties to be "mapped out" of the floodplain if they are elevated on fill. By providing guidance on the placement of fill (FEMA 2001b) and allowing individuals to remove their property from regulation by artificially filling it, FEMA is in effect encouraging filling (Rosenbaum 2005). Galloway *et al.* (2006, p. 122) noted that the LOMR-F provisions "provide an indirect incentive for filling in the flood fringe with minimal consideration for environmental impacts."[104]

As indicated in earlier sections of this document, placing fill to elevate properties and building or modifying levees to trigger floodplain map revisions are detrimental to floodplain and channel functions. Undeveloped and less developed 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. These functions are essential to the survival of juvenile salmonids during flood events. Filling in functioning floodplains to remove them from the mapped floodplain affects other flow variables, which are mutually interdependent, meaning that a change in any single parameter (channel width, depth, velocity, roughness, slope, etc.) causes a response in one or more of the other variables (Ritter 1986). Fill in the floodpain alters the cross-sectional area, which in turn can modify velocity or depth, each of which may negatively influence fluvial/geomorphological processes that create or maintain salmon habitat in or near the river. Fill in floodplains also reduces flood water storage. This causes higher water levels downstream, and potentially upstream from the effect of backwatering, greater water velocity during high-flow events, and increased erosion, which have adverse effects on anadromous fish and their habitat. The resulting physical habitat loss, increased flow velocities, and reduced base flow may create partial or complete barriers to anadromous fish movement. Channels that are unconfined by floodplain fill provide more habitat area and have more diverse habitat complexity that supports salmon survival.

FEMA's decision-making process related to mapping includes approving map revisions. 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 based on fill, FEMA does not require information on the volume of floodplain fill, the floodplain habitat and storage functions that are lost or displaced, or the effects on ESA-listed salmon. FEMA proposes to require the community to ensure that any needed ESA compliance has been independently met, which is FEMA's standard for all LOMC requests. However, FEMA's reliance on Procedure Memorandum 64, as supplemented by its October 19, 2015 Memorandum, and 44 CFR 60.3(a)(2) (obtain all necessary Federal and state permits), seem to create a conundrum for local governments and property owners, since, absent FEMA's involvement, there is no Federal nexus that would trigger ESA section 7 consultation for the majority of floodplain developments. This creates uncertainty as to how "ESA compliance" is to be demonstrated, because ESA section 7 would not apply, and habitat conservation plans are not a federally required permit. Also, an individual development project,

[104] The U.S. District Court for the Western District of Washington observed: "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." *National Wildlife Fed'n v. FEMA*, 345 F. Supp. 2d, 1151, 1173 (W.D. Wash. 2004).

considered in isolation, may not result in the "take" of listed species and therefore not trigger ESA liability or the need to obtain take coverage through the ESA section 10 process. Nevertheless, the cumulative effects of such projects at the landscape scale may significantly degrade floodplain habitat functions, adversely affecting the survival and recovery of listed salmonids.

FEMA requires verification by a surveyor that the fill is placed so that the final elevation is at or above base flood elevation. FEMA can also monitor enforcement through the LOMC process (requests to make map changes) which may indicate that floodplain areas have been improperly filled.

Flood-Related Erosion. FEMA differentiates between chronic erosion and episodic erosion due to flooding. Despite the fact that the NFIA defines the term "flood" to include flood-related erosion at 42 U.S.C. 4121(c), FEMA does not utilize its authority under the NFIA to map chronic erosion and interprets its authority as limited to mapping episodic flood-related erosion. Additionally, FEMA has regulations that authorize the agency to delineate flood-related erosion-prone areas on flood maps and to identify the areas as "Zone E" (44 CFR 64.3), but declines to do so without a specific request from a participating local jurisdiction, and then only if the jurisdiction supplies the mapping data. FEMA does currently consider erosion when delineating coastal flood zones (FEMA 2005), but does not when delineating riverine floodplains. In an erosion mapping feasibility study, FEMA determined that there were "scientifically sound procedures for delineating riverine erosion hazard rates" (FEMA 1999). In 2000, the Technical Mapping Advisory Council (TMAC) recognized the failure of FIRMs to reflect riverine erosion, including channel migration, and endorsed FEMA 1999. The TMAC recommended that FEMA map riverine erosion with or without correlation to specific risk frequencies (TMAC 2000). By not considering erosion in floodplain mapping of riverine floodplains, the SFHA artificially limits the extent of the floodplain by not including areas above the base flood elevation that are likely to be recruited to the floodplain by erosional forces and does not provide information to communities about areas at risk of flooding from lateral channel movement.

The channel migration zone (CMZ) is the area where a stream or river is susceptible to flood-related channel erosion (Rapp and Abbe 2003). Erosion associated with lateral channel movement may occur in various forms (*e.g.*, bank erosion, avulsion, channel recapture). In some instances, erosion includes areas outside of the mapped flood inundation zone. A good example in Oregon is the upper Sandy River where erosion prone areas outside of the SFHA, as mapped by English *et al*. (2011a) and demonstrated by the January 2011 flood (Figure 2.4-2), are recruited into the floodplain.[105]

[105] Telephone conversation between Jim O'Connor (USGS) and Robert Markle (NMFS) regarding CMZs in Oregon and suggested USGS edits to a draft write up on CMZs (October 18, 2012).

Doug Beghtel/The Oregonian

Doug Beghtel/The Oregonian

Photograph courtesy of Portland General Electric

Figure 2.4-2. In January 2011, the Sandy River flooded and eroded its banks undermining the foundations of numerous homes and the Lolo Pass Road, Clackamas County, Oregon.

The magnitude and frequency of channel erosion also varies. Typically, dramatic erosion events are associated with periods of high flow and/or saturated soils. Flows that have the capacity to erode channels generally occur at or above bankfull discharge, at recurrence intervals greater than one year (Grant *et al.* 2008, p. 9). The actual flow at which channel erosion occurs is reach-specific. For example, the upper Willamette River shifts through gravel bars and erodible floodplains at flows equal to the 2-year flood or less (≥50% annual-chance flood).[106] Other Willamette River floodplain reaches show little channel erosion during larger flood flows, perhaps even greater than 10-year floods (≤10% annual-chance flood).

NMFS has found the simple and relatively inexpensive methodology used by Rapp and Abbe (2003) suitable for delineating the channel migration zone (NMFS 2008c). However, numerous channel migration zone delineation methods exist (FEMA 1999) and some of these may also be suitable. In Oregon, channel migration zone delineations, using various methods, have included segments of the Coos River, Coquille River, Sandy River, Still Creek, Marys River, and Hood River (Ellis-Sugai 1999, Bishop and Parker 2009, English and Coe 2011, English *et al.* 2011a and 2011b). Other delineations may exist. Certainly other river reaches have been identified as at risk of channel migration (*e.g.*, Willamette River, Clackamas River, Molalla River, McKenzie River, Rogue River, Chetco River, Umatilla River, Catherine Creek), and others remain to be evaluated. The channel migration zone provides important habitat functions for salmonids (see discussion above in section 2.4.3 regarding floodplain connectivity).

The failure to map flood-related erosion-areas like channel migration zones, and provide management criteria that limit development in these areas, results in reductions in floodplain access for anadromous fishes, and contributes to the simplification of in-channel and off-channel habitat. The significant reduction in accessible floodplain habitat and habitat simplification are two of the reasons salmon, steelhead, and other anadromous fishes were listed under the ESA. Both have been identified as limiting factors for all ESA-listed salmonid species occurring in Oregon (see Status of the Species section). Where conditions are suitable for lateral channel movement, the erosional processes associated with the channel migration zone are fundamental to maintaining both the channel's connection to the floodplain and diverse, complex habitat conditions. It appears that FEMA has the discretion to delineate the channel migration zone and to provide associated management criteria, but proposes neither. Given that the loss of habitat complexity has been a factor for decline among listed salmonid species, and is identified for nearly all of these species as a limiting factor, NMFS remains concerned about any further loss of ecosystem processes essential to providing high quality habitat and achieving recovery of ESA-listed anadromous fishes in Oregon.

Levees. "Levees function by confining flood discharges within the river channel and excluding overbank flows from some or all of the floodplain. This confinement causes higher water-surface elevations in the remaining portion of the channel (known as levee 'surcharge'). These surcharges are caused by the loss of storage volume on the floodplain and loss of conveyance capacity" (Pinter *et al.* 2016, citing Yen 1995; Bhowmik and Demissie 1982; Heine and Pinter 2011). The presence of a 100-year levee, when accredited 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. However, "no levee provides full protection from flooding – even the best

[106] E-mail from Rose Wallick (USGS) to Robert Markle (NMFS) regarding channel migration in Oregon (October 12, 2012).

flood control system or structure cannot completely eliminate the risk of flooding."[107] Put another way, "There are two kinds of levees … [t]hose that have failed and those that will fail'" (Pinter *et al*. 2016, citing Martindale and Osman 2010). Nationally, the economic damage from the flooding of leveed areas is estimated to be between $5 and $10 billion each year. In fact, recognizing the residual flood risk of leveed areas, the National Committee on Levee Safety (NCLS) recommended to Congress that the purchase of risk-based flood insurance be required in leveed areas (Recommendation 18) (NCLS 2009 and 2011). This recommendation was, in part, because leveed areas are perceived to be safe from flooding and are typically developed using the same standards as areas above the base flood elevation. However, the flood risks are not equal nor are the consequences for any given flood event. Given the current understanding that all levees will eventually fail, increased development in these flood risk areas provides a short-term economic benefit with likely long-term adverse consequences, particularly from the perspective of floodplain and channel functions for salmonid and other anadromous fish habitat as development in these areas increases.

Levee Accreditation. An effect of FEMA's levee accreditation process is that, because of the regular reliance on the U.S Army Corps of Engineers (Corps) to evaluate and certify levee integrity as foundational to the accreditation, levee owners and operators meet Corps' vegetation requirements, which have generally required the removal of vegetation. The issue is complex because of: (1) the different financial incentives that encourage levee owners to participate in the NFIP and in the Corps' levee programs; and (2) the interconnections that exist between the Federal programs.

Communities are incentivized by the NFIP to get their levees accredited as providing 100-year flood protection, because FEMA will then remap the areas behind levees as no longer being in the floodplain, avoiding insurance mandates and compliance with FEMA's regulatory floodplain management criteria (44 CFR 65.10).[108] Communities are also incentivized to establish eligibility under section 5 of the Flood Control Act (33 U.S.C. 701n), commonly referred to as Public Law (PL) 84-99 (33 CFR 203.12), which provides Federal funds (from the Corps) to repair and rehabilitate flood damaged levees to the level of protection they provided before the flood. PL 84-99 eligibility has, until recently, required that levees be maintained only in grasses to achieve an acceptable status; some herbaceous growth would support a minimally acceptable rating; the presence of woody vegetation (trees) would disqualify a levee as unacceptable.

The relationship between Corps' certification processes (which determine level of flood protection) and FEMA's accreditation processes (which confirm that the levee meets all requirements to provide protection against a 100-year flood) is complex. They are related to each other under FEMA's existing regulations, through the NFIA reauthorization via Biggert-Waters 2012, and through FEMA policies related to the Stafford Act.

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[107] National Committee on Levee Safety website, "All Properties in Leveed Areas Should Have Risk-Based Flood Insurance, February 2011. Accessed on January 17, 2013; *http://www.leveesafety.org/ip_Updated_FloodInsurance_04February11.cfm.*

[108] "In the current NFIP when levees are accredited, the requirements for mandatory flood insurance and floodplain management are removed. This can result in increased consequences as development in the floodplain intensifies." FEMA and Corps. Flood Protection Structure Accreditation Task Force: Final Report. November 2013.

FEMA, at 44 CFR 65.10(d), requires that levee owners have a maintenance plan, that is under the jurisdiction of a Federal or State agency, or an agency created by Federal or State law. For vegetation maintenance practices, levee owners traditionally default to the Corps' engineering technical guidance, regulations, and pamphlets. This course of action helps to guarantee their continued eligibility for PL 84-99 funding when levees are damaged. The Biggert-Waters Act of 2012 requires even closer alignment of the two agencies on levee certification and accreditation: "information collected for either program can be used interchangeably and [intends] to align the information and data collected by or for the USACE Inspection of Completed Works (ICW) program so it is sufficient to satisfy National Flood Insurance Program (NFIP) accreditation requirements specified in 44 CFR 65.10."[109] FEMA's Recovery Policy 9524.3 (September 23, 2011) states that levees eligible for inclusion in PL 84-99, whether active or inactive, cannot receive FEMA's financial assistance for emergency repairs. The Corps has a recent memorandum identifying that eligible levees that fail standards will be considered inactive.[110]

Thus, under prior practices, levees that fell into the "unacceptable" category because vegetation was present were not eligible for funding of emergency repairs from either the Corps' RIP program, or from FEMA via the Stafford Act because they were construed as inactive. While the Corps' current vegetation standards are provided in a technical letter (ETL 1110-2-583)[111] and require levees be devoid of any vegetation except grass on the levee and within 15 feet of any levee (Corps 2014), this same technical letter does indicate that the presence of vegetation is currently not a basis for automatic disqualification of the levee from enrollment in the PL 84-99 program, a significant change in practice. Vegetation must now be demonstrated to cause a risk to the levee integrity in order to make the levee ineligible.

Field information and scientific studies demonstrate that root structure and brushy vegetation may protect levee stability, decrease seepage rates, and decrease levee failures (Abernethy and Rutherfurd 2000a and 2000b, Allen and Leech 1997, Corcoran *et al.* 2011, Dwyer *et al.* 1997, Fischenich and Copeland 2001, Gray *et al.* 1991, Geyer *et al.* 2003, Kabir and Bean 2011, Shields and Gray 1992, Shriro *et al*. 2011). In California, a review of more than 10,000 levee performance records identified 11 records (0.1%) that indicated a vegetation influence on levee performance (Kabir and Bean 2011). Therefore, NMFS has considered the Corps' standard inconsistent with best available science, and has previously recommended that FEMA modify its policies or develop its own guidance with regard to vegetation standards on levees (NMFS 2008c).

Resource agencies, non-governmental entities, and many Indian tribes have expressed concerns regarding resource and cultural values provided by riparian vegetation, including vegetation on levees. The recently enacted Water Resources Reform and Development Act of 2014 (WRRDA)

[109] FEMA and Corps. Flood Protection Structure Accreditation Task Force: Final Report. November 2013.

[110] Department of Army Memorandum dated 3/21/14 on Interim Policy for Determining Eligibility Status of Flood Risk Management Projects for the Rehabilitation Program Pursuant to Public Law (PL) 84-99 "If one levee segment does not meet the interim eligibility criteria, the entire levee system will be Inactive." Document available at: *www.iwr.usace.army.mil/Portals/70/docs/frmp/Interim_Policy_for_Rehabilitation_Program_21March2014_FINAL.PDF*.

[111] ETL 1110-2-583 (April 2014) supersedes ETL 1110-2-571 (April 2009). Expires April 30, 2019.

requires the Corps to review the suitability of its vegetation standards in light of several factors, including: (1) the benefits that can be provided by woody vegetation on levees; (2) the preservation of natural resources, including habitat for endangered and threatened species; (3) the impact of removing vegetation on compliance with other regulatory requirements; and (4) protecting the rights of Indian tribes. The WRRDA prohibits the Corps from requiring the removal of existing vegetation on levees, unless necessary to address an unacceptable safety risk, pending the Corps' review of its vegetation standards. Pub. L. 113-121, § 3013 (2014). The current policy that the Corps will not disqualify levees based on the presence of vegetation, and the requirement that FEMA accreditation be closely linked to Corps review of levee integrity, indicates that except on levees where specific information shows vegetation poses a risk, vegetation removal practices are no longer required. Thus it appears that baseline conditions will not be further exacerbated by FEMA's levee accreditation activities. In the future, if the Corps changes their position on tree retention on levees, our conclusion may no longer be appropriate.

In Oregon, there are 219 levee systems in the Corps' Rehabilitation and Inspection Program (RIP; currently known as the Levee Safety Program's Rehabilitation Program). [112] These 219 levee systems include over 333 miles of levees protecting more than 256,779 acres of land from flooding. FEMA identified five accredited levee systems in Oregon (Table 1.3-6). While other accredited levees exist in Oregon, FEMA does not know how many. FEMA has only maintained a list of accredited levees since the 1980s. FEMA's recent change in levee mapping policy is likely to increase the number levees seeking accreditation in the near future. Where the Corps determines that vegetation poses a specific risk, that levee can be designated as provisionally accredited, and the Corps does provide the opportunity for a variance from the vegetation standards and the inclusion of planting berms (77 FR 9637). During the processing of a vegetation variance request, active RIP levees can remain eligible to receive rehabilitation assistance from the Corps under the System-wide Improvement Framework (SWIF) (Corps 2011, p. 5).[113] The SWIF also requires environmental compliance. To fulfill environmental compliance responsibilities, levee owners may be required to provide mitigation as a condition of their participation in the RIP. For FEMA-accredited levees, involvement in the SWIF process does not constitute an extension of accreditation by FEMA (Corps 2011, p. 7). FEMA determines how a SWIF may or may not impact accreditation. To our knowledge, the vegetation variance and SWIF processes have been used in Oregon only once.

The single SWIF example in Oregon is for the community of Milton-Freewater, which FEMA recognized in 2013 as providing protection from the 100-year flood. Prior to receiving that recognition, the Milton-Freewater levee sponsor began pursuing vegetation retention via the SWIF process with the Corps. Our understanding is that the SWIF process is not yet complete[114] and may be terminated in light of WRRDA 2014.[115] In the meantime, vegetation is being retained on the levee pending completion of the variance process. The Corps has indicated that it

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[112] E-mail from Scott Vollink (Corps) to Robert Markle (NMFS) regarding Oregon levees (January 23, 2013).

[113] Corps (US Army Corps of Engineers). 2011. Memorandum, HQ USACE (CECW–HS), Subject: Policy for Development and Implementation of System-wide Improvement Frameworks (SWIFs), 29 November 2011.

[114] Telephone conversation between Diane Driscoll (NMFS) and Robert Markle (NMFS) regarding project status (August 22, 2014).

[115] Telephone conversation between Diane Driscoll (NMFS) and Robert Markle (NMFS) regarding project status (September 5, 2014).

intends to complete ESA section 7 consultation before granting the vegetation variance. Previously, FEMA informed us that they sequence the process and that levee accreditation would follow the Corps' variance and levee certification.[116] Why FEMA recognized the levee as providing 100-year protection before the Corps completed their process is unclear to NMFS, and serves to demonstrate the complicated interconnections that exist between agency actions during the levee flood protection certification process. Furthermore, while the Corps has disconnected their vegetation management guidelines from the RIP (WRRDA 2014) and appears willing to allow some vegetation on levees, it remains unclear whether the FEMA accreditation standards are still linked to those guidelines (ETL 1110-2-583). Regardless, this serves as an example of the need to improved coordination between Federal agencies (*e.g.*, FEMA, Corps, NMFS) regarding the levee flood protection certification process. While the Corps (33 CFR 203.12) and FEMA (44 CFR 65.10) levee programs are on their face implemented independently of one another, we recognize that have often been tightly linked and this linkage is likely to increase with the Biggert-Waters Flood Insurance Reform Act of 2012.

Non-Accredited Levees. FEMA's new levee mapping policy (FEMA 2013b) will extend the levee maintenance standards to non-accredited levees. The proposed policy would require the same levee operation and maintenance plans as accredited levees. Non-accredited levees are much more prevalent than accredited levees. Only five of the 219 recognized levee systems in Oregon are currently listed as accredited by FEMA, and there are thought to be many more levees that remain unrecognized. By linking the new levee policy (FEMA 2013b) to the accreditation stability and maintenance standards, FEMA implicates the Corps vegetation management standards discussed above. FEMA does have the capacity to put levees into Provisional Accreditation status to correct deficiencies with in previously certified levees, which can afford enough time for a SWIF to be approved for levee owners that wish to retain some woody vegetation.

The issue of levee vegetation management and tree retention remains an issue in need of a more permanent resolution. However, the recent changes regarding the Corps' requirements are encouraging (Corps 2011, 77 FR 9637, ETL 1110-2-583), and the language of WRRDA 2014 directing the Corps to review the science on vegetation and levee integrity in light of listed species and habitat concerns suggests that a more reliable resolution will be presented in coming years. Consequently, while tree removal in some circumstances may be associated with FEMA's accreditation process, we recognize the progress made on this issue and that vegetation retention is largely the responsibility of the Corps.

A second effect of FEMA's levee accreditation is "substantial additional costs to the floodplain-river ecosystem. Natural floodplains are some of the richest and most diverse habitats on earth and owe this diversity primarily to their hydrological connectivity to the river channel (Tockner and Stanford 2002). Large levee systems sever this connectivity and thus significantly degrade floodplain and channel habitats and reduce the ecosystem services provided by river corridors (Tockner *et al*. 1999; Opperman *et al*. 2009). Along with other processes, levees have

[116] E-mail from David Ratté (FEMA) to Robert Markle (NMFS) regarding accredited levees in Oregon (January 31, 2013).

contributed to the loss of roughly 57% of the original wetlands that existed across the Midwestern US (SAST 1994; Hey and Philippi 1995; Gergel *et al*. 2002)" (Pinter *et al*. 2016).

Map Adoption Procedures. The NFIA provides communities and properties owners an opportunity to appeal new maps before the maps are finalized by FEMA and adopted by communities. Appeals of preliminary maps may only be based on knowledge or information indicating that the flood elevations proposed by FEMA are scientifically or technically incorrect, or that FEMA's proposed designation of the SFHA is scientifically or techinically incorrect (42 U.S.C. 4104). Appeals of preliminary maps commonly extend for many years, and frequently community adoption of a new map is delayed well beyond the end of the statutory appeal period.[117] Where a preliminary map proposes expanding the SFHA or increasing BFEs, which is frequently the case, delay in final adoption and implementation of the new map means that areas that are factually within the SFHA may be developed without regard to flood hazard, resulting in permanent loss of floodplain functions and floodplain habitat features.

FEMA's Proposed Conservation Measures for Mapping. As part of its proposed action for Oregon, FEMA proposes to provide guidance on use of flood mapping models, such as unsteady state models and two-dimensional models. Because the guidance will not be mandatory and was not included in the BA, it is not possible for NMFS to evaluate whether it will result in more appropriate use of models or more accurate floodplain mapping. FEMA also proposes to incorporate ESA species and habitat information early into its map sequencing process, used to prioritize communities for mapping/remapping. This means that if two communities with equal need, data, and risk factors were selected as high priority for map updates, the community with listed species or designated critical habitat present would receive priority. If this situation were to occur, it may provide some benefit to listed species that utilize the remapped area.

Implementation of FEMA's proposed conservation measures would not avoid map changes of the SFHA that are derivative of the incentive FEMA provides through its mapping regulations, to elevate structures on fill. Additionally, continued development in the SFHA is likely to impact the delineation of the SFHA by increasing base flood elevations and flood velocities as flood storage areas are encroached.

Floodplain Mapping Program - Summary. FEMA proposes to issue guidance intended to increase the use of mapping methods that would improve the accuracy of SFHA delineations over their past practices (*e.g.*, use of unsteady state or multidimensional models and lidar elevation data). However, these improved methods would not be required in all instances. In some not well identified circumstances, steady state modeling and less accurate vertical elevation data would continue to be used for SFHA mapping. Furthermore, when establishing base flood elevations and associated SFHAs, FEMA's current and proposed methodologies do not account for flood-related erosion in riverine areas or future changes in the level of the 1% annual-chance flood. While the base flood elevation provided by FEMA is a mean modeled

[117] Pers. comm., NORFMA members, 10/2014, and DLCD staff, 2/8/16: "The biggest source of delays in getting a draft FIRM to final have been due to FEMA contractor workload and budget reallocations following suggestions made during community review of draft flood maps and following an appeal after a preliminary map is issued. If the map making process leaves a predetermined schedule due to community comments or appeals, it take years to get it back on track."

value, the elevation range (or a confidence interval) is not provided. Consequently, the appropriate level of confidence associated with that estimate is poorly understood.

FEMA has made improvements in the accuracy of its past SFHA mapping practices. As such, the proposed action would improve the accuracy of identifying some areas that influence the quality and quantity of suitable anadromous fish habitat in the associated channels and off-channel areas that are periodically occupied by ESA-listed anadromous fishes. However, significant deficiencies remain that perpetuate concerns about the accuracy of floodplain delineations. As such, the proposed action would continue to misidentify some areas as floodplain habitat that are actually not likely to provide floodplain functions that benefit ESA-listed anadromous fishes (not a particular concern to us), and misidentify other areas as being outside the floodplain that actually are in the floodplain. Thus, some areas of floodplain habitat would be developed without being subject to the required floodplain management criteria.

We are hopeful that some of these deficiencies may be addressed in the future under the Biggert-Waters Flood Insurance Reform Act of 2012 and the Homeowner Flood Insurance Affordability Act of 2014, which require the development of recommendations on the impacts on flood risk due to future conditions associated with sea level rise and future development. Furthermore, the Homeowner Flood Insurance Affordability Act of 2014 requires TMAC review of the national flood mapping program authorized under the 2012 and 2014 flood insurance reform laws and requires FEMA consider the effects of non-structural flood control features, such as habitat restoration when mapping the SFHA. However, the action as currently proposed does not account for these concerns.

2.4.4.2 Regulatory Floodplain Management Criteria

The NFIA provides a strong incentive for communities to participate in the NFIP, so that property owners may obtain federal, or federally insured, financing and other benefits. Also, as a consequence of Oregon’s Goal 7 requirements, 257 communities and three Indian tribes in the State participate in the NFIP. To participate in the NFIP, a community must adopt floodplain management criteria at least as restrictive as those established by FEMA. The U.S. District Court recognized that the NFIP facilitates floodplain development, 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)).

Recognizing some of the environmental shortcomings of the regulatory floodplain management criteria led to FEMA’s 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.

The NFIA directs FEMA to develop floodplain management criteria, which, to the "maximum extent feasible," will constrict the development of land exposed to flood damage, guide proposed development away from flood hazards, assist in reducing flood damage, and improve the long-range management and use of flood-prone areas (42 U.S.C. 4102(c)). While the statute do not define "feasible," the term is defined by Merriam-Webster as "capable of being done or carried out" or "reasonable."[118] The corresponding criteria developed by FEMA require flood-proofing and elevation of structures, but do not constrict development or guide development away from flood hazards except in two circumstances: (1) development within a floodway that will increase base flood elevations is prohibited without FEMA's prior approval; and (2) when a floodway has not yet been designated by FEMA, development in the floodplain that will increase base flood elevations more than 1 foot is prohibited without FEMA's prior approval (44 CFR 60.3(c)(13), (d)(4)). As observed by the U.S. District Court in 2004, FEMA's regulatory floodplain management criteria "are currently designged to reduce threats to lives and to minimize damages to structures and water systems during flood events … not to protect habitat, imperiled species, or other environmental values" (345 F. Supp. 2d at 1156).

While FEMA's regulatory floodplain management criteria were intended by Congress to constrain development in flood-prone areas, some of the criteria in fact encourage activities that are ecologically harmful, and result in conditions that adversely affect anadromous fishes and their habitat. For example, FEMA's regulations allow unlimited development across the floodplain, except in the floodway (where one has been designated), so long as the developed areas are either at or above the level of the base flood elevation, or protected by accredited levees that provide protection from inundation during a 1% annual-chance flood event.[119] This requirement to raise structures above the level of the 100-year flood is one of the regulatory floodplain management criteria of the NFIP. The lowest habitable floor of a structure must be placed at or above the level of the base flood elevation using an open foundation (*e.g.*, piles or posts), stem wall foundation, or fill. Structures elevated on piles and on stem wall foundations remain identified as floodplain structures and are subject to the flood insurance mandate. Only fill is recognized as permanently raising the structure out of the floodplain, which releases the structure from the flood insurance mandate. FEMA provides technical guidance on elevating structures (FEMA 2008) and specifically on building structures on fill (FEMA 2001b) to reduce risk of damage from flooding. This guidance facilitates floodplain development that is likely to endanger fish present during flooding and leads to placing fill in the floodplain as a part of NFIP participation. FEMA itself stated in its 1976 EIS that "[t]o the extent that fill is used to elevate strutures in flood hazard areas in compliance with the required performance standards, wetlands may be negatively impacted, and valley storage capacity reduced." (FEMA 1976).

Elevating Structures. As mentioned above, FEMA's regulatory floodplain management criteria require that structures be elevated at least to the BFE, and FEMA's

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[118] As provided by Merriam-Webster Dictionary on-line (*www.merriam-webster.com/dictionary/feasible*), accessed on February 21, 2013.

[119] In Oregon, FEMA Region X has proposed to limit the types of allowable development in the floodway and a riparian buffer zone for those actions that need and do not already have ESA "take" coverage.

mapping regulations incentive the use of fill by allowing filled properties to be mapped out of the SFHA. FEMA provides guidance on acceptable methods of elevating structures above the base flood elevation (*e.g.*, fill, piles, stem walls). When considering the elevation of structures, FEMA considers the natural grade elevation based on when the floodplain was first mapped. Where material was placed before the mapping date, FEMA considers the material to reflect the natural grade. However, where material has been placed after the mapping date, FEMA considers the material to be fill, not the natural grade, and placement of the fill must have met all the regulatory floodplain management criteria, including a floodplain development permit before FEMA would remove the area from the SFHA.[120] For example, if dredge spoils were placed before the first flood insurance map was issued for a community (*e.g.*, 1950s), FEMA would recognize the fill as the "natural" grade and map it in or out of the SFHA relative to the BFE. However, if the spoils were placed after the first mapping, FEMA would consider it fill subject to the minimum criteria (*e.g.*, require a floodplain development permit) and to their proposed conservation measures (*e.g.*, mitigation for fill that adversely affects ESA-listed species) before they would remove a structure or property from the SFHA.

Structures raised above the base flood elevation on enclosed foundations (*e.g.*, stem wall foundation) are subject to hydrostatic pressure during flooding. Hydrostatic pressure occurs when different water levels exist on opposite sides of the foundation wall. The pressure can cause structural failure. To address hydrostatic pressure, FEMA requires that stem wall foundations in the floodplain include openings to equalize hydrostatic pressure inside and outside of the foundations. To limit access by insects and rodents, FEMA's regulatory floodplain management criteria allows openings to "be equipped with screens, louvers, valves, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters" (44 CFR 60.3(c)(5)). FEMA acknowledges that such opening covers "tend to clog" and indicates that additional openings may be required to "increase the likelihood that openings will perform as expected, even if some become clogged with debris" (FEMA 2008, p. 20). While FEMA requires a minimum "net open area" per enclosed area, specific opening cover designs standards are not required. Depending on various factors, including the direction of floodwater approach, the floodwater approach velocity, and screen size, fish are at risk of impingement on the opening covers or accumulated debris as flows enter foundation openings. Where fish safely pass foundation openings, they are then at risk of impingement and entrapment as flows drain from the foundation.

Another acceptable elevation method is the use of an open foundation (*e.g.*, piles, posts, pier). While structures elevated on open foundations continue to largely provide flood storage capacity, potentially allow velocity refugia for fish, and avoid passage issues associated with elevated foundations, the presence of structures in the floodplain prevent the development of vegetation thus reducing habitat quality and frequently constitute a source of pollution due to use of the area for storage (*e.g.*, lawnmower, chainsaw, fuel barrels, pesticides). During floods, these substances are often released into the flood waters and transported offsite.

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[120] E-mail correspondence between John Graves (FEMA) and Robert Markle (NMFS) regarding fill and determination of natural grade (March 12, 2013).

The use of fill to elevate structures is common. The placement of fill, whether it elevates areas above the base flood elevation or not, directly modifies available off-channel habitat from periodic seasonal use by anadromous salmonids. Where fill raises areas above the base flood elevation, off-channel floodplain habitat is completely removed from access. Where fill is placed in the floodplain but the site elevation remains below base flood elevation, the frequency of habitat access is reduced and the quality of that habitat when inundated is degraded by the development the fill supports.

Similarly, depending on the site characteristics before development and the development constructed, floodplain development modifies the quality and functions available to anadromous salmonids in the area developed and potentially elsewhere. Floodplain development provides a new or expanded source of pollutants (*e.g.*, roads and parking lots; materials stored in garages, sheds, and under elevated structures; commercial structures containing hazardous materials), modifies stormwater runoff and transports pollutants during periods when the site is not inundated by flood waters, and modifies site conditions associated with numerous habitat functions (*e.g.*, vegetation, infiltration, food web, hydrology). Frequently, development creates conditions that influence the character of habitat offsite (*e.g.*, elsewhere in the floodplain and main channel).

Erosion-Prone Areas. It appears that FEMA has authority under the NFIA to map erosion-prone areas. The act states:

> the term ‘flood’ shall also include the collapse or subsidence of land along the shore of a lake or other body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels, and all of the provisions of this chapter shall apply with respect to such collapse or subsidence in the same manner and to the same extent as with respect to floods described in subsection (a)(1) of this section [*defining flood as inundation from rising waters, tidal surges, other severe storms, etc.*], subject to and in accordance with such regulations, modifying the provisions of this chapter (including the provisions relating to land management and use) to the extent necessary to insure that they can be effectively so applied, as the Administrator may prescribe to achieve (with respect to such collapse or subsidence) the purposes of this chapter and the objectives of the program. [42 U.S.C. 4121.]

Furthermore, FEMA’s regulations define “flood-prone area” as: “any land area susceptible to being inundated by water from any source” and refers the reader to the definition of flooding (44 CFR 59.1). “Flooding” is defined as, in part, (a) a general and temporary condition of partial or complete inundation of normally dry land areas from (1) overflow of inland or tidal waters, (2) unusual and rapid accumulation or runoff of surface waters from any source, and mudslides; and (b) the collapse or subsidence of land along the shore of a waterbody as a result of erosion or undermining caused by waves or currents (44 CFR 59.1). Therefore, by definition, areas at risk of flood inundation due to flood-related erosion are in the “flood-prone area.” FEMA has not mapped any riverine erosion areas or channel migration zones for inclusion on a FIRM or Flood Hazard Boundary Map (FHBM), which is the map issued by FEMA delineating A Zones (areas of special flood hazard), M Zones (areas of special mudslide hazard, and E Zones (areas of special flood-related erosion hazard) (see 44 CFR 64.3).

FEMA has established floodplain management criteria, at 44 CFR 60.5, that apply to flood-relatead erosion-prone areas. The criteria require, among other restrictions, that any proposed site alterations or improvements in the path of flood-related erosion be relocated or adequately protected from erosion, and also mandate a set-back/safety buffer from the flood source for new development (44 CFR 60.5(a)-(b)). However, because FEMA's policy is to not map riverine erosion zones, the criteria are not operative for such areas. Unless a channel migration zone is also within the designated SFHA, it is not subject to any NFIP requirements. If a channel migration zone is within the SFHA, FEMA's flood-proofing and elevation standards apply, but the safety buffer/set-back requirements do not. FEMA's proposed action does not include channel migration zone mapping or application of the regulatory criteria for flood-related erosion prone-areas.

The dynamic equilibrium of flood-related erosion areas (*e.g.,* CMZs) provides habitat functions important to salmonids. The significance of these areas to salmonids and the effect of not implementing the management criteria specific to these areas were discussed previously in Section 2.4.3. As also stated previously in this section, the significant reduction in accessible floodplain habitat and habitat simplification are two of the dominant reasons salmon and steelhead were listed under the ESA. Both have been identified as limiting factors for ESA-listed salmonid species occurring in Oregon.

Where conditions are suitable for lateral channel movement, the erosional processes associated with the channel migration zone are fundamental to maintaining both the channel's connection to the floodplain and diverse, complex habitat conditions. FEMA has the discretion to delineate the channel migration zone and to implement associated management criteria, but proposes neither, which will perpetuate the current level of under-representation of floodplain habitat, and the current level of development in areas prone to flooding and flood-related erosion, and perpetuate a corollary demand for bank armoring and flood control measures to reduce risk of property damage from both of these anticipated river processes. Any further loss of ecosystem processes essential to providing high quality habitat and achieving recovery of ESA-listed salmon and steelhead in Oregon is likely to delay or prevent recovery.

Substantial Damage/Substantial Improvement. FEMA's regulatory floodplain management criteria allow grandfathering, in that they only apply to new construction. However, the criteria also apply to existing structures that are "substantially improved." FEMA's regulations define "substantial improvement" as any improvement the cost of which equals or exceeds 50 percent of the market value of the structure measured at the time construction of the improvement begins (44 CFR 59.1). Substantial improvement also includes structures that have incurred "substantial damage," regardless of the actual repair work performed. FEMA defines "substantial damage" as damage incurred by any means where the cost of restoring the structure to its pre-damaged condition would equal or exceed 50 percent of the market value measured before the damage occurred (44 CFR 59.1). Because FEMA defines substantial improvement / substantial damage based on each occurrence, improvements that cost less than 50 percent of market value may be repeatedly applied to the same structure without limitation. Legislative history for the 1973 reauthorization of the NFIA suggests that flood insurance was to be required for existing structures,[121] which were assumed to have been constructed without access to information indicating flood risk. An emphasis on speedy provision of flood maps in order to create an informed realty market, coupled with restrictive floodplain management standards that would restrict floodplain development and guide such development away from flood prone areas was intended to limit mounting flood disaster costs.[122] Regulatory provisions defining the substantial improvement trigger for full compliance with the floodplain development criteria were crafted so as either to force adequate safety improvements being incorporated when the life of the existing structure was extended, or to limit the overall life of the structure so that such floodprone buildings would ultimately be "sunsetted." FEMA's current regulatory provisions however, allow such grandfathered structures to avoid either outcome.

FEMA's Proposed Conservation Measures. FEMA Region X, without modifying its regulatory floodplain management criteria, is proposing to inform participating communities in Oregon that they must apply certain restrictions on allowable new development and substantial improvements to existing development in the floodway and portions of the flood fringe depending on the development's location (*e.g.*, riparian zone), type (*e.g.*, water-dependent) and duration of habitat effect (*e.g.*, short term). FEMA also proposes that in Oregon the participating communities will be instructed to mitigate all adverse effects to existing floodplain functions so that no net loss or a net beneficial gain is achieved. However, mitigation alternatives are not specified. The uncertainty associated with the mitigation requirements (discussed later in this document) is likely to lead to additional development in floodplains (and the associated loss or degradation of floodplain functions) without adequate commensurate off-setting actions.

Under FEMA's proposed action, improvements or repairs to existing structures or utilities that do not increase their footprint by more than 10% would not be restricted or effects evaluated. This means that development with additional adverse effects may occur without further review, evaluation, mitigation, or limit. The assumption is that this incremental loss will be insignificant regardless of location (*e.g.*, outer floodplain, riparian zone), type (*e.g.*, residential, commercial), or cumulative scale (*e.g.*, 1 structure, 100 structures). This assumption appears faulty. While there likely are situations where the effect would be insignificant, we cannot be certain that in all instances the effect would not be meaningful or contribute to an incrementally aggregated effect

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[121] "[I]t is in the public interest for *persons already living in flood-prone areas* to have both an opportunity to purchase flood insurance and to access more adequate limites of coverage" House Subcommittee on Housing and Urban Development, Hearings on the Expansion of the National Flood Insurance Program, Tuesday May 8, 1973. Emphasis added.

[122] "The 1968 act solved this problem [of irresponsible constructionin the Nation's flood plains] by providing subsidized insurance only to properties that were already in existence at the time the area in which they were located was identified as an area having special flood hazards, and by requiring flood-prone communities, as a strict condition of participation in the benefits of the program, to adopt local land use and control measures…I want to point out at the outset that it is the combination of effective land use controls and full actuarial rates for new construction that makes the national flood insurance program an insurance program rather than a reckless and unjustifiable giveaway that could impose an enormous burden on the vast majority of the Nation's taxpayers without giving them anything in return. With adequate land use, there is hope of eventually reducing the tax burden, *while at the same time providing protection at low cost to those who built where they did without fully knowing* or understanding the inevitibale and tragic consequences." *Id.* (Statment of George K. Bernstein, Federal Insurance Administrator, Department of Housing and Urban Development (emphasis added).

that would be meaningful without criteria that limit such development. Moreover, there is no mechanism by which the 10% increase in footprint is curtailed to a property as a single time occurrence. This presents a scenario where a single owner, or a series of successive owners, may each request multiple expansions of 10%, each of which goes un-reviewed and unmitigated. This is very like the sliding baseline that occurs in the "no rise beyond 1 foot in the base flood elevation" described above.
FEMA proposes to recognize that any development proposal that has received prior review under the ESA (*i.e.,* section 4(d), 7, or 10) would not be subject to compliance with FEMA's conservation measures and would be compliant with FEMA's "all necessary permits" requirement (44 CFR 60.3(a)(2)). Furthermore, FEMA assumes that any project that occurs in the floodplain that has previously been "approved" under ESA section 4(d), 7, or 10 satisfies FEMA's ESA obligation. We believe this is inconsistent with section 7 of the ESA because it effectively absolves FEMA of its independent obligation to ensure its actions are not likely to jeopardize the continued existence of ESA-listed species or destroy or adversely modify designated critical habitat. There is no provision that dismisses that obligation because another Federal agency has satisfied its own ESA obligation for its action. For instance, a proposed development that includes "upland development" in the floodplain and an associated boat dock is likely to be reviewed under a section 7 consultation with the Corps as the action agency, since the Corps would issue a permit for the boat dock. However, the Corps may not be aware of the upland development, or not include the upland portions of the project in their environmental review, because the development is outside of the agency's jurisdiction. Consequently, the Corps' boat dock consultation may not address the floodplain development at all, or the consultation may not contain terms and conditions regarding the floodplain development if the development is non-jurisdictional since the Corps lacks authority over that aspect of the project. Furthermore, any take exemptions provided by a section 7 consultation are specific to the consulting agency and its authorities and jurisdictional limits. Where multiple Federal agencies are involved, all relevant agencies should be a party to the consultation so that they may all concurrently satisfy their ESA obligations (50 CFR 402.07), and so that NMFS may comprehensively consider the authorities and jurisdiction of all Federal action agencies when completing the consultation. If the consultation process is sequenced (*i.e.,* one Federal agency consults, followed by another), an agency with an action that may affect a listed species or their designated critical habitat that was not party to the consultation retains the obligation to consult under section 7(a)(2).

The revised implementation of the NFIP proposed for Oregon primarily differs from the regulatory floodplain management criteria by incorporating three conservation measures. These measures would limit development in a conservation zone, defined by FEMA as the floodway and riparian buffer zone, to: (1) development that would not adversely affect ESA-listed species and their habitat; and (2) select development types intended to have limited adverse affects. The allowable development types include habitat restoration activities, functionally-dependent uses, and activities that result in a beneficial gain for ESA-listed salmonids and their habitat. As determined as a net effect, all development in the conservation zone would be limited to short-term adverse effects (*i.e.,* not to exceed 1 year).

Habitat restoration activities presumably would achieve long-term beneficial fish habitat objectives. Therefore, by design these activities are not expected to result in adverse effects that would persist beyond the short term. Furthermore, since restoration actions would benefit the ESA-listed species, we are interested in encouraging habitat restoration activities and not creating impediments to their implementation. Allowing their implementation in the conservation zone is consistent with our species recovery objectives.

However, we view the other allowable conservation zone development types as being based on a more complicated equation that balances adverse and beneficial effects. The short-term adverse effect criterion as it would apply to functionally-dependent uses would allow poorly defined compensatory mitigation, including out-of-kind and off-site mitigation, to offset (*i.e.*, rectify or replace) adverse effects in order to result in a net neutral or beneficial effect conclusion. Also, the "beneficial gain" development is very subjective and includes no specific parameters beyond the "short-term adverse effect" and "beneficial gain" criteria. While we suspect it best applies to areas of degraded habitat and therefore presumably to areas of existing development, the proposed action does not limit it to such areas.

Habitat Assessment. In the case of functionally-dependent development and beneficial-gain development, FEMA would have local permitting officials require a "habitat effects and mitigation assessment" intended to identify the anticipated level of adverse effects to listed species and habitat that would result from the development. FEMA proposes to require that these assessments conform to certain standards. The assessment standards would be provided in an as-yet-to-be-completed habitat assessment guide developed by FEMA. FEMA's expectation is that the project proponent would complete the necessary assessment, and the community permitting official would validate the assessment's conclusions. Therefore, in order to effectuate FEMA's proposal, permitting officials and associated floodplain development permittees must have both (1) sufficient knowledge of the presence or absence of ESA-listed species and designated critical habitat on a project site and the requirements of the ESA, and (2) the technical knowledge necessary to determine if their activity might have direct or indirect effects on those species or their habitats that occur both within the project area and in areas adjacent to or downstream of their project.

This is problematic because many community permitting officials and permittees lack this specialized knowledge. While professional environmental consultants could help alleviate some concern, the permitting official would still need to be able to validate the accuracy of the assessment. Consequently, these officials are at risk of making determinations that are contrary to FEMA's expectations. FEMA did not provide information to substantiate the assumption that community permitting officials have sufficient resources to satisfy FEMA's standard. FEMA has proposed to provide technical assistance and workshops, as budgets allow, to aid community officials in evaluating ESA effects. However, community officials have other responsibilities and forces exerting pressure on them that may influence their decision-making in regards to the effects of individual development projects, and they are not accountable to FEMA. Moreover, the experience of RPA implementation in Puget Sound, Washington, which FEMA implemented using this same construct, has proven inconsistant and unreliable at the local level (see Appendix 2.4-A), yielding uncertain benefits to species and habitat. Finally, Rosenbaum (2005, p. 11) observes that "local governments may provide many inducements for floodplain development through, for example, failure to enact or to enforce ordinances affecting development or other constraints on floodplain transformation." Therefore, a high degree of uncertainty remains about both the success of FEMA's transfer of responsibility to community officials and the capacity of local entities to make accurate ESA "effect determinations"[123] consistent with FEMA's expectations.

Mitigation. The same dilemma applies to floodplain development outside of the conservation zone (and regarding functionally-dependent development in the conservation zone), where FEMA would advise local communities that they must require compensatory mitigation for all adverse effects of development in the floodplain. Community permitting officials in Oregon generally lack the specialized knowledge necessary to ensure the success of such a requirement. Furthermore, other compensatory mitigation programs, such as those associated with the Clean Water Act, have a poor record of implementation, performance, or effectiveness (NRC 2001, GAO 2005). In many instances mitigation is never implemented and when implemented it often fails to replace the ecological functions lost, including flood storage. FEMA's proposed action does not identify the types of development activities that would require mitigation, or what appropriate mitigation would consist of, increasing the uncertainty regarding whether the mitigation requirement would be effectively implemented.

Other than noting that very few communities in Oregon have been placed on probation, FEMA has not offered data that would allow us to determine the likelihood that communities and associated floodplain development permittees would implement the proposed mitigation requirements as intended by FEMA. FEMA has little experience with the mitigation requirement (NMFS 2008c). The Corps has years of experience with compensatory mitigation, particularly with wetland mitigation under their Clean Water Act section 404 program (404 Program). Examining Corps required compensatory mitigation, compliance rates greatly vary (NRC 2001, GAO 2005) even though the Corps has a much more direct involvement with the individuals implementing the activities than FEMA proposes. The factors contributing to low compliance include limited or nonexistent monitoring and inspections, lack of specific mitigation requirements, and the failure to specify a timeline with deadlines for implementation (GAO 2005).

FEMA's proposal does not address any of these factors. Compliance monitoring would be achieved by way of CAVs, which monitor community compliance with the NFIP standards. In most years, FEMA (or DLCD) reviews NFIP implementation in select communities. For any given community, the monitoring is infrequent. CAVs are discussed in more detail below under Program Oversight. FEMA did not provide information regarding community compliance and inspection standards. For example, FEMA has not indicated that it requires a certain level of post-construction inspections to be found in compliance. Nor did FEMA provide data on permit compliance within communities, for example, data indicating the average and range of community permit compliance.

In regard to mitigation, increased oversight appears to lead to increased compliance. Mitigation banks also appear to have greater oversight and better compliance than permittee-responsible

[123] We are concerned about the unclear meaning of FEMA's usage of the term "effects determination," which is normally associated with a Federal agency's responsibility under section 7 of the ESA. In that context, the term relates to a Federal agency's preliminary determination whether its proposed action as a whole is or is not likely to affect listed species or designated critical habitat, not whether discrete components of a proposed action will have such an effect.

mitigation (GAO 2005). However, mitigation banks tend to relocate and concentrate well-distributed functions into discrete sites, which may be problematic if the result is a series of well-functioning sites separated by large reaches of severely degraded habitat. The National Research Council (NRC 2001) and Government Accountability Office (GAO 2005) concluded that the Corps 404 Program achieved a low level of oversight due to a failure to provide clear guidance combined with limited resources.

FEMA’s premise that each development activity can effectively offset its own impacts is not a reasonable expectation. Nothing in FEMA's proposed action for implementation of the NFIP in Oregon would lead us to expect equivalent or better performance with mitigation compliance and implementation than the Corps has seen. FEMA did not provide us with data that would have allowed us to determine whether or to what level FEMA was likely to achieve compliance with the proposed mitigation measure. Therefore, based on the information available, we expect a substantial number of activities that should be mitigated would not be, either because the adverse effects were not accurately discerned by developers and local officials in the first instance, or the effects are not sufficiently compensated. The fact is that rather than a no-net-loss outcome, the compounding failures of implementation and functional replacement mean that at a landscape scale, a net decrease in habitat function is a highly likely outcome. Consequently, the likely failure to achieve compliance and effective mitigation means that at the watershed scale and above, the functionality of floodplain habitat in Oregon will likely continue to decline under FEMA’s proposed action.

***Riparian Buffer Zone*.** Bankside buffer widths equal to the maximum site-potential tree height of native species are adequate for ensuring a majority of riparian functions for confined waterbodies (FEMAT 1993, Pollock and Kennard 1998). For waterbodies that move laterally between points of confinement, the riparian area is more extensive then the bankside zone. In such systems, the riparian area functionally consists of the entire channel migration zone and a lateral distance generally equivalent to the maximum possible tree height (*i.e.*, one site-potential-tree height). In both instances, the functional riparian area may include up to the entire floodplain and even extend to adjacent upslope areas depending on channel dynamics, the native tree species, and the floodplain width.

FEMA has proposed that local communities establish a 170-foot riparian buffer zone (RBZ). Based on a review of tree species commonly found within Oregon, many dominant species have maximum potential heights in excess of 170 feet (Table 2.4-2). At the site scale, where specific conditions influence the growth potential of individual trees, this distance is likely narrower than the site-potential tree height in some instances and wider in others.

The 170-foot RBZ proposed by FEMA generally equates to 75 to 85% of the maximum site-potential tree height of commonly dominant tree species, and in most instances would be expected to provide an equivalent or greater percentage of associated riparian functions (*e.g.*, ≥74%). For example, looking at wood recruitment to the channel and water temperature for hardwood and conifer areas, a 170-foot buffer zone would in general conserve approximately 95% or more of the associated wood and shade functions (McDade *et al*. 1990, Spies *et al.* 2013, Leinenbach *et al*. 2013).

Table 2.4-2. A selection of common tree species that occur in Oregon and their height at maturity and maximum.[124] As considered herein, when two heights are presented the greater of the two is considered equivalent to the site-potential tree height. Asterisk denotes species that are commonly considered a dominate stand species within its range.

Species		**Height (feet)**	
Common Name	**Scientific Name**	**At Maturity**	**Maximum**
Grand Fir	*Abies grandis*	150	330
Western Red Cedar	*Thuja plicata*	150	250
Ponderosa Pine*	*Pinus ponderosa*	223	230
Douglas-Fir*	*Pseudotsuga menziesii*	200	>220
Sitka Spruce	*Picea sitchensis*	200	200
Western Hemlock	*Tsuga heterophylla*	170	200
Black Cottonwood*	*Populus balsamifera ssp. trichocarpa*	100	200
Oregon Oak	*Quercus garryana*	80	100
Red Alder	*Alnus rubra*	90	100
Western Larch	*Larix occidentalis*	200	-
Big Leaf Maple	*Acer macrophyllum*	60	80
Oregon Ash	*Fraxinus latifolia*	70	-
Port Orford Cedar	*Chamaecyparis lawsoniana*	200	-
Western Juniper	*Juniperus occidentalis*	33	35

Therefore, the proposed buffer appears to provide nearly all of the potential wood and shade functions associated with an adjacent channel, provided the channel does not move and buffer areas are allowed to establish or maintain woody vegetation. The value of the measure is significantly diminished if: (1) migrating channels are restricted so that complex riparian mosaics are not able to develop (Gregory *et al*. 2002c, Ward *et al.* (2002b); (2) migrating channels occupy other areas where vegetation was not conserved (Ellis-Sugai and Godwin 2002); or (3) actions that reduce the habitat functions of the buffer are allowed to occur (*e.g.*, felling of trees).

Channel Migration Zones. FEMA's proposal that local communities will delineate a conservation zone where allowable floodplain development would be limited (*i.e.*, floodway and RBZ) is consistent with the recommendations of NMFS and others as a way to accommodate geomorphic processes and reduce development effects (NMFS 2008c, Florsheim *et al.* 2008, Piegay *et al.* 2005, Larson and Plasencia 2001). However, FEMA does not propose to modify its flood risk mapping protocols to include flood-related erosion-prone areas such as channel migration zones, as previously discussed, nor implement floodplain management criteria that limit the geomorphic effects of floodplain development. While recognizing that lateral channel movement occurs, that channel migration information can provide valuable data regarding habitat functions and processes, and that channel migration information provides communities information regarding public safety and infrastructure risks associated with flooding, FEMA states that it lacks the authority to require development standards in channel

[124] Source of tree heights: NRCS Plants Database and associated fact sheets. Available on line: http://plants.usda.gov/.

migration zones even where they occur in floodplains; however, FEMA has promulgated regulatory floodplain management criteria with specific development limits that apply in floodways, which are similar to CMZs, in that both are sensitive, high-risk zones within flooplains.

This omission of the channel migration zone from the conservation zone significantly undermines the value of the proposed conservation zone and limits the ability of FEMA to minimize the adverse effects of floodplain development on geomorphic processes important to ESA-listed species. Presumably, the placement of floodplain fill, bank stabilization, and levee construction and modification that adversely affects the ability of stream and river channels to accommodate lateral movement would require mitigation consistent with the "no net loss" and "net beneficial gain" standard. However, NMFS is not clear on how channel migration zone effects would be evaluated or mitigated by NFIP communities under FEMA's proposal. Given that FEMA's proposed action does not include the CMZ in the conservation zone or offer development standards specific to flood-related erosion-prone areas, we conclude that the proposed action does not adequately address the effect that floodplain development will have on flood-related erosion-prone areas.

Community Adoption of Conservation Measures. While FEMA proposes these conservation measures, FEMA is not adopting revisions to their regulatory floodplain management criteria, which govern NFIP eligibility. Therefore, it is difficult to assess whether communities will adopt and implement the conservation measures. FEMA has stated that they have no authority to require a community to modify its local ordinances to provide floodplain management requirements beyond the NFIP regulatory requirements. FEMA has stated that incorporation of the proposed conservation measures would be consistent with 44 CFR 60.3(a)(2), the "all necessary permits" regulation. However, it is unclear how these measures fall under the scope of that regulation. Presumably, the measures are offered by FEMA as a non-regulatory approach for communities and individuals to demonstrate compliance with the ESA – similar to FEMA's Procedure Memorandum 64 method for seeking ESA compliance for map changes.[125] However, we have several concerns with this approach: (1) as discussed previously (Section 2.4.4.1) and below, there are no required ESA permits for most community floodplain development activities, and permit-by-permit review of individual projects will not capture the aggregate landscape effects to listed species and designated critical habitat of FEMA's program; (2) it incorrectly assumes that a suite of non-regulatory measures, when applied, will always fully avoid detrimental effects, which is uncertain as it is premised on applicants or local government personnel first correctly ascertaining the type and duration of adverse effect thay may occur, and then implementing a corollary mitigation requirement; and (3) it is unclear whether a community's failure to achieve the intended level of habitat protection would be grounds for probation or suspension from the NFIP. Furthermore, we are unclear what constitutes an "enforceable procedure" and whether FEMA

[125] On March 20, 2014, FEMA informed NMFS that new mapping standards had been issued as of August 22, 2013 (FP 204-078-01) and that Procedure Memorandum 64 had been incorporated into the new standards (communicated during inter-agency meeting in Lacey, Washington). On March 27, 2014, FEMA clarified that FEMA had not changed their procedures with regard to Procedure Memorandum 64 (E-mail correspondence from David Ratté (FEMA) to Robert Markle (NMFS) regarding the 2013 mapping standards (FP 204-078-1, adopted August 22, 2013)).

has any greater ability to enforce this provision. For these reasons, it remains unclear that these measures are likely to achieve their intended outcomes.

In order for us to rely on conservation measures to ameliorate the effects of an agency's proposed action, we must determine that the measures are reasonably certain to occur. Absent FEMA being able to require and enforce the implementation of these measures, we cannot conclude that they are reasonably certain to perform as intended and therefore must rely on the regulatory floodplain management criteria set forth by 44 CFR 60.3, the regulatory standards, for purposes of our analysis.

Implementation Area. FEMA stipulates that the proposed conservation measures would apply to all communities with ESA-listed species and critical habitat present within the floodplain. Thus it appears that floodplains within a community that are upriver of species distribution and communities wholly located upriver of species distribution are not required to implement the proposed conservation measures. This fails to consider the potential downstream effects associated with floodplain development (*e.g.*, changes in flow, velocity, water quality, sediment load, wood volume).

All Necessary Permits Requirement. The conservation measures that FEMA proposes for Oregon do not appear to be mandatory. They are intended as a means by which communities can satisfy "their" ESA obligations and therefore carry forward as a surrogate FEMA's responsibility of ensuring that the NFIP does not jeopardize listed species or adversely modify designated critical habitat. This surrogacy hinges on FEMA's regulations, which require that locally permitted development obtain all necessary permits (44 CFR 60.3(a)(2)). FEMA's fundamental assumption is that the conservation measures will sufficiently limit the effects of floodplain development to allow us to exempt incidental take of ESA-listed species for development that complies with the proposed conservation measures. However, this approach has three major weaknesses.

First, from a physical outcomes perspective, the proposed conservation measures identify only general management areas and provide broad development standards (*e.g.*, short-term adverse effect, compensatory mitigation). The measures do not include any design criteria specific to various types of development (*e.g.*, building or road construction, over-water structures, restoration) or effect pathways (*e.g.*, stormwater management, vegetation management, construction equipment operation). In the absence of specific criteria to limit the potential scope of activities and effects that may result from floodplain development authorized under the NFIP, FEMA does not appear able to ensure that the effects of the program will be predictable or limited in their magnitude and intensity.

The second weakness is procedural and turns on the lack of a Federal nexus for most floodplain development projects, FEMA's reliance on the section 7 compliance of other Federal agencies, and the fact that there is no obligation for private parties or local jurisdictions to obtain ESA section 10 permits. FEMA proposes to recognize ESA section 7 consultations issued to other Federal agencies as adequate to fulfill its own ESA obligations. This might be satisfactory if the approvals were certain to consider all elements of the proposed development including interrelated and interdependent actions and when no new information subsequent to the approval would change the expected effects of that development. Instead, however, FEMA proposes to recognize the section 7 consultation of other agencies regardless of the jurisdictional limits of the consulting agency or any potential remaining FEMA nexus (*i.e.*, CLOMR, FEMA funding, levee accreditation).

The Federal Highway Administration and the Corps are likely the most common Federal agencies that will have completed section 7 consultations with NMFS that may involve activities in the floodplain. The floodplain includes the associated waterways, and therefore the Corps and FEMA often have co-occurring jurisdictions within those waterways. Frequently, the Corps issues regulatory permits for activities that include development activities in the floodplain outside of the Corps' jurisdiction (*e.g.*, residence and boat dock). In 2007 (72 FR 11092) and reaffirmed in 2012 (77 FR 10184),[126] the Corps modified its Nationwide Permit Program (NWP) to limit its authority regarding fill in floodplains to only wetlands. The Corps' stated purpose in reducing its permitting function for above-grade fill in 100-year floodplains was to harmonize the NWP program with FEMA's floodplain management program (71 FR 56258). The NWP requires (general condition 10) the permitted activity comply with applicable FEMA-approved state or local floodplain management requirements. In modifying this condition, the Corps stated that adverse effects to 100-year floodplains would continue to be addressed through the pre-construction notification process (71 FR 56258). In 2012, the Corps restated that sufficient safeguards were in effect to ensure that NWP activities would have minimal adverse effects on the aquatic environment including floodplain values and flood hazards because of required terms and conditions, pre-construction notifications, and the discretionary authority of district engineers (77 FR 10184). However, some question remains about whether the Corps can (or does) meet those standards.[127]

Stein and Ambrose (1998) reported that Corps permitted actions in California from 1985 to 1993 had substantial adverse indirect effects, due for example to development of adjacent non-jurisdictional floodplains, inhibiting exchange of water, flood energy, sediment, nutrients and organisms between active channels and floodplains (as cited in NMFS 2012b). As a recent Oregon example, in 2012, a project proponent proposed to dispose of dredged material in the floodplain outside of the Corps jurisdiction. When we raised concerns about the disposal the Corps responded that they lacked the jurisdiction to require mitigation for impacted floodplain functions or to condition the disposal beyond the return flow. Consequently, as demonstrated by the preceding examples, consultations with other Federal agencies may not allow floodplain effects to be satisfactorily addressed in FEMA's stead.

[126] The National Marine Fisheries Service issued a Reasonable and Prudent Alternative to the U.S. Army Corps of Engineers for the Nationwide Permit program on February 16, 2012 (FPR-2011-6426). The Corps requested a re-initiation of consultation, and in December 2014, NMFS released a No Jeopardy opinion based on the Corps' revised proposed action, which included increased tracking of impacts, proposed rulemaking to modify requirements for NWPs 12 (utility lines), 13 (bank stabilization), 14 (transporation projects), and 36 (boat ramps); and engagement in regional consultations on activity specific proposals.

[127] NMFS concluded that, at the national level, the Corps' nationwide permit program jeopardized listed species and adversely modified designated critical habitat (NMFS 2012c), per re-initiated consultation, new consultations are proposed to occur with the next nationwide permit re-issuance at a region by region level.

The third weakness is that the ESA's take prohibition, which applies to communities and individuals under ESA section 9, and the ESA section 7 no-jeopardy standard, which applies to FEMA, are different. Activities that do not cause take at a site-scale and therefore do not violate section 9 may collectively cause take or result in jeopardy at the scale of FEMA's proposed action – implementation of the NFIP in Oregon. Telling communiuties to avoid take for individual projects doesn't mean that FEMA is avoiding jeopardy to listed species in Oregon.

It is also unclear how FEMA will ensure that floodplain development will be consistent with the standards included in the three conservation measures. It appears that local community permitting officials would be able to authorize any development project that satisfied the regulatory floodplain management criteria (44 CFR 60.3), including the "all necessary permits" requirement (44 CFR 60.3(a)(2)). FEMA asserts in its BA that the community permitting official could satisfy the "all necessary permits" requirement simply by determining that an "ESA permit" was not warranted. Consequently, FEMA's proposal could allow an undetermined amount of floodplain development that is non-compliant with the Oregon conservation measures, as long as it is consistent with the regulatory floodplain management criteria. We previously concluded that the regulatory floodplain management criteria would result in jeopardy to ESA-listed species and adversely modify designated critical habitat in Puget Sound, Washington (NMFS 2008c).

In sum, it appears that FEMA is assuming that in many instances communities need an "ESA permit" for floodplain development where ESA-listed species occur, and that if those communities implement FEMA's proposed conservation measures, they will be compliant with the ESA, and therefore FEMA will be compliant with the ESA. However, it also appears that under the proposed action FEMA is unable to ensure that: (1) communities will implement the conservation measures since they are not required by the regulatory floodplain management criteria, or (2) FEMA's acceptance of prior ESA approvals (granted under sections 4(d), 7, or 10) would adequately avoid or minimize the adverse effects of floodplain development. For these reasons, we cannot be reasonably certain that FEMA can meet its independent ESA obligation through reliance on the "all necessary permits" regulation (44 CFR 60.3(a)(2)).

Development Oversight. FEMA requires implementation of the regulatory floodplain management criteria as a requirement of community participation in the NFIP, but FEMA's proposed action provides very limited oversight of pre-construction development. Thus FEMA relies heavily on those entities that implement the NFIP standards (*i.e.*, State, communities, applicants) to avoid, minimize, and mitigate adverse effects. The CLOMR process provides FEMA an opportunity to review a proposed development and confirm effects have been appropriately minimized and compensated, if needed, before construction. However, while a community or individual may request a CLOMR for any development (44 CFR 65.8), FEMA only requires a CLOMR under limited circumstances: when a community proposes to permit encroachments upon (1) the floodplain when a regulatory floodway has not been adopted which will cause BFE increases in excess of one foot, or (2) an adopted regulatory floodway which will cause any increase in the BFE (44 CFR 65.12(a), 44 CFR 60.3(c)(10), 44 CFR 60.3(d)(3)). The lack of FEMA oversight of floodplain development that may adversely affect floodplain functions combined with the vague mitigation standard proposed by FEMA is problematic as it increases the uncertainty that effects will be consistently identified and adequately compensated.

Implementation Schedule. In Oregon, under the proposed action, communities would transition from managing floodplains using the regulatory floodplain management criteria to using the modified standards proposed for Oregon over a 4-year period. Consequently, depending on how rapidly communities incorporate the new standards into their ordinances or other enforceable procedures, there would be ongoing effects from the continued implementation of the existing national standards during the transition period. After 4-years, the effects of implementing the NFIP would reflect the new Oregon standards.

Conservation Measure Summary. It appears to us that under the proposed conservation measures, communities would have the discretion to:

1. Apply the conservation measures for floodplains only where ESA-listed fish occur, which fails to consider the effects of floodplain development upriver.
2. Accept ESA consultations from Federal agencies other than FEMA for proposed developments, which may not reflect the conservation measures proposed by FEMA and therefore reflect jurisdictional differences between the consulting agency and FEMA.
3. Make "effect determinations"[128] on a development-by-development basis, which may allow communities to errantly determine development, even development that does not conform to the conservation measures, may have no adverse effect on ESA-listed species or critical habitat and result in unidentified adverse effects and allow those effects to accumulate across the landscape and over time.

Program Oversight. FEMA oversight of NFIP implementation is inadequate as currently proposed. The proposed action does not provide measurable performance standards or an adaptive management plan. Without identifying specific measurable thresholds or sideboards to limit effects to minor and predictable adverse effects it would be difficult to determine whether the NFIP implementation in Oregon were exceeding effect expectations necessitating corrective action either through an adaptive management plan or reinitiation of consultation.

Pre-Development Review. FEMA has previously acknowledged that CLOMRs constitute a Federal nexus that provide FEMA the ability to complete section 7 consultation on a development activity prior to its implementation.[129] A community or an individual through the community may request a CLOMR for any project (44 CFR 65.8). However, FEMA does not require CLOMRs except in limited circumstances (44 CFR 65.12(a), 44 CFR 60.3(c)(10), 44 CFR 60.3(d)(3)). Other opportunities that provide FEMA with a Federal nexus by which to complete section 7 consultation before development activities are implemented may exist, such as when FEMA accredits a levee and establishes associated risk zone determinations; adopts new minimum design, operation, or maintenance standards for levees; or adopts new floodplain development standards. However, FEMA has not routinely conducted section 7 consultations on these actions.

[128] As mentioned previously, we are confused with this usage of "effects determination," which is associated with a Federal agency's responsibility under section 7 of the ESA

[129] *E.g.*, Letter from Michael K. Buckley (FEMA) to Barry Thom (NMFS), April 24, 2009.

Compliance Monitoring. FEMA's NFIP decision-making process includes approving the floodplain ordinances of local communities, monitoring communities to ensure that they have adopted an ordinance that meets or exceeds FEMA's regulatory floodplain management criteria, and ensuring that communities are effectively enforcing their ordinances. FEMA determines a community's NFIP compliance via CAVs, which reviews community actions taken since the last visit. FEMA proposes no pre-construction oversight beyond existing mechanisms (*e.g.*, CLOMRs, levee accreditation).

The most accurate monitoring program would involve reviewing every community and every permit issued by the community that authorized activities in the floodplain, but with a program the size of the NFIP in Oregon (260 communities), complete review is not feasible given current resource levels. Therefore, FEMA uses a prioritized sampling approach. Each year, FEMA reviews a certain number of communities. The number of CAVs completed each year has declined from a peak in the 1990s (average of 35 CAVs completed per year) (Table 2.4-3).[130] Using the 2002 to 2006 period as representative of current capacity,[131] FEMA completes an average of 12 CAVs per year, with a range of 2 to 25 CAVs (Table 2.4-3). Both FEMA and DLCD conducted the visits (0 to 4 per year by FEMA and 2 to 23 per year by DLCD).

FEMA's goal is to perform a CAV for each community every 5 years. However, current effort does not match this objective. As of March 2013, available data indicated approximately 59 participating communities (23%) have never had a CAV. FEMA prioritizes community selection, and many communities go much longer between visits. Based again on the representative period (2002 to 2006) and excluding communities that have never been visited, the average time since a community's previous CAV is 9.9 years with 63% being more than 10 years (44 communities) (Table 2.4-3).

Table 2.4-3. FEMA and DLCD have completed Community Assist Visits (CAVs) with Oregon NFIP communities since 1986. The 2002-2006 is used as representative of current capacity. Source: DLCD

	Completed CAVs (#)		Time Since Previous CAV	
Period	Total	Annual Avg	Average (yrs)	>10 Years (%)
1986-2012	591	22		
1986-1989	132	33		
1990-1999	353	35		
2000-2009	87	9		
Select Periods				
2002-2006	56	12	9.9	63%
2007-2012	30	5	13.9	83%

To increase the frequency that communities with ESA-listed species get reviewed, FEMA has proposed to consider the presence of ESA-listed species when prioritizing CAVs. Furthermore,

[130] Based on CAV data for 1986-2012 provided via e-mail from Chris Shirley (DLCD) to Robert Markle (NMFS) on March 5, 2013.

[131] The 2002-2006 period was selected as the representative period because recently (2007-2012) staff effort has been allocated to implementing the Map Modernization program, which was completed in 2012.

FEMA has indicated an effort to increase the resources available to conduct more CAVs in coming years. However, given the number of action area communities in river basins with ESA-listed species (~235 communities[132]), we do not expect the frequency to be appreciably different from the representative period (2002-2006), 12 CAVs per year. Also, considering that 60% of communities (167 communities) have never had a CAV or have not had one since 2000, CAVs would need to increase considerably before FEMA can achieve its stated goal of visiting each community every 5 years.

While we understand that FEMA prioritizes community selection based on a set of criteria, we do not have information to validate that the frequency of CAVs is sufficient to detect non-compliance in a timely manner. Consequently, considerable uncertainty exists in regard to whether community compliance with FEMA's regulations, either the proposed Oregon measures or the regulatory floodplain management criteria, and permittee compliance with permit requirements are reasonably likely to occur.

Implementing a subsampling plan is acceptable, particularly in the situation where the pool of eligible communities is too large to sample all of them each year. However, the sample objective needs to be considered when evaluating the adequacy of the sampling plan. In this case, the objective should be to quantitatively determine community and program compliance. A shortcoming of FEMA's current sampling approach is that quantitative estimates of program compliance cannot be provided.

FEMA uses a non-random sampling approach based on a set of "risk factors" to select the sample group (*i.e.*, communities) that will be visited each year. Some communities are never sampled and some communities are sampled very infrequently. Consequently, it appears a significant proportion of the pool of NFIP communities is not being represented by the sampling. Furthermore, since compliance is often lower when oversight is low, compliance in this unsampled group may be lower than the communities that are being sampled more frequently. Thus, a sampling bias may exist. FEMA's use of a non-probabilistic sampling method (*i.e.*, non-random) prevents the development of an unbiased quantitative compliance estimate for the implementation of the NFIP in Oregon.

FEMA's current compliance monitoring is very limited, approximately 12 community reviews per year. The frequency of monitoring is low, an average of 10 years between community reviews. A substantial number of communities have never been monitored, approximately 23% of communities. The monitoring lacks the ability to quantitatively estimate community and program compliance. Consequently, considerable uncertainty exists regarding community and permittee compliance.

Enforcement. If FEMA finds a community is out of compliance with the regulatory floodplain management criteria, FEMA can initiate a formal enforcement action, or if the community does not make adequate progress in rectifying non-compliance, FEMA can

[132] Excluding 25 communities in Klamath, Lake, Harney, Malheur, Baker, and portions of Deschutes Counties.

initiate formal probation.[133] If a community does not address FEMA's concerns within the probation period, the community may be suspended from the program (44 CFR 59.24). Although there are financial disincentives for communities to be on probation and suspended, FEMA prefers to work with the communities to achieve compliance. An evaluation of the NFIP noted that there is not a "sufficient use of the negative incentives that were designed to encourage community compliance – probation and suspension" (Wetmore *et al*. 2006, p. 16).

FEMA proposes to treat non-compliance with the proposed Oregon conservation measures differently from non-compliance with the regulatory floodplaine management criteria. While FEMA enforces non-compliance with the regulatory criteria based on whether a community adheres to the criteria or not, FEMA proposes to require that NMFS demonstrate harm to ESA-listed species in order for FEMA to proceed with enforcement of non-compliance with the proposed Oregon conservation measures. Should NMFS fail to demonstrate harm to ESA-listed species, FEMA proposes to retain discretion on electing whether to proceed with enforcement. This approach changes the burden of ensuring no jeopardy or adverse modification into a burden of demonstrating harm to an individual of the listed species and conflates the ESA section 7(a)(2) standard with the ESA section 9 take prohibition.

To what degree the community or individual satisfies their ESA obligation to avoid take is a separate matter from whether they are in compliance with the NFIP and whether FEMA is in compliance with the ESA's "no jeopardy" standard. For instance, an individual floodplain development project might not kill or injure a listed species, but the aggregate effect of multiple projects in the same area may degrade habitat to the point where negative impacts on population abundance and productivity occur. Also, it can be extremely challenging to "prove" that an individual of a listed species is injured or killed through habitat modification, yet the best available scientific information (*e.g.*, ESA listing decisions and recovery plans) clearly supports the causal link between habitat alterations – and specifically floodplain development – and the decline of listed Pacific salmonid species.

Also, while some level of compliance assurance may be accomplished by the CLOMR and LOMR processes (approximately 15 letters per year), this is minimal as currently implemented (Table 1.3-5). FEMA's principle vehicle for determining compliance is the CAV. As discussed above, in many instances this takes place years, even decades, after development has occurred.

Other Compliance Issues. There are other compliance issues with the NFIP as currently implemented and as proposed. These issues further increase the uncertainty that habitat functions will be adequately retained. The NFIP is constructed with implementation relying on many "downstream users" (*e.g.*, State, community, landowner). At each level, the program has ever-increasing opportunities to go astray. We have little data on the degree to which landowners are getting permits to implement development activities in the floodplain. Furthermore, compliance under the proposed program is difficult to predict. Based on our experience with the NFIP in Puget Sound, we know that compliance varies considerably. Also, we lack information

[133] It is the standard practice that FEMA, on finding a community out of compliance, will spend 1 to 2 years providing technical support and assistance toward compliance before reaching the probation threshold. (Meeting with FEMA, DLCD, and NMFS; February 17, 2011.)

regarding community enforcement efforts beyond the understanding that they are underfunded and minimally implemented. The information we do have does not ameliorate our concern (CPW 2009). Also, when we see the State's highest CRS-rated community waiving balanced cut and fill regulations where development is deemed important to regional growth and the City's economic development, it is cause of concern.[134]

Given the uncertainty regarding program compliance and the lack of adequate oversight at every level, we do not have reasonable assurance that habitat functions will be adequately retained under the proposed action. Consequently, we must assume uncompensated adverse effects will continue to occur in association with floodplain development under FEMA's proposed action.

Summary: Effects of the Regulatory Floodplain Management Criteria. Although well intended, the conservation measures proposed by FEMA lack the reasonable certainty needed to offset the adverse effects of the NFIP. While an improvement over the existing regulatory floodplain management criteria, which have been found to jeopardize salmonids in Puget Sound, the modified standards would still allow floodplain development with limited oversight, unspecified mitigation, no quantitative limits, and no adaptive management plan.

FEMA's proposed conservation measures would:

- Continue to allow floodplain development and flood control activities that alter habitat used by ESA-listed salmonids, including development that removes and degrades available off-channel floodplain habitat (*e.g.*, fill, pollution, stormwater runoff, vegetation removal, channel confinement, hydrologic modifications).
- Provide insufficient assurances that mitigation would adequately offset any unavoidable adverse effects.
- Not abate the current rate, level, or caliber of habitat effects associated with the regulatory floodplain management criteria during the 4-year program transition period, nor of habitat effects that will arise from development taking place in floodplains located upriver of species distribution.
- Where FEMA accepts another Federal agency's ESA section 7 compliance in place of the standards included in the proposed action, retain the current range and level of effects associated with the NFIP for elements of the project that occur outside of the authority of the other Federal agency.
- Provide no certainty about whether communities that permit floodplain development are able to make well-informed permit decisions in terms of potential effects and associated mitigation, due in part to the lack of pre-construction review by FEMA and lack of any specificity regarding mitigation requirements.
- Not include timely ability to determine when corrective action is needed, due to the extended periods between compliance monitoring by FEMA (or the DLCD), and also due to the lack of measurable performance standards, measurable thresholds, or specific sideboards.

[134] The City of Portland has a balanced cut and fill requirement (Ordinance 24.50.060 F 8). However, it is our understanding that the requirement has been waived for some floodplain development (*e.g.*, South Waterfront) and is currently proposed to be waived for the West Hayden Island marine terminal development project (City of Portland, Bureau of Planning and Sustainability memo from Eric Engstrom to Mike Rosen, 22 January 2013, p. 4).

2.4.4.3 Effects of the 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[135] 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 C of the BA).

However, under the 2007 CRS program,[136] active participation in Oregon has been low. Only 31 of the 260 communities participating in the NFIP in Oregon (12%) are active in the CRS program. Of these 31 active communities, none currently has a class rating that would require Natural Functions Open Space (NFOS) prerequisite credits under the 2013 CRS program. Consequently, measures to guard against the loss of ecological functions do not appear to be in place in most Oregon communities, at least as measured by the CRS. It is likely that additional communities have measures in place that would realize a premium reduction for their property owners by participating in the CRS program, but for various reasons they do not. It is also likely that if communities fully embraced the natural floodplain function credits alone, they would be eligible for substantial premium reductions and would similarly reduce the risk that development authorized by the community would adversely affect ESA-listed species. In fact, adherence to FEMA's proposed Oregon implementation measures, which requires mitigation for lost functions like flood storage capacity, would make all communities eligible for credits under the development limitations (DL) element 1 (Activity 430).

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. In addition, while participation in the CRS may significantly inhibit floodplain development if communities adopt ordinances that require more than the NFIP mandates (Rosenbaum 2005), it does not appear that most participating communities in Oregon have adopted standards with that degree of additional stringency. Some CRS elements can be beneficial to salmonids (*e.g.*, prohibition of fill (DL 1) provides up to 280 points, preservation of open space designated as critical habitat (NFOS 3) provides up to 50 points), while other elements do have deleterious effects to salmonid habitat (*e.g.*, channel debris removal (CDR) provides up to 200 points, building on fill (FDN 3) provides up to 35 points).

FEMA identified three of the four CRS series of activities as having the potential to affect fish and their habitats: Series 400 (Mapping and Regulation), Series 500 (Flood Damage Reduction), and Series 600 (Warning and Response). In 2008, the NMFS issued a biological opinion for implementation of the NFIP in Puget Sound (NMFS 2008c). One element of the Reasonable and Prudent Alternative (RPA Element 4) associated with the opinion was specific to the 2007 CRS program. The 2013 CRS program includes changes that FEMA states are, in part, a result of that opinion and are intended to better address ESA-listed salmon and steelhead species.[137]

[135] National Flood Insurance Reform Act of 1994, Subtitle C, Section 541 (Public Law 103-325).

[136] The 2007 CRS program refers to the 2007 CRS Coordinator's Manual.

[137] Draft CRS Coordinator's Manual, dated April 6, 2012, is available at: *www.crs2012.org*/.

Therefore, NMFS assumes the effects of the proposed CRS program on these species can be determined by comparing the 2013 program to the 2007 program that was consulted on in Puget Sound. We identified the following deficiencies in our 2008 evaluation:

1. RPA Element 4D required the reduction of available points for structural changes that reduce the amount of functional floodplain (*e.g.*, levees, berms, floodwalls, diversions, and storm sewer improvements), including enclosing open channels and constructing small reservoirs. The 2013 CRS program made several changes that increase the incentives for protecting natural and beneficial functions and requiring compensatory storage (elements FRB, FDN, and DL 1b). However, the compensatory storage criteria can be satisfied without providing an equivalent amount of compensatory habitat area or quality. There is no associated requirement to provide spatial compensation for lost floodplain habitat or ensure the value of that replacement habitat is equal to or better than the affected habitat. Only requiring compensation of lost flood storage capacity fails to ensure that lost floodplain habitat is adequately compensated.

2. RPA Element 4E required points be awarded for moving levees away from the channel and restoring riparian and floodplain function, and dismantling pre-existing levees in part or whole. The 2013 CRS program does provide points for creating additional open space (elements NFOS 1 and NSP), but the available points are relatively small and would not provide much incentive to encourage communities to pursue what is likely a significant undertaking.

3. RPA Element 4G required, in part, clarification that levee certification only requires certification by a professional engineer and that the NFIP accreditation does not require an Army Corps of Engineers certification. The 2013 CRS manual has made the role of a professional engineer less obvious. The previous CRS program manual included specific language requiring a licensed professional engineer to certify that levee maintenance meets all the NFIP levee maintenance requirements. The new program manual replaced that language with the requirement that documentation be provided that the maintenance plan has been approved by FEMA as meeting Procedure Memorandum 63 requirements (Guidance for Reviewing Levee Accreditation Submittals)[138] or approval by the Corps. Procedure Memorandum 63 in turn requires compliance with 44 CFR 65.10, or receiving Army Corps of Engineers approval. Under 44 CFR 65.10(e), certification by a registered professional engineer is required. This requirement to comply with Procedure Memorandum 63 applies even though accredited levees (or levees owned and operated by a Federal agency) are excluded from earning points under the levee maintenance element under Activity 620. Consequently, the 2013 CRS program has not clarified that levee certification only requires certification by a professional engineer and that the NFIP accreditation does not require an Army Corps of Engineers certification. Instead, additional layers of procedural guidance (*i.e.*, PM 63 and 44 CFR 65.10) must now be

[138] On March 27, 2014, FEMA informed NMFS that, while new mapping standards had been issued, FEMA had not changed their procedures with regard to Procedure Memorandum 63 (E-mail correspondence from David Ratté (FEMA) to Robert Markle (NMFS) regarding the 2013 mapping standards (FP 204-078-1, adopted August 22, 2013)).

found and read through in order to find that a professional engineer certification is all that is required.

4. RPA Element 4H required including a category of actions that benefited ESA-listed salmonids, and weighting those credits so that communities seeking CRS class improvements would have an incentive to choose actions that would benefit salmonids. The 2013 CRS program removed points specifically associated with ESA-listed species, but increased the number of ways points are awarded for protecting natural floodplain functions.[139] The 2013 CRS program also added minimum natural floodplain function point requirements for community advancement to Class 4 and Class 1 ratings. For Class 4 and Class 1 ratings, a minimum of 100 and 150 points from these elements is needed, respectively. However, these minimum point thresholds represent only 3% of the total required class points and none are required below the Class 4 rating.

The 2013 CRS program was intended to increase incentives for protecting and restoring natural and beneficial floodplain functions. The NFIA (42 U.S.C. 4121(12)) defines "natural and beneficial floodplain functions" as:

> (A) the functions associated with the natural or relatively undisturbed floodplain that (i) moderate flooding, retain flood waters, reduce erosion and sedimentation, and mitigate the effect of waves and storm surge from storms, and (ii) reduce flood related damage; and
>
> (B) ancillary beneficial functions, including maintenance of water quality and recharge of ground water, that reduce flood related damage.

The assumption is that by providing more incentives, more communities will modify their floodplain management practices in such a manner as to benefit anadromous fishes, while reducing their flood damage risk.

The 2013 CRS program revisions do provide better opportunities for communities to be awarded credits for implementing measures that are likely to reduce the effects of floodplain development on ESA-listed salmonids and their habitat, while also providing substantial flood insurance premium reductions for all community property owners. However, participation in the CRS program does not prevent adverse effects to habitat functions and processes from occurring. The adverse effects of the program are an inherent aspect of the NFIP's foundation, namely FEMA's regulatory floodplain management criteria. Furthermore, at least one CRS pathway likely encourages those adverse effects by providing credits to communities that pursue structural means of reducing flood risk, particularly for lower rated communities where natural floodplain function credits are not required.

The vast majority of the 12,304 available credits are not associated with improved conditions for ESA-listed salmonids or their habitat. The CRS class rating of a community does not in and of itself provide a measure of the magnitude or severity of floodplain development on remnant habitat processes and functions in the community. In no small part this is because there are no

[139] The 2013 CRS program includes points for protecting natural floodplain functions for 13 elements under five different activities (Activities 420, 430, 440, 450, and 510).

natural floodplain function credit prerequisites for 60% of the class ratings (*i.e.*, Classes 5 through 10), and the prerequisite natural floodplain functions credits for Class 1 and Class 4 are low (3% of minimum required points per class rating). The potential beneficial effects of this new program aspect on floodplain functions and processes remain to be fully understood and demonstrated. Consequently, at this time, based on the current lack of community participation in the CRS program in Oregon[140] and the CRS's clear overall goal that protection of development, not habitat preservation, is the principle community interest, it is not clear the revised CRS program will avoid or reduce the adverse effects of floodplain development on ESA-listed salmon or their habitat.

Summary: Effects of the CRS. The 2013 CRS program revisions provide better opportunities for communities that voluntarily participate to be awarded credits for implementing measures that are likely to reduce the effects of floodplain development on ESA-listed salmonids and their habitat. However, participation in the CRS program does not prevent adverse effects to habitat processes and functions from occurring. The adverse effects of the program are inherent in the NFIP's foundation, namely FEMA's regulatory floodplain management criteria. Furthermore, at least one pathway likely encourages those adverse effects by providing credits to communities that pursue structural means of reducing flood risk.

We previously evaluated the effects of an earlier version of the CRS program (2007 CRS) in our 2008 biological opinion on the NFIP implementation in the Puget Sound region of Washington State (NMFS 2008c). The 2013 CRS program appears to address many of the previously identified issues. However, several issues remain unaddressed or inadequately addressed. These include the failure to require spatial compensation for lost floodplain habitat when compensating for lost flood storage capacity under element DL 1b, providing minimal credits for the significant undertaking of moving levees away from the channel, burying the professional engineer levee certification within layers of procedural guidance, not requiring any natural floodplain function credits for class ratings below Class 4, and requiring only 3% of class rating points for Class 4 and Class 1 be natural floodplain function credits.

2.4.4.4 Summary: Effects of the NFIP on Floodplain Development, and Consequential Loss of Floodplain Function

Floodplain mapping, the regulatory floodplain management criteria, and the CRS each include aspects that directly and indirectly impact the quantity and quality of available salmonid habitat in both in-channel areas and off-channel floodplain areas.

The proposed floodplain mapping practices:

- Continue use of the current mapping methodologies, which do not always apply the most appropriate techniques to accurately depict habitat features; omit watersheds smaller than 1 square mile; do not account for flood-related erosion in riverine areas; and do not reflect anticipated future changes in the level of the 1% annual-chance flood due to continued development, sea level change, and climate change. Consequently, floodplain

[140] Community participation in the CRS program is 12% in Oregon with none rated higher than Class 5.

areas that influence in-channel habitat quantity and quality and off-channel areas periodically occupied by anadromous fishes are not accurately delineated.

- Use the modeled mean 1% annual-chance elevation as the base flood elevation estimate without providing the range of predicted elevations or a confidence interval, which inhibits understanding the certainty of the SFHA delineation.
- Continue to incentivize elevation of structures on fill without defined mitigation requirements or oversight to ensure that mitigation is adequately performed.
- Allow for lengthy delays in community implementation of updated maps.
- Define the regulatory floodway in a manner that allows development to occur in areas close to the flood source that contribute significantly to listed species habitat values, and allow a designated floodway to be relocated to accommodate new development.

The regulatory floodplain management criteria as proposed for Oregon:

- Continue to allow largely unrestricted floodplain development and flood control activities that alter habitat used by anadromous fishes, including development that removes and degrades available in-channel and off-channel floodplain habitat (*e.g.*, fill, pollution, stormwater runoff, vegetation removal, impervious surface, channel confinement, hydrologic modifications).
- Allow unlimited improvements to existing structures without requiring compliance with the regulatory floodplain management criteria as long as each improvement activity costs less than 50 percent of market value.
- Provide insufficient assurances that proposed mitigation requirements would adequately offset any adverse effects to habitat function.
- Continue the habitat effects associated with the regulatory floodplain management criteria during the 4-year program transition period, and beyond in floodplains located upriver of species distribution.
- Do not provide criteria to protect channel migration zones from the effects of development.
- For those developments that FEMA proposes to accept ESA section 7 consultations completed by other Federal agencies, the effects associated with the regulatory criteria may also occur for aspects outside the authority of the subject Federal agency.
- Because of the vague mitigation standard and lack of pre-construction review by FEMA, include a high degree of uncertainty about whether communities permitting floodplain development are capable of making well informed permit decisions in terms of potential effects.
- Because of the sampling design used by FEMA for compliance monitoring and the lack of measurable performance standards, measurable thresholds, or specific sideboards, the ability to determine when corrective action is needed is not well identified.

The proposed CRS:

- Continues to credit activities that have adverse effects to habitat functions and processes. The adverse effects of the program are inherent in the program's foundation, namely FEMA's regulatory floodplain management criteria. Furthermore, at least one pathway likely encourages those adverse effects by providing credits to communities that pursue structural means of reducing flood risk.

- Scoring system does not require natural floodplain function prerequisites for lower class ratings (Class Ratings 5 through 10) and the prerequisites for Class Ratings 1 and 4 are low (3% of minimum required points per class rating).
- Buries the professional engineer levee certification alternative under layers of procedural guidance.

2.4.5 Effects to ESA-Listed Species

Having evaluated in the sections above the NFIP's influence on floodplain development, and how floodplain development in turn impacts habitat features for listed anadromous fish, in this section we consider how the proposed action would affect the species' reproduction, numbers, and distribution. We also evaluate the proposed action's effects on designated critical habitat. Where recovery plans have been completed, that information has been incorporated.

In the evaluation below, we conclude that the proposed action would result in reductions in VSP parameters for all anadromous species that occur in the action area. Furthermore, the proposed action would increase the likelihood of a reduction in the availability of prey for Southern Resident killer whales, which would appreciably reduce the likelihood of survival and recovery of that species.

2.4.5.1 Effects to Salmon and Steelhead

Human-created changes that have resulted in the loss, degradation, and simplification of salmon habitat have been substantial over the past 200 years (Waples *et al*. 2008). Losses have occurred disproportionately in floodplains and, although "individual habitat losses may have a small effect, collectively they can have important evolutionary consequences by reducing life-history diversity, resilience, and population size" (Waples *et al*. 2008, p. 197, *internal citations omitted*). "One of the most pervasive and long-lasting effects on river-floodplain systems is conversion of natural vegetation to agriculture, residential, or industrial use" (Waples *et al*. 2008, p. 197). Human modifications of the natural landscape have resulted in "major departures from the historical template of an ecosystem," which "can potentially result in the loss of habitat capacity needed to rear fish, resulting in a reduction in abundance of the population" (Fresh *et al.* 2005).

In our analysis we began by looking at the limiting factors of the listed species that occur in the action area and comparing them to the effects of the proposed action described above to determine their significance. Then we evaluated how the effects of the proposed action, in consideration of the relevant limiting factors, were likely to affect the species' viability by assessing the four VSP parameters; abundance, productivity, spatial structure, and diversity.

- "Abundance" generally refers to the number of naturally-produced adults (*i.e*., the progeny of naturally-spawning parents) in the natural environment (*e.g*., on spawning grounds). A viable population needs sufficient abundance to maintain genetic health and to respond to normal environmental variation.
- "Productivity," as applied to viability factors, refers to the entire life cycle (*i.e.*, the number of naturally-spawning adults produced per parent). The productivity of a population (the average number of surviving offspring per parent) is a measure of the

population's ability to sustain itself. A viable population needs sufficient productivity to enable the population to quickly rebound from periods of poor ocean conditions or freshwater perturbations.

- "Spatial structure" refers both to the spatial distributions of individuals in the population and the processes that generate that distribution. A population's spatial structure depends on habitat quality and spatial configuration, and the dynamics and dispersal characteristics of individuals in the population. Populations with restricted distribution and few spawning areas are at a higher risk of extinction as a result of catastrophic environmental events, such as flooding or landslides, than are populations with more widespread and complex spatial structure.
- "Diversity" refers to the distribution of traits within and among populations. These range in scale from DNA sequence variation in single genes to complex life history traits (McElhany *et al.* 2000). Populations exhibiting greater diversity are generally more resilient to short-term and long-term environmental changes.

Where recovery plans have been completed, we used the identified recovery scenarios to frame our viability assessment. Where recovery plans are still in development, we took a precautionary approach. While recognizing that not all populations are likely required for species recovery, in the absence of a recovery plan we assumed that for a listed species to become viable, all populations need to remain available to contribute to the species' survival and recovery. Consequently, all populations must not deteriorate further and their current extinction risk must be maintained or improved. In particular, for this analysis we relied on the recovery plans for the Upper Willamette River (ODFW and NMFS 2011), Middle Columbia River (NMFS 2009c), Lower Columbia River (NMFS 2013a), and Upper Columbia River species (UCSRB 2007) together with the Estuary Module for Columbia River Basin species (NMFS 2011d).

Effect of Habitat Change on Fish. Individual fish that spawn, rear, and migrate in the action area may be exposed to the effects of the proposed action throughout their freshwater residency (incubation, rearing, and out-migration). Individuals that spawn and rear (*i.e.*, originate) outside of the action area and occur in the action area during migration are exposed to the effects of the proposed action only during their periods of incubation and migration downriver as juveniles and upriver as adults. Therefore, while recognizing the proposed action is likely to contribute to environmental stressors of fish that migrate through the action area, individuals that originate in the action area would be more greatly affected than individuals that originate outside of the action area.

Also, juvenile rearing strategies of anadromous fish are important to consider when evaluating the effects of the proposed action. In the simplest of terms, salmon and steelhead exhibit two basic juvenile rearing strategies. One strategy is for juveniles to migrate to the ocean to mature the same year that they are born. This is termed an "ocean-type" life history. The other strategy is for juveniles to remain in freshwater for one or more years before migrating to the ocean. This is termed a "stream-type" life history.

***Effect on Populations*.** Effects that occur among individuals must then be considered in terms of the multiplicity of individuals that make up cohorts, and populations, and in that context, over time how population viability parameters are likely to be altered.

Populations that originate in the action area are susceptible to the effects of the proposed action regardless of their juvenile rearing strategy. However, individuals that exhibit an ocean-type rearing strategy are exposed to the proposed action effects as juveniles for a matter of months, while individuals that exhibit a stream-type strategy remain in freshwater may be exposed to effects considerably longer. Furthermore, ocean-type juveniles typically spend more time in the estuary in shallow water areas than stream-type juveniles, which migrate through the estuary more rapidly. For this reason, individuals exhibiting an ocean-type rearing strategy are generally more susceptible to habitat effects in the estuary, while individuals exhibiting a stream-type rearing strategy are more susceptible to habitat effects in freshwater reaches.

Accordingly, we assume that where the proposed action would affect habitat features and limiting factors in estuary reaches, populations that exhibit a predominately ocean-type rearing strategy would be more greatly affected in the estuary than populations that exhibit a predominately stream-type strategy. Conversely, we assume that where the proposed action would affect limiting factors in freshwater reaches, populations that exhibit a predominately stream-type rearing strategy would be more greatly affected in the freshwater portions (including freshwater reaches in the estuary) than populations that exhibit a predominately ocean-type strategy.

Limiting factors are defined as “physical, biological, or chemical features (*e.g.*, inadequate spawning habitat, high water temperature, insufficient prey resources) experienced by the fish at the population, intermediate (*e.g.*, stratum or major population grouping), or ESU [or DPS] species levels that result in reductions in viable salmonid population (VSP) parameters (abundance, productivity, spatial structure, and diversity)” (NMFS 1997a, as cited by Stout *et al*. 2012, p. 53). Consequently, we assume that proposed actions that would adversely affect limiting factors for more than a limited duration will reduce the viability of the population, stratum, or ESU/DPS level, depending on the spatial scale of the effect.

The floodplain development effects associated with the proposed action are: (1) predominately negative, permanent, and aggregating over time; (2) likely to outpace floodplain restoration activities; and (3) likely to adversely affect multiple life stages, across multiple generations. Because these effects multiply across the life cycle and generations, “small effects at individual life stages can result in large changes in the overall dynamics of populations” (Stout *et al*. 2012, p. 62). This means the mostly negative effects predicted for individual life history stages will most likely result in a substantially negative overall effect on salmon and steelhead in the action area over the succeeding decades.

The NFIP does not apply on Federally-owned lands. Floodplain management on Federal lands is guided by Executive Order #11988 (42 FR 26951). Consequently, we assume implementation of the NFIP will not have appreciable effects on populations where river reaches have no or little (<10%) non-Federal ownership within the distribution of the listed species, or when floodplain development of that non-Federal land would not affect a majority of individuals within the population or impact high intrinsic potential habitat. However, non-Federal ownership is quite common in valley bottoms, even in watersheds where Federal ownership is high (*e.g.*, Imnaha River). While Federal ownership is quite common in upper watersheds and upland areas of lower watersheds, a landscape scale review of land ownership failed to identify any populations in Oregon that met our exclusion criteria. Of specific note, the habitat of the Wenaha population of SR spring/summer Chinook salmon is approximately at only 7% non-Federal land ownership, meeting the ownership criterion, but the non-Federal land is located along the lower reach of the Wenaha River where all individuals of the population would be affected by development because they must all migrate through this area. Consequently, we assume that all populations or portions of populations in Oregon would be at risk of exposure to the effects of the proposed action.

Columbia River Estuary. The Columbia River estuary refers to the mainstem portions of the Willamette River below Willamette Falls and the Columbia River below Bonneville Dam downriver to the mouth of the Columbia River and out to include the near-shore plume (*i.e.*, that portion of the plume within the continental shelf). All populations of all species in the Willamette-Lower Columbia Recovery Domain and Interior Columbia Recovery Domain occur in the Columbia River estuary. Therefore, the Columbia River Estuary ESA Recovery Plan Module for Salmon and Steelhead (Estuary Module) is relevant to all 13 ESA-listed salmon and steelhead species in these domains, and their associated 184 populations (NMFS 2011d).

The Columbia River estuary is about 20% smaller than it was prior to development (NMFS 2011d). The reduction is predominately due to "diking and filling practices used to convert the floodplain to agricultural, industrial, commercial, and residential uses" (NMFS 2011d, p. ES-4). The other dominant alteration is due to a 44% reduction in spring freshets or floods and changes in the timing, magnitude, and duration of flows due to flood control and hydropower projects (NMFS 2011d). Historically, floodplains supplied macrodetritus inputs that were the basis of the estuary's food web. The loss of floodplain connectivity has reduced macrodetritus inputs by about 84% and changed the food web to a microdetritus based system (NMFS 2011d, p. ES-4). "In addition, access to and use of floodplain habitats by ocean-type ESUs (salmonids that typically rear for a shorter time in tributaries and a longer time in the estuary) have been severely compromised through alterations in the presence and availability of these critical habitats" (NMFS 2011d, p. ES-4).

The most relevant threats and limiting factors in the estuary associated with the proposed action include (NMFS 2011d, Chapter 4):

- Riparian Practices - Sediment/nutrient-related estuary habitat changes, reduced macrodetrital inputs, water temperature, and exotic plants.
- Urban and Industrial Practices - Non-bioaccumulative toxicity, bioaccumulation toxicity, and increased microdetrital inputs.
- Diking and Filling - Reduced macrodetrital inputs, sediment/nutrient-related estuary habitat and plume changes, bankfull elevation increases, and exotic plants.

The effects of the proposed action would contribute negatively to these limiting factors and affect all populations of salmon and steelhead species in the Columbia River Basin, particularly species with life stages that spend more time in the estuary (*e.g.*, Lower Columbia River and Upper Willamette River species). These effects would be in addition to those associated with the proposed action that the species would be exposed to elsewhere in the basin. As described in the species assessments, the proposed action is likely to adversely affect multiple VSP parameters of several species in their natal watersheds, resulting in a reduction in population and species abundance, productivity, spatial structure, and diversity.

Willamette-Lower Columbia Recovery Domain. There are six ESA-listed salmonid species that originate in this domain. Those species are comprised of 107 populations (Table 2.2-3). All 107 populations occur in the action area and would be exposed to habitat changes associated with implementation of the proposed action (Table 2.4-4).

Lower Columbia River Chinook salmon. This species is listed as "threatened" under the ESA. All 32 populations that comprise this species occur in the action area. However, 12 populations originate in the action area and are likely to be most affected by the proposed action. A recovery plan has been completed for LCR Chinook salmon (NMFS 2013a).

Life History. LCR Chinook salmon currently exhibit a predominately ocean-type life history and typically display a sub-yearling life history strategy. However, the species also displays fry, fingerling, and yearling life history strategies (NMFS 2011d, p. 2-5; Table 2.4-5).

Relevant Limiting Factors. Water withdrawals, land use practices, transportation corridor, dams, and pollution are among the identified causes or contributors to the limiting factors (NMFS 2013a). The proposed action would further contribute to the following limiting factors identified in the plan:

- riparian condition,
- channel structure and form,
- side channels and wetland conditions,
- floodplain conditions,
- sediment conditions,
- water temperature,
- flow,
- toxic contaminants, and
- estuary condition.

The effects of the proposed action would contribute to these limiting factors, and particularly affect the 12 populations of LCR Chinook salmon that originate in the action area (Table 2.4-4).

In addition, since all populations of this species use the Columbia River as a migration corridor, limiting factors associated with the mainstem Columbia River and its estuary are relevant. Therefore, the Estuary Module is relevant to this species (NMFS 2011d). Regardless of life history strategy, individuals in this species may use freshwater portions of the upper estuary for extended periods of rearing. Consequently, within the mainstem portions of the Columbia River below Bonneville Dam and Willamette River below Willamette Falls, in-channel and off-channel effects are likely to impact all life history stages, all life history strategies, and all populations of LCR Chinook salmon. The Estuary Module indicates that the limiting factors most likely affected by the proposed action would have significant to major effects on ocean-type populations (NMFS 2011d, p. 3-24). Refer to the Columbia River estuary discussion above for limiting factors relevant to the estuary portion of this species' habitat.

VSP Evaluation. The LCR Chinook salmon populations are grouped into six strata: Cascade spring, Gorge spring, Coast fall, Cascade fall, Gorge fall, and Cascade late fall. The recovery plan provides the following recovery and biological goals (NMFS 2013a).

1. All strata that historically existed have a high probability of persistence or have a probability of persistence consistent with their historical condition.[141] High probability of stratum persistence is defined as:
   a. at least two populations in the stratum have at least a 95% probability of persistence over a 100-year time frame (*i.e.*, two populations with a score of 3.0 or higher based on the TRT's scoring system);
   b. other populations in the stratum have persistence probabilities consistent with a high probability of stratum persistence (*i.e.*, the average of all stratum population scores is 2.25 or higher, based on the TRT's scoring system);
   c. populations targeted for a high probability of persistence are distributed in a way that minimizes risk from catastrophic events, maintains migratory connections among populations, and protects within-stratum diversity.
2. The identified threats have been ameliorated so as not to limit attainment of the species' desired biological status, and such that the desired status will be maintained. The consideration of threats are organized into five factors.
   a. The present or threatened destruction, modification, or curtailment of the species' habitat or range.
      - Habitat-related threats:
        - recovery plan actions addressing habitat limiting factors have been substantially implemented;
        - threat reduction targets identified in the recovery plan have been met;
        - trends in overall habitat conditions, based on evaluation of the combined effect of factors, including, but not limited to, habitat access, hydrograph/water quantity, physical habitat quality and quantity, and water temperature and other water quality parameters, are stable or improving;
        - functioning habitat areas, including those expected to be less vulnerable to impacts from climate change, have been protected; and other actions to support adaptation to climate change impacts have been implemented.
      - Hydropower and/or flood control dam-related threats/
   b. Over-utilization for commercial, recreational, scientific, or educational purposes.
      - Harvest-related threats.
      - Any other threats related to overutilization for commercial, recreational, scientific, or educational purposes (*e.g.*, research purposes)/
   c. Disease or predation.
      - Predation-related threats.
      - Disease-related threats.
   d. The inadequacy of existing regulatory mechanisms.

[141] A probability of persistence consistent with historical condition refers to the concept that strata that historically were small or had complex population structures may not have met all three criteria, but could still be considered sufficiently viable if they provide a contribution to overall ESU viability similar to their historical contribution.

- Regulatory mechanisms have been maintained and/or established and are being implemented in a way that supports attaining and maintaining the desired status of the species:
    - regulatory programs that govern land use and resource utilization are in place and are adequate to protect salmon and steelhead habitat, including water quality, water quantity, and stream structure and function, and to attain and maintain the biological recovery criteria in the recovery plan;
    - states have established and protected instream flow levels;
    - regulatory programs are in place and are adequate to manage fisheries;
    - regulatory, control, and education measures are in place to prevent introductions of non-native plant and animal species;
    - regulatory programs have adequate funding, prioritization, enforcement, coordination mechanisms, and research, monitoring, and evaluation to ensure habitat protection and effective management of fisheries.

e. Other natural or human-made factors affecting the species' continued existence.
- Hatchery-related threats.
- Other natural or human-caused factors have been accounted for.

The effects of the proposed action would contribute to the limiting factors for all populations of LCR Chinook salmon, and particularly affect the 12 populations that originate in the action area. Consequently, considering the nature and duration of the effects, which would affect multiple generations, the proposed action would reduce the abundance and productivity of the LCR Chinook salmon ESU, and particularly the 12 populations that originate in the action area. This reduction is likely to increase the extinction risk of at least some populations. Furthermore, the resulting reductions in population distribution and suitable spawning areas associated with the proposed action are likely to reduce the spatial structure of the species. The effect of the proposed action on juveniles rearing in freshwater would disproportionately affect the abundance and productivity of individuals displaying a yearling life history strategy. The reduction, and potential loss, of this species' yearling life history component would constitute a reduction in the species' diversity. The proposed action would also contribute to the limiting factors associated with the estuary, which is likely to disproportionately affect the abundance and productivity of individuals displaying early life history strategies. The reduction, and potential loss, of this species' fry, fingerling, or sub-yearling life history component would constitute a reduction in the species' diversity.

Due to the permanency of habitat degradation caused by the proposed action, the aggregative quality of the habitat degradation that will occur under the proposed action over time, the high likelihood of additional negative habitat effects from future floodplain development associated with the proposed action over time, and the effects of such habitat degradation on individual fish from all future cohorts and populations, NMFS determines that the proposed action is likely to cause a decrease in abundance, productivity, spatial structure, and diversity of LCR Chinook salmon in the action area.

Lower Columbia River coho salmon. This species is listed as "threatened" under the ESA. All 24 populations that comprise this species occur in the action area. However, 8 populations originate in the action area and are likely to be most affected by the proposed action. A recovery plan has been completed for LCR coho salmon (NMFS 2013a).

Life History. LCR coho salmon currently exhibit a predominately stream-type life history and typically display a yearling life history strategy. However, the species also does display a sub-yearling life history strategy (NMFS 2011d, p. 2-5; Table 2.4-5).

Relevant Limiting Factors. Water withdrawals, land use practices, transportation corridor, dams, and pollution are among the identified causes or contributors to the limiting factors (NMFS 2013a). The proposed action would further contribute to the following limiting factors identified in the plan:

- riparian condition,
- channel structure and form,
- side channels and wetland conditions,
- floodplain conditions,
- sediment conditions,
- water temperature,
- flow,
- toxic contaminants, and
- estuary condition.

The effects of the proposed action would contribute to these limiting factors, and particularly affect the 8 populations of LCR coho salmon that originate in the action area (Table 2.4-4).

In addition, since all populations of this species use the Columbia River as a migration corridor, limiting factors associated with the mainstem Columbia River and its estuary are relevant. Therefore, the Estuary Module is relevant to this species (NMFS 2011d). Regardless of life history strategy, individuals in this species may use freshwater portions of the upper estuary for extended periods of rearing. Consequently, within the mainstem portions of the Columbia River below Bonneville Dam and Willamette River below Willamette Falls, in-channel and off-channel effects are likely to affect all life history stages, all life history strategies, and all populations of LCR coho salmon. The Estuary Module indicates that the limiting factors most likely affected by the proposed action would have moderate effects on stream-type populations (NMFS 2011d, p. 3-24). Refer to the Columbia River estuary discussion above for limiting factors relevant to the estuary portion of this species' habitat.

VSP Evaluation. The LCR coho salmon populations are grouped into three strata: Coast, Cascade, and Gorge. The recovery plan provides the following recovery and biological goals (NMFS 2013a).

1. All strata that historically existed have a high probability of persistence or have a probability of persistence consistent with their historical condition.[142] High probability of stratum persistence is defined as:
    a. at least two populations in the stratum have at least a 95% probability of persistence over a 100-year time frame (*i.e.*, two populations with a score of 3.0 or higher based on the TRT's scoring system);
    b. other populations in the stratum have persistence probabilities consistent with a high probability of stratum persistence (*i.e.*, the average of all stratum population scores is 2.25 or higher, based on the TRT's scoring system);
    c. populations targeted for a high probability of persistence are distributed in a way that minimizes risk from catastrophic events, maintains migratory connections among populations, and protects within-stratum diversity.
2. The identified threats have been ameliorated so as not to limit attainment of the species' desired biological status, and such that the desired status will be maintained. The consideration of threats are organized into five factors.
    a. The present or threatened destruction, modification, or curtailment of the species' habitat or range.
        - Habitat-related threats:
            - recovery plan actions addressing habitat limiting factors have been substantially implemented;
            - threat reduction targets identified in the recovery plan have been met;
            - trends in overall habitat conditions, based on evaluation of the combined effect of factors, including, but not limited to, habitat access, hydrograph/water quantity, physical habitat quality and quantity, and water temperature and other water quality parameters, are stable or improving;
            - functioning habitat areas, including those expected to be less vulnerable to impacts from climate change, have been protected; and other actions to support adaptation to climate change impacts have been implemented.
        - Hydropower and/or flood control dam-related threats.
    b. Over-utilization for commercial, recreational, scientific, or educational purposes.
        - Harvest-related threats.
        - Any other threats related to overutilization for commercial, recreational, scientific, or educational purposes (*e.g.*, research purposes).
    c. Disease or predation.
        - Predation-related threats.
        - Disease-related threats.
    d. The inadequacy of existing regulatory mechanisms.
        - Regulatory mechanisms have been maintained and/or established and are being implemented in a way that supports attaining and maintaining the desired status of the species:
            - regulatory programs that govern land use and resource utilization are in place and are adequate to protect salmon and steelhead habitat, including

[142] *Id.*

water quality, water quantity, and stream structure and function, and to attain and maintain the biological recovery criteria in the recovery plan;
- states have established and protected instream flow levels;
- regulatory programs are in place and are adequate to manage fisheries;
- regulatory, control, and education measures are in place to prevent introductions of non-native plant and animal species;
- regulatory programs have adequate funding, prioritization, enforcement, coordination mechanisms, and research, monitoring, and evaluation to ensure habitat protection and effective management of fisheries.

e. Other natural or human-made factors affecting the species' continued existence.
   - Hatchery-related threats.
   - Other natural or human-caused factors have been accounted for.

The effects of the proposed action would contribute to the limiting factors for all populations of LCR coho salmon, and particularly affect the 8 populations that originate in the action area. Consequently, considering the nature and duration of the effects, which would affect multiple generations, it is likely that the proposed action would reduce the abundance and productivity of the LCR coho salmon ESU, and particularly the 8 populations that originate in the action area. This reduction is likely to increase the extinction risk of at least some populations. Furthermore, the resulting reductions in population distribution and suitable spawning areas associated with the proposed action are likely to reduce the spatial structure of the species. The effect of the proposed action on juveniles rearing in freshwater would disproportionately affect the abundance and productivity of individuals displaying a yearling life history strategy. The reduction, and potential loss, of this species' yearling life history component would constitute a reduction in the species' diversity.

The proposed action would also contribute to the limiting factors associated with the estuary, which is likely to disproportionately affect the abundance and productivity of individuals displaying early life history strategies. The reduction, and potential loss, of this species' sub-yearling life history component would constitute a reduction in the species' diversity.

Due to the permanency of habitat degradation caused by the proposed action, the aggregative quality of the habitat degradation that will occur under the proposed action over time, the high likelihood of additional permanent negative habitat effects from future floodplain development associated with the proposed action over time, and the effects of such habitat degradation on individual fish from all future cohorts and populations, NMFS determines that the proposed action is likely to cause a decrease in abundance, productivity, spatial structure, and diversity of LCR coho salmon in the action area.

Lower Columbia River steelhead. This species is listed as "threatened" under the ESA. All 23 populations that comprise this species occur in the action area. However, 6 populations originate in the action area and are likely to be most affected by the proposed action. A recovery plan has been completed for LCR steelhead (NMFS 2013a).

Life History. LCR steelhead currently exhibit a predominately stream-type life history and typically display a yearling life history strategy. However, the species also displays a sub-yearling life history strategy (NMFS 2011d, p. 2-5; Table 2.4-5).

Relevant Limiting Factors. Water withdrawals, land use practices, transportation corridor, dams, and pollution are among the identified causes or contributors to the limiting factors (NMFS 2013a). The proposed action would further contribute to the following limiting factors identified in the plan:

- riparian condition,
- channel structure and form,
- side channels and wetland conditions,
- floodplain conditions,
- sediment conditions,
- water temperature,
- flow,
- toxic contaminants, and
- estuary condition.

The effects of the proposed action would contribute to these limiting factors, and particularly affect the 6 populations of LCR steelhead that originate in the action area (Table 2.4-4).

In addition, since all populations of this species use the Columbia River as a migration corridor, limiting factors associated with the mainstem Columbia River and its estuary are relevant. Therefore, the Estuary Module is relevant to this species (NMFS 2011d). Regardless of life history strategy, individuals in this species may use freshwater portions of the upper estuary for extended periods of rearing. Consequently, within the mainstem portions of the Columbia River below Bonneville Dam and Willamette River below Willamette Falls, in-channel and off-channel effects are likely to affect all life history stages, all life history strategies, and all populations of LCR steelhead. The Estuary Module indicates that the limiting factors most likely affected by the proposed action would have moderate effects on stream-type populations (NMFS 2011d, p. 3-24). Refer to the Columbia River estuary discussion above for limiting factors relevant to the estuary portion of this species' habitat.

VSP Evaluation. The LCR steelhead populations are grouped into four strata: Cascade summer, Gorge summer, Cascade winter, and Gorge winter. The recovery plan provides the following recovery and biological goals (NMFS 2013a).

1. All strata that historically existed have a high probability of persistence or have a probability of persistence consistent with their historical condition.[143] High probability of stratum persistence is defined as:
    a. at least two populations in the stratum have at least a 95% probability of persistence over a 100-year time frame (*i.e.*, two populations with a score of 3.0 or higher based on the TRT's scoring system);

[143] *Id.*

   b. other populations in the stratum have persistence probabilities consistent with a high probability of stratum persistence (*i.e.*, the average of all stratum population scores is 2.25 or higher, based on the TRT's scoring system);
   c. populations targeted for a high probability of persistence are distributed in a way that minimizes risk from catastrophic events, maintains migratory connections among populations, and protects within-stratum diversity.
2. The identified threats have been ameliorated so as not to limit attainment of the species' desired biological status, and such that the desired status will be maintained. The consideration of threats are organized into five factors.
   a. The present or threatened destruction, modification, or curtailment of the species' habitat or range.
      - Habitat-related threats:
         - recovery plan actions addressing habitat limiting factors have been substantially implemented;
         - threat reduction targets identified in the recovery plan have been met;
         - trends in overall habitat conditions, based on evaluation of the combined effect of factors, including, but not limited to, habitat access, hydrograph/water quantity, physical habitat quality and quantity, and water temperature and other water quality parameters, are stable or improving;
         - functioning habitat areas, including those expected to be less vulnerable to impacts from climate change, have been protected; and other actions to support adaptation to climate change impacts have been implemented.
      - Hydropower and/or flood control dam-related threats.
   b. Over-utilization for commercial, recreational, scientific, or educational purposes.
      - Harvest-related threats.
      - Any other threats related to overutilization for commercial, recreational, scientific, or educational purposes (*e.g.*, research purposes).
   c. Disease or predation.
      - Predation-related threats.
      - Disease-related threats.
   d. The inadequacy of existing regulatory mechanisms.
      - Regulatory mechanisms have been maintained and/or established and are being implemented in a way that supports attaining and maintaining the desired status of the species:
         - regulatory programs that govern land use and resource utilization are in place and are adequate to protect salmon and steelhead habitat, including water quality, water quantity, and stream structure and function, and to attain and maintain the biological recovery criteria in the recovery plan;
         - states have established and protected instream flow levels;
         - regulatory programs are in place and are adequate to manage fisheries;
         - regulatory, control, and education measures are in place to prevent introductions of non-native plant and animal species;
         - regulatory programs have adequate funding, prioritization, enforcement, coordination mechanisms, and research, monitoring, and evaluation to ensure habitat protection and effective management of fisheries.

e. Other natural or human-made factors affecting the species' continued existence.
    - Hatchery-related threats.
    - Other natural or human-caused factors have been accounted for.

The effects of the proposed action would contribute to the limiting factors for all populations of LCR steelhead, and particularly affect the 6 populations that originate in the action area. Consequently, considering the nature and duration of the effects, which would affect multiple generations, we assume the proposed action would reduce the abundance and productivity of the LCR steelhead DPS, and particularly the 6 populations that originate in the action area. This reduction is likely to increase the extinction risk of at least some populations. Furthermore, the resulting reductions in population distribution and suitable spawning areas associated with the proposed action are likely to reduce the spatial structure of the species. The effect of the proposed action on juveniles rearing in freshwater would disproportionately affect the abundance and productivity of individuals displaying a yearling life history strategy. The reduction, and potential loss, of this species' yearling life history component would constitute a reduction in the species' diversity.

The proposed action would also contribute to the limiting factors associated with the estuary, which is likely to disproportionately affect the abundance and productivity of individuals displaying early life history strategies. The reduction, and potential loss, of this species' sub-yearling life history component would constitute a reduction in the species' diversity.

Due to the permanency of habitat degradation caused by the proposed action, the aggregative quality of the habitat degradation that will occur under the proposed action over time, from future floodplain development associated with the proposed action over time and the effects of such habitat degradation on individual fish from all future cohorts and populations, NMFS determines that the proposed action is likely to cause a decrease in abundance, productivity, spatial structure, and diversity of LCR steelhead in the action area.

Columbia River chum salmon. This species is listed as "threatened" under the ESA. All 17 populations that comprise this species occur in the action area. However, 8 populations originate in the action area and are likely to be most affected by the proposed action. A recovery plan has been completed for Columbia River chum salmon (NMFS 2013a).

<u>Life History</u>. CR chum salmon exclusively exhibit an ocean-type life history and display a fry life history strategy (NMFS 2011d, p. 2-5; Table 2.4-5).

<u>Relevant Limiting Factors</u>. Water withdrawals, land use practices, transportation corridor, dams, and pollution are among the identified causes or contributors to the limiting factors (NMFS 2013a). The proposed action would further contribute to the following limiting factors identified in the plan:

- riparian condition,
- channel structure and form,
- side channels and wetland conditions,
- floodplain conditions,
- sediment conditions,

- water temperature,
- flow,
- toxic contaminants, and
- estuary condition.

The effects of the proposed action would contribute to these limiting factors, and particularly affect the 8 populations of CR chum salmon that originate in the action area (Table 2.4-4).

In addition, since all populations of this species use the Columbia River as a migration corridor, limiting factors associated with the mainstem Columbia River and its estuary are relevant. Therefore, the Estuary Module is relevant to this species (NMFS 2011d). The Estuary Module indicates that the limiting factors most likely affected by the proposed action would have significant to major effects on ocean-type populations (NMFS 2011d, p. 3-24). Refer to the estuary discussion above for limiting factors relevant to the estuary portion of this species' habitat

VSP Evaluation. The Columbia River chum salmon populations are grouped into three strata: Coast, Cascade, and Gorge. The recovery plan provides the following recovery and biological goals (NMFS 2013a):

1. All strata that historically existed have a high probability of persistence or have a probability of persistence consistent with their historical condition.[144] High probability of stratum persistence is defined as:
   a. at least two populations in the stratum have at least a 95% probability of persistence over a 100-year time frame (*i.e.*, two populations with a score of 3.0 or higher based on the TRT's scoring system);
   b. other populations in the stratum have persistence probabilities consistent with a high probability of stratum persistence (i.e., the average of all stratum population scores is 2.25 or higher, based on the TRT's scoring system);
   c. populations targeted for a high probability of persistence are distributed in a way that minimizes risk from catastrophic events, maintains migratory connections among populations, and protects within-stratum diversity.
2. The identified threats have been ameliorated so as not to limit attainment of the species' desired biological status, and such that the desired status will be maintained. The consideration of threats are organized into five factors.
   i. The present or threatened destruction, modification, or curtailment of the species' habitat or range.
      - Habitat-related threats:
        - recovery plan actions addressing habitat limiting factors have been substantially implemented;
        - threat reduction targets identified in the recovery plan have been met;
        - trends in overall habitat conditions, based on evaluation of the combined effect of factors, including, but not limited to, habitat access, hydrograph/water quantity, physical habitat quality and quantity, and

[144] *Id.*

water temperature and other water quality parameters, are stable or improving;
- functioning habitat areas, including those expected to be less vulnerable to impacts from climate change, have been protected; and other actions to support adaptation to climate change impacts have been implemented.

▪ Hydropower and/or flood control dam-related threats.

ii. Over-utilization for commercial, recreational, scientific, or educational purposes.
- ▪ Harvest-related threats.
- ▪ Any other threats related to overutilization for commercial, recreational, scientific, or educational purposes (*e.g.*, research purposes).

iii. Disease or predation.
- ▪ Predation-related threats.
- ▪ Disease-related threats.

iv. The inadequacy of existing regulatory mechanisms.
- ▪ Regulatory mechanisms have been maintained and/or established and are being implemented in a way that supports attaining and maintaining the desired status of the species:
  - regulatory programs that govern land use and resource utilization are in place and are adequate to protect salmon and steelhead habitat, including water quality, water quantity, and stream structure and function, and to attain and maintain the biological recovery criteria in the recovery plan;
  - states have established and protected instream flow levels;
  - regulatory programs are in place and are adequate to manage fisheries;
  - regulatory, control, and education measures are in place to prevent introductions of non-native plant and animal species;
  - regulatory programs have adequate funding, prioritization, enforcement, coordination mechanisms, and research, monitoring, and evaluation to ensure habitat protection and effective management of fisheries.

v. Other natural or human-made factors affecting the species' continued existence.
- ▪ Hatchery-related threats.
- ▪ Other natural or human-caused factors have been accounted for.

The effects of the proposed action would contribute to the limiting factors for all populations of CR chum salmon, and particularly affect the 8 populations that originate in the action area. Consequently, considering the nature and duration of the effects, which would affect multiple generations, we assume the proposed action would reduce the abundance and productivity of the CR chum salmon ESU, and particularly the 8 populations that originate in the action area. This reduction is likely to increase the extinction risk of at least some populations. Furthermore, the resulting reductions in population distribution and suitable spawning areas associated with the proposed action are likely to reduce the spatial structure of the species. Species diversity is not expected to be affected.

Due to the permanency of habitat degradation caused by the proposed action, the aggregative quality of the habitat degradation that will occur under the proposed action over time, the high likelihood of additional permanent negative habitat effects from future floodplain development associated with the proposed action over time, and the effects of such habitat degradation on individual fish from all future cohorts and populations, NMFS determines that the proposed action is likely to cause a decrease in abundance, productivity, and spatial structure of CR chum salmon in the action area.

Upper Willamette River Chinook salmon. This species is listed as "threatened" under the ESA. All 7 populations that comprise this species originate in the action area. A recovery plan has been completed for UWR Chinook salmon (ODFW and NMFS 2011).

Life History. UWR Chinook salmon currently exhibit a predominately ocean-type life history, and typically display a yearling life history strategy. However, the species also displays fingerling and sub-yearling life history strategies (NMFS 2011d, p. 2-5; Table 2.4-5).

Relevant Limiting Factors. Urbanization, floodplain development, and channel confinement in the lower subbasins, mainstem Willamette River, and Columbia River estuary are identified as a cause or contributor to the limiting factors (ODFW and NMFS 2011, p. 5-1 and 5-9 through 5-11). The proposed action would further contribute to five of the nine limiting factors identified in the plan:

- food web - change from macrodetritus-based to microdetritus-based inputs;
- habitat access - diked streams;
- hydrograph/water quantity – altered hydrograph, timing, and magnitude of flows;
- physical habitat quality/quantity - habitat characteristics include floodplain connectivity and function, channel structure and complexity, channel morphology, riparian condition (including loss or alteration of stream habitat) and large wood recruitment, sediment routing (fine and coarse sediment), and upland processes; and quantity refers to the amount of accessible habitat for different life history stages; and
- water quality – temperature, dissolved oxygen, suspended sediment, pH, toxics.

These limiting factors were associated with all lifestages of all 7 populations of UWR Chinook salmon (ODFW and NMFS 2011, p. 5-26) (Table 2.4-4).

In addition, since all populations of this species use the Columbia River as a migration corridor, limiting factors associated with the mainstem Columbia River and its estuary are relevant. Therefore, the Estuary Module is relevant to this species (NMFS 2011d). Individuals in this species that exhibit a stream-type life history (*i.e.*, yearling life history strategy) may use freshwater portions of the upper estuary for extended periods of rearing. Consequently, within the mainstem portions of the Columbia River below Bonneville Dam and Willamette River below Willamette Falls, in-channel and off-channel effects are likely to affect all life history stages, all life history strategies, and all populations of UWR Chinook salmon. The Estuary Module indicates that the limiting factors most likely affected by the proposed action would have moderate effects on individuals fulfilling the stream-type life history and significant to major effects on those fulfilling the ocean-type life history (NMFS 2011d, p. 3-24). Refer to the estuary discussion above for limiting factors relevant to the estuary portion of this species' habitat.

VSP Evaluation. The UWR Chinook salmon populations were not grouped into strata or major population groups, so it is assumed the attributes of a viable stratum are attributes of a viable ESU. The recovery plan provides the following population-based biological goals and delisting criteria (NMFS 2011d, p. 3-5 and p. 6-3):

- At least two populations meet the population viability criteria (extinction risk classification score of 3 or 4).
- The average of all population extinction risk category scores is 2.25 or greater.
- Three of the 4 "core" populations are viable (Clackamas, North Santiam, McKenzie, and Middle Fork Willamette populations).
- Remaining "genetic legacy" population is improved to a very low extinction risk (McKenzie population).
- All populations do not deteriorate and are maintained at a minimum at their current risk of extinction.

In addition, threats delisting criteria must also be satisfied. Consequently, riparian and stream habitat loss and degradation particularly in the lowland, valley must be addressed, including the adequacy of existing regulatory mechanisms (NMFS 2011d, p. 3-6). Several specific metrics are required. One metric is:

> Major tributaries and the mainstem Willamette River must have sufficient habitat conditions to allow juvenile spring Chinook salmon adequate "rest areas" (*e.g.*, thermal refugia, off-channel areas).

The effects of the proposed action would exacerbate the limiting factors for all populations of UWR Chinook salmon. Consequently, considering the nature and duration of the effects, which would affect multiple generations, the proposed action would reduce the abundance and productivity of the UWR Chinook salmon ESU. This reduction is likely to increase the extinction risk of at least some populations. Furthermore, the resulting reductions in population distribution and suitable spawning areas associated with the proposed action are likely to locally reduce the spatial structure of the species, although recent dam passage actions would likely result in a net increase in species distribution within the sub-basin. The effect of the proposed action on juveniles rearing in freshwater would disproportionately affect the abundance and productivity of individuals displaying a yearling life history strategy. The reduction, and potential loss, of this species' yearling life history component would constitute a reduction in the species' diversity.

The proposed action would also contribute to the limiting factors associated with the estuary, which is likely to disproportionately affect the abundance and productivity of individuals displaying early life history strategies. The reduction, and potential loss, of this species' fingerling and sub-yearling life history component would constitute a reduction in the species' diversity.

Due to the permanency of habitat degradation caused by the proposed action, the aggregative quality of the habitat degradation that will occur under the proposed action over time, the high likelihood of additional permanent negative habitat effects from future floodplain development associated with the proposed action over time, and the effects of such habitat degradation on individual fish from all future cohorts and populations, NMFS determines that the proposed action is likely to cause a decrease in abundance, productivity, spatial structure, and diversity of UWR Chinook salmon in the action area.

Upper Willamette River steelhead. This species is listed as "threatened" under the ESA. All 4 populations that comprise this species originate in the action area. A recovery plan has been completed for UWR steelhead (ODFW and NMFS 2011).

Life History. UWR steelhead currently exhibit a stream-type life history with individuals exhibiting a yearling life history strategy (NMFS 2011d, p. 2-5; Table 2.4-5).

Relevant Limiting Factors. Urbanization, floodplain development, and channel confinement in the lower subbasins, mainstem Willamette River, and Columbia River estuary are identified as a cause or contributor to the limiting factors (ODFW and NMFS 2011, p. 5-2, 5-3, and 5-9 through 5-11). The proposed action would further contribute to five of the nine limiting factors identified in the plan:

- food web - change from macrodetritus-based to microdetritus-based inputs;
- habitat access - diked streams;
- hydrograph/water quantity – altered hydrograph, timing, and magnitude of flows;
- physical habitat quality/quantity - habitat characteristics include floodplain connectivity and function, channel structure and complexity, channel morphology, riparian condition (including loss or alteration of stream habitat) and large wood recruitment, sediment routing (fine and coarse sediment), and upland processes; and quantity refers to the amount of accessible habitat for different life history stages; and
- water quality – temperature, dissolved oxygen, suspended sediment, pH, toxics.

These limiting factors were associated with all lifestages of all 4 populations of UWR steelhead (ODFW and NMFS 2011, p. 5-27) (Table 2.4-4).

In addition, since all populations of this species use the Columbia River as a migration corridor, limiting factors associated with the mainstem Columbia River and its estuary are relevant. Therefore, the Estuary Module is relevant to this species (NMFS 2011d). Individuals of this species that exhibit a stream-type life history may use freshwater portions of the upper estuary for extended periods of rearing. Consequently, within the mainstem portions of the Columbia River below Bonneville Dam and Willamette River below Willamette Falls, in-channel and off-channel effects are likely to affect all life history stages, all life history strategies, and all populations of UWR steelhead. The Estuary Module indicates that the limiting factors most likely affected by the proposed action would have moderate effects on stream-type populations (NMFS 2011d, p. 3-24). Refer to the estuary discussion above for limiting factors relevant to the estuary portion of this species' habitat.

VSP Evaluation. The UWR steelhead populations were not grouped into strata or major population groups, so it is assumed the attributes of a viable stratum are attributes of a viable ESU. The recovery plan provides the following population-based biological goals and delisting criteria (NMFS 2011d, p. 3-5 and p. 6-3):

- At least two populations meet the population viability criteria (extinction risk classification score of 3 or 4).

- The average of all population extinction risk category scores is 2.25 or greater.
- Both of the "core" populations are viable (North Santiam and South Santiam).
- Remaining "genetic legacy" populations are improved to a very low extinction risk (Santiam populations).
- All populations do not deteriorate and are maintained at a minimum at their current risk of extinction.

In addition, threats delisting criteria must also be satisfied. Consequently, riparian and stream habitat loss and degradation particularly in the lowland valley must be addressed, including the adequacy of existing regulatory mechanisms (NMFS 2011d, p. 3-6). Several specific metrics are required. One metric is:

> Major tributaries and the mainstem Willamette River must have sufficient habitat conditions to allow juvenile steelhead adequate "rest areas" (*e.g.*, thermal refugia, off-channel areas).

The effects of the proposed action would contribute to the limiting factors for all populations of UWR steelhead. Consequently, considering the nature and duration of the effects, which would affect multiple generations, we assume the proposed action would reduce the abundance and productivity of the UWR steelhead DPS. This reduction is likely to increase the extinction risk of at least some populations. Furthermore, the resulting reductions in population distribution and suitable spawning areas associated with the proposed action are likely to locally reduce the spatial structure of the species, although recent dam passage actions would likely result in a net increase in species distribution within the sub-basin.

Due to the permanency of habitat degradation caused by the proposed action, the aggregative quality of the habitat degradation that will occur under the proposed action over time, the high likelihood of additional permanent negative habitat effects from future floodplain development associated with the proposed action over time, and the effects of such habitat degradation on individual fish from all future cohorts and populations, NMFS determines that the proposed action is likely to cause a decrease in abundance, productivity, spatial structure, and diversity of UWR steelhead in the action area.

Interior Columbia Recovery Domain. There are seven ESA-listed salmonid species that originate in this domain. Those species are comprised of 77 existing populations (Table 2.2-10). All 77 populations occur in the action area and would be exposed to habitat changes associated with implementation of the proposed action (Table 2.4-4).

Upper Columbia River spring-run Chinook salmon. This species is listed as “endangered” under the ESA. All three populations of this species originate in eastern Washington outside of the action area. However, all populations migrate through the action area (Columbia River mainstem) as juveniles and returning adults. A recovery plan has been completed for this species (UCSRB 2007).

Life History. UCR spring-run Chinook salmon currently exhibit a predominately stream-type life history and typically display a yearling life history strategy. Rarely, individuals display a sub-yearling life history strategy (NMFS 2011d, p. 2-5; Table 2.4-5).

Relevant Limiting Factors. The relevant limiting factors for this ESU are associated with the mainstem Columbia River and its estuary. Mainstem factors above Bonneville Dam are primarily related to hydropower and agricultural (*e.g.*, water withdrawals) uses. Therefore, we concentrated on the estuary and referred to the Estuary Module (NMFS 2011d) to identify relevant limiting factors. The Estuary Module indicates that the limiting factors most likely affected by the proposed action would have moderate effects on stream-type populations (NMFS 2011d, p. 3-24). Refer to the estuary discussion above for limiting factors relevant to the estuary portion of this species' habitat.

VSP Evaluation. The recovery plan indicates that all three populations are needed for recovery and must meet abundance and productivity criteria that represents a 5% extinction risk over a 100-year period (UCSRB 2007, p. 115).

The effects of the proposed action would contribute to the limiting factors for all populations of UCR spring-run Chinook salmon, predominately in the Columbia River estuary (Table 2.4-4). Consequently, considering the nature and duration of the effects, which would affect multiple generations, we assume the proposed action would reduce the abundance and productivity of the UCR spring-run Chinook salmon ESU in the action area. This reduction is likely to increase the extinction risk of at least some populations. The proposed action is not likely to affect the spatial structure of the species. The proposed action would contribute to the limiting factors in the estuary, which is likely to disproportionately affect the abundance and productivity of individuals displaying early life history strategies. The reduction, and potential loss, of this species' sub-yearling life history component would constitute a reduction in the species' diversity.

Due to the permanency of habitat degradation caused by the proposed action, the aggregative quality of the habitat degradation that will occur under the proposed action over time, the high likelihood of additional permanent negative habitat effects from future floodplain development associated with the proposed action over time, and the effects of such habitat degradation on individual fish from all future cohorts and populations, NMFS determines that the proposed action is likely to cause a decrease in abundance, productivity, and diversity of UCR spring-run Chinook salmon in the action area.

Furthermore, the effects of the proposed action would exacerbate anticipated habitat changes associated with climate change. Lawrence *et al*. (2014) predicted that changes in water temperature in streams lacking intact riparian vegetation may cause the near total loss of rearing habitat for stream-rearing juvenile salmonids and expand the distribution of warm-water predators (*i.e*., bass). The exacerbation of water temperature increases and associated expansion of predator species by the proposed action would further diminish UCR spring-run Chinook salmon viability.

Upper Columbia River steelhead. This species is listed as "threatened" under the ESA. All four populations of this species originate in eastern Washington outside of the action area. However, all populations migrate through the action area as juveniles and returning adults. A recovery plan has been completed for this species (UCSRB 2007).

Life History. UCR steelhead currently exhibit a stream-type life with individuals exhibiting a yearling life history strategy (NMFS 2011d, p. 2-5; Table 2.4-5).

Relevant Limiting Factors. The relevant limiting factors for this DPS are largely associated with the mainstem Columbia River and its estuary. Mainstem factors above Bonneville Dam are primarily related to hydropower and agricultural (*e.g.*, water withdrawals) uses. Therefore, we concentrated on the estuary and referred to the Estuary Module (NMFS 2011d) to identify relevant limiting factors. The Estuary Module indicates that the limiting factors most likely affected by the proposed action would have moderate effects on stream-type populations (NMFS 2011d, p. 3-24). Refer to the estuary discussion above for limiting factors relevant to the estuary portion of this species' habitat.

VSP Evaluation. The recovery plan indicates that all four populations are needed for recovery and must meet abundance and productivity criteria that represents a 5% extinction risk over a 100-year period (UCSRB 2007, p. 116).

The effects of the proposed action would contribute to the limiting factors for all populations of UCR steelhead, predominately in the estuary (Table 2.4-4). Consequently, considering the nature and duration of the effects, which would affect multiple generations, we assume the proposed action would reduce the abundance and productivity of the UCR steelhead DPS in the action area. This reduction is likely to increase the extinction risk of at least some populations. The proposed action is not likely to affect the spatial structure or diversity of the species.

Due to the permanency of habitat degradation caused by the proposed action, the aggregative quality of the habitat degradation that will occur under the proposed action over time, the high likelihood of additional permanent negative habitat effects from future floodplain development associated with the proposed action over time, and the effects of such habitat degradation on individual fish from all future cohorts and populations, NMFS determines that the proposed action is likely to cause a decrease in abundance and productivity of UCR steelhead in the action area.

Furthermore, the effects of the proposed action would exacerbate anticipated habitat changes associated with climate change. Lawrence et al. (2014) predicted that changes in water temperature in streams lacking intact riparian vegetation may cause the near total loss of rearing habitat for stream-rearing juvenile salmonids and expand the distribution of warm-water predators (i.e., bass). The exacerbation of water temperature increases and associated expansion of predator species by the proposed action would further diminish UCR steelhead viability.

Snake River spring/summer-run Chinook salmon. This species is listed as "threatened" under the ESA. All 27 populations that comprise this species migrate through the action area. However, 6 extant populations originate in the action area and are likely to be most affected by the proposed action. A recovery plan has not been completed for this species.

Life History. SR spring/summer-run Chinook salmon currently exhibit a predominately stream-type life history and typically display a yearling life history strategy. Rarely, individuals display a sub-yearling life history strategy (NMFS 2011d, p. 2-5; Table 2.4-5).

Relevant Limiting Factors. The following relevant limiting factor, previously presented in the Status of the Species section of this opinion, has been identified for the species:

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood supply, stream substrate, elevated water temperature, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development.

The effects of the proposed action would contribute to these limiting factors, and particularly affect the 6 populations of SR spring/summer-run Chinook salmon that originate in the action area (Table 2.4-4).

In addition, since all populations of this species occur in the Columbia River portion of the action area, limiting factors associated with the mainstem Columbia River and its estuary are relevant. Therefore, Estuary Module is relevant this species (NMFS 2011d). The Estuary Module indicates that the limiting factors most likely affected by the proposed action would have moderate effects on stream-type populations (NMFS 2011d, p. 3-24). Refer to the estuary discussion above for limiting factors relevant to the estuary portion of this species' habitat.

VSP Evaluation. Since a recovery plan has not been completed for this species, we assume all populations must maintain or decrease their current extinction risk for the survival and recovery of the species. Consequently, while not all populations likely must become viable, all populations must not experience further declines in their VSP parameters.

The effects of the proposed action would contribute to the limiting factors for all populations of SR spring/summer-run Chinook salmon, and particularly affect the six populations that originate in the action area. Consequently, considering the nature and duration of the effects, which would affect multiple generations, we assume the proposed action would reduce the abundance and productivity of the SR spring/summer-run Chinook salmon ESU, and particularly the six populations that originate in the action area. This reduction is likely to increase the extinction risk of at least some populations. Furthermore, the resulting reductions in population distribution and suitable spawning areas associated with the proposed action are likely to reduce the spatial structure of the species. The effect of the proposed action on juveniles rearing in freshwater would disproportionately affect the abundance and productivity of individuals displaying a yearling life history strategy. The reduction, and potential loss, of this species' yearling life history component would constitute a reduction in the species' diversity.

The proposed action would also contribute to the limiting factors associated with the estuary, which is likely to disproportionately affect the abundance and productivity of individuals displaying early life history strategies. The reduction, and potential loss, of this species' sub-yearling life history component would constitute a reduction in the species' diversity.

Due to the permanency of habitat degradation caused by the proposed action, the aggregative quality of the habitat degradation that will occur under the proposed action over time, the high likelihood of additional permanent negative habitat effects from future floodplain development associated with the proposed action over time, and the effects of such habitat degradation on individual fish from all future cohorts and populations, NMFS determines that the proposed action is likely to cause a decrease in abundance, productivity, spatial structure, and diversity of SR spring/summer-run Chinook salmon in the action area.

Furthermore, the effects of the proposed action would exacerbate anticipated habitat changes associated with climate change. Lawrence et al. (2014) predicted that changes in water temperature in streams lacking intact riparian vegetation may cause the near total loss of rearing habitat for stream-rearing juvenile salmonids and expand the distribution of warm-water predators (i.e., bass). The exacerbation of water temperature increases and associated expansion of predator species by the proposed action would further diminish SR spring/summer-run Chinook salmon viability.

Snake River fall-run Chinook salmon. This species is listed as "threatened" under the ESA. A portion of the single population that comprises this species originates in the action area. However, all individuals of this population migrate through the action area as juveniles and returning adults. A recovery plan was proposed for this species (NMFS 2015b).

Life History. SR fall-run Chinook salmon currently exhibit a predominately ocean-type life history and typically display a sub-yearling life history strategy. However, the species displays two other life history strategies. Individuals rarely display a fingerling life history strategy and more commonly a yearling life history does occur (NMFS 2011d, p. 2-5; Table 2.4-5).

Relevant Limiting Factors. The following relevant limiting factors, previously presented in the Status of the Species section of this opinion, have been identified for the species:

- Degraded freshwater habitat: Floodplain connectivity and function, and channel structure and complexity have been degraded as a result of cumulative impacts of agriculture, forestry, and development.
- Degraded estuarine and nearshore habitat.

The effects of the proposed action would contribute to these limiting factors, and particularly affect that portion of the population of SR fall-run Chinook salmon that originates in the action area (Table 2.4-4).

In addition, since all individuals of the population use the Columbia River as a migration corridor, limiting factors associated with the mainstem Columbia River and its estuary are relevant. Therefore, the Estuary Module is relevant this species (NMFS 2011d). The Estuary Module indicates that the limiting factors most likely affected by the proposed action would have significant to major effects on ocean-type populations (NMFS 2011d, p. 3-24). Refer to the estuary discussion above for limiting factors actions relevant to the estuary portion of this species' habitat.

VSP Evaluation. Since a recovery plan has not been completed for this species, we assume all populations must maintain or decrease their current extinction risk for the survival and recovery of the species. Consequently, while not all populations likely must become viable, all populations must not experience further declines in their VSP parameters.

The effects of the proposed action would contribute to the limiting factors for the single population of SR fall-run Chinook salmon, and particularly affect that portion of the population that originates in the action area. Consequently, considering the nature and duration of the effects, which would affect multiple generations, we assume the proposed action would reduce the abundance and productivity of the SR fall-run Chinook salmon ESU, and particularly that portion of the population that originates in the action area. This reduction is likely to increase the extinction risk of the population. Furthermore, the resulting reductions in population distribution and suitable spawning areas associated with the proposed action are likely to reduce the spatial structure of the species. The effect of the proposed action on juveniles rearing in freshwater would disproportionately affect the abundance and productivity of individuals displaying a yearling life history strategy. The reduction, and potential loss, of this species' yearling life history component would constitute a reduction in the species' diversity.

The proposed action would also contribute to the limiting factors associated with the estuary, which is likely to disproportionately affect the abundance and productivity of individuals displaying early life history strategies. The reduction, and potential loss, of this species' fingerling and sub-yearling life history component would constitute a reduction in the species' diversity.

Due to the permanency of habitat degradation caused by the proposed action, the aggregative quality of the habitat degradation that will occur under the proposed action over time, the high likelihood of additional permanent negative habitat effects from future floodplain development associated with the proposed action over time, and the effects of such habitat degradation on individual fish from all future cohorts and populations, NMFS determines that the proposed action is likely to cause a decrease in abundance, productivity, spatial structure, and diversity of SR fall-run Chinook salmon in the action area.

Furthermore, the effects of the proposed action would exacerbate anticipated habitat changes associated with climate change. Lawrence et al. (2014) predicted that changes in water temperature in streams lacking intact riparian vegetation may cause the near total loss of rearing habitat for stream-rearing juvenile salmonids and expand the distribution of warm-water predators (i.e., bass). The exacerbation of water temperature increases and associated expansion of predator species by the proposed action would further diminish SR fall-run Chinook salmon viability.

Snake River sockeye salmon. This species is listed as "endangered" under the ESA. A single population that originates outside of the action area comprises this species.

However, all individuals of this population migrate through the action area as juveniles and returning adults. A recovery plan has been completed for this species.

Life History. SR sockeye salmon currently exhibit a predominately stream-type life history and typically display a yearling life history strategy. Rarely, individuals display a sub-yearling life history strategy (NMFS 2011d, p. 2-5; Table 2.4-5).

Relevant Limiting Factors. The following relevant limiting factor, previously presented in the Status of the Species section of this opinion, has been identified for the species:

- degraded water quality and temperature.

The effects of the proposed action would contribute to this limiting factor (Table 2.4-4).

In addition, since all individuals of the population use the Columbia River as a migration corridor, limiting factors associated with the mainstem Columbia River and its estuary are relevant. Therefore, the Estuary Module is relevant this species (NMFS 2011d). The Estuary Module indicates that the limiting factors most likely affected by the proposed action would have moderate effects on stream-type populations (NMFS 2011d, p. 3-24). Refer to the estuary discussion above for limiting factors and management actions relevant to the estuary portion of this species' habitat.

VSP Evaluation. Since a recovery plan has not been completed for this species, we assume all populations must maintain or decrease their current extinction risk for the survival and recovery of the species. Consequently, while not all populations likely must become viable, all populations must not experience further declines in their VSP parameters.

The effects of the proposed action would contribute to the limiting factors affecting the single population of SR sockeye salmon, predominately in the estuary. Consequently, considering the nature and duration of the effects, which would affect multiple generations, we assume the proposed action would reduce the abundance and productivity of the SR sockeye salmon ESU in the action area. This reduction is likely to increase the extinction risk of the species' single population. The proposed action is not likely to affect the spatial structure of the species. The proposed action would contribute to the limiting factors in the estuary, which is likely to disproportionately affect the abundance and productivity of individuals displaying early life history strategies. The reduction, and potential loss, of this species' sub-yearling life history component would constitute a reduction in the species' diversity.

Due to the permanency of habitat degradation caused by the proposed action, the aggregative quality of the habitat degradation that will occur under the proposed action over time, the high likelihood of additional permanent negative habitat effects from future floodplain development associated with the proposed action over time, and the effects of such habitat degradation on individual fish from all future cohorts and populations, NMFS determines that the proposed action is likely to cause a decrease in abundance, productivity, and diversity of SR sockeye salmon in the action area.

Furthermore, the effects of the proposed action would exacerbate anticipated habitat changes associated with climate change. Lawrence et al. (2014) predicted that changes in water temperature in streams lacking intact riparian vegetation may cause the near total loss of rearing habitat for stream-rearing juvenile salmonids and expand the distribution of warm-water predators (i.e., bass). The exacerbation of water temperature increases and associated expansion of predator species by the proposed action would further diminish SR sockeye salmon viability.

Snake River Basin steelhead. This species is listed as "threatened" under the ESA. All 24 populations that comprise this species migrate through the action area. However, 5 populations originate in the action area and are likely to be most affected by the proposed action. A recovery plan has not been completed for this species.

Life History. SRB steelhead currently exhibits a stream-type life history with individuals exhibiting a yearling life history strategy (NMFS 2011d, p. 2-5; Table 2.4-5).

Relevant Limiting Factors. The following relevant limiting factors, previously presented in the Status of the Species section of this opinion, have been identified for the species:

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large woody debris recruitment, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development.
- Impaired water quality and increased water temperature.

The effects of the proposed action would contribute to these limiting factors, and particularly affect the 5 populations of SRB steelhead that originate in the action area (Table 2.4-4).

In addition, since all populations of this species use the Columbia River as a migration corridor, limiting factors associated with the mainstem Columbia River and its estuary are relevant. Therefore, the Estuary Module is relevant this species (NMFS 2011d). The Estuary Module indicates that the limiting factors most likely affected by the proposed action would have moderate effects on stream-type populations (NMFS 2011d, p. 3-24). Refer to the estuary discussion above for limiting factors relevant to the estuary portion of this species' habitat.

VSP Evaluation. Since a recovery plan has not been completed for this species, we assume all populations must maintain or decrease their current extinction risk for the survival and recovery of the species. Consequently, while not all populations likely must become viable, all populations must not experience further declines in their VSP parameters.

The effects of the proposed action would contribute to the limiting factors for all populations of SRB steelhead, and particularly affect the 5 populations that originate in the action area. Consequently, considering the nature and duration of the effects, which would affect multiple generations, we assume the proposed action would reduce the abundance and productivity of the SRB steelhead DPS, and particularly the 5 populations that originate in the action area. This reduction is likely to increase the extinction risk of at least some populations. Furthermore, the resulting reductions in population distribution and suitable spawning areas associated with the proposed action are likely to reduce the spatial structure of the species. The proposed action is not likely to affect the diversity of the species.

Due to the permanency of habitat degradation caused by the proposed action, the aggregative quality of the habitat degradation that will occur under the proposed action over time, the high likelihood of additional permanent negative habitat effects from future floodplain development associated with the proposed action over time, and the effects of such habitat degradation on individual fish from all future cohorts and populations, NMFS determines that the proposed action is likely to cause a decrease in abundance, productivity, and spatial structure of SRB steelhead in the action area.

Furthermore, the effects of the proposed action would exacerbate anticipated habitat changes associated with climate change. Lawrence et al. (2014) predicted that changes in water temperature in streams lacking intact riparian vegetation may cause the near total loss of rearing habitat for stream-rearing juvenile salmonids and expand the distribution of warm-water predators (i.e., bass). The exacerbation of water temperature increases and associated expansion of predator species by the proposed action would further diminish SRB steelhead viability.

Middle Columbia River steelhead. This species is listed as "threatened" under the ESA. All 17 populations that comprise this species occur in the action area. However, 11 populations originate in the action area and are likely to be most affected by the proposed action. A recovery plan has been completed for MCR steelhead (NMFS 2009c).

Life History. MCR steelhead currently exhibit a predominately stream-type life history with individuals exhibiting a yearling life history strategy. However, some individuals display a sub-yearling life history strategy (NMFS 2011d, p. 2-5; Table 2.4-5).

Relevant Limiting Factors. Historically, "extensive beaver activity created diverse instream habitats with deep pools and strong connections to floodplains" (NMFS 2009c, p. 6-4). Extensive and abundant riparian vegetation supported sufficient stream temperatures throughout the year, provided storage and cool water refugia during summer, protected stream banks from erosion, and provided an abundant food supply (NMFS 2009c, p. 6-4). "Dynamic patterns of channel migration in floodplains continually created complex channel, side channel, and off-channel habitats" (NMFS 2009c, p. 6-4). Urban development in the DPS is concentrated in valley bottoms and human populations are growing (NMFS 2009c, p. 1-5). "Nearly all historical habitat lies in areas modified by human settlement and activities" and current conditions "pose a significant impediment to achieving recovery" (NMFS 2009c, p. 6-4 and 6-5). "Of particular importance is the loss of rearing habitat quality and floodplain channel connectivity in the lower reaches of major tributaries" of the John Day River (NMFS 2009c, 7-23).

The proposed action would further contribute to 7 of the 12 key limiting factors identified in the recovery plan (NMFS 2009c, p. 6-3):

- Degraded estuarine and nearshore marine habitat – Inadequate large woody debris; loss of estuary complexity; loss of off-channel habitats; loss of intertidal, salt marsh and other functional estuarine and marine vegetation.

- Degraded floodplain connectivity and function – Loss of off-channel habitat and floodplain connectivity, seasonal wetlands, wet meadows, side channels habitat; loss of connected and functional hyporheic zone.
- Degraded channel structure and complexity – Loss of pool frequency and quantity, large wood debris; channel straightening and confinement; simplified habitat; loss of spawning habitat structure, redd diversity; loss of sinuosity, insufficient instream complexity and roughness.
- Degraded riparian area and large wood recruitment – Degraded riparian condition; loss of vegetation, shade, overhead cover, terrestrial food sources; unstable or eroding stream banks.
- Altered hydrology – Higher peak flows, lower low flows; intermittent flow; increased stream energy; significant flow fluctuations on weekly, daily or hourly basis; dewatered channel.
- Degraded water quality – High water temperatures, high level of chemical contaminants, and nutrients.
- Altered sediment routing – Sedimentation; high levels of suspended sediment, turbidity, sediment load; increased fine sediments in spawning gravel; unnatural level of course-grained sediments; embedded substrate; contaminated sediment.

These limiting factors were associated with all populations and all life stages of MCR steelhead (NMFS 2009c, p. 6-3).

In addition, since all populations of this species use the Columbia River as a migration corridor, limiting factors associated with the mainstem Columbia River and its estuary are relevant. Therefore, the Estuary Module is relevant to this species (NMFS 2011d). The Estuary Module indicates that the limiting factors most likely affected by the proposed action would have moderate effects on stream-type populations (NMFS 2011d, p. 3-24). Refer to the estuary discussion above for limiting factors relevant to the estuary portion of this species' habitat.

VSP Evaluation. The 11 populations of this species that originate in Oregon (Table 2.2-13) are part of three major population groups (MPG): Cascade Eastern Slope Tributaries MPG, John Day River MPG, and Umatilla/Walla Walla MPG.

Cascade Eastern Slope Tributaries MPG (5 populations): The recovery plan identifies the following recovery scenario for the Cascade Eastern Slope Tributaries MPG. For the Cascade Eastern Slope Tributaries MPG to reach viable status, four of the five extant populations should be viable, including Fifteenmile and both the Deschutes populations (Eastside and Westside) in Oregon, and one population should reach a highly viable status. Of these three Oregon populations, two are currently viable (Fifteenmile and Deschutes Eastside) and one is a high extinction risk (Deschutes Westside) (Table 2.2-13). The Deschutes Westside population has the greatest survival gap to overcome, needing a 78% improvement in survival (NMFS 2009c, p. 7-17). Reintroduction efforts in the Deschutes Westside population are expected to improve the viability of the population, but at this time it is too early to determine the effect of reintroduction. Reintroduction efforts in the White Salmon River (Washington) and Crooked River (Oregon) populations may also improve the viability of this MPG.

John Day River MPG (5 populations): The recovery plan identifies the following recovery scenario for the John Day River MPG. For the John Day River MPG to reach viability, the Lower Mainstem John Day River, North Fork John Day River, and either the Middle Fork John Day River or Upper Mainstem John Day River populations should achieve viable status, with one highly viable. Of these four populations, the North Fork population is highly viable and the remaining populations have a moderate extinction risk rating (Table 2.2-13).

Umatilla/Walla Walla MPG (3 populations): The recovery plan identifies the following recovery scenario for the Umatilla/Walla Walla MPG. For the Umatilla/Walla Walla MPG to reach viability, two of the three extant populations should meet viability criteria, and of these one should be highly viable. The Umatilla River is the only large population, and therefore should be viable. Either the Walla Walla River or Touchet River (Washington) population also should be viable. Currently, the Umatilla and the Walla Walla River populations are a moderate extinction risk (Table 2.2-13). These populations need a 9% and 34% improvement in survival (NMFS 2009c, p. 7-27).

The effects of the proposed action would contribute to the limiting factors for all populations of MCR steelhead, and particularly affect the 11 populations that originate in the action area (Table 2.4-4). Consequently, considering the nature and duration of the effects, which would affect multiple generations, we assume the proposed action would reduce the abundance and productivity of the MCR steelhead DPS, and particularly the 11 populations that originate in the action area. This reduction is likely to increase the extinction risk of at least some populations. Furthermore, the resulting reductions in population distribution and suitable spawning areas associated with the proposed action are likely to reduce the spatial structure of the species. The effect of the proposed action on juveniles rearing in freshwater would disproportionately affect the abundance and productivity of individuals displaying a yearling life history strategy. The reduction, and potential loss, of this species' yearling life history component would constitute a reduction in the species' diversity.

The proposed action would also contribute to the limiting factors associated with the estuary, which is likely to disproportionately affect the abundance and productivity of individuals displaying early life history strategies. The reduction, and potential loss, of this species' sub-yearling life history component would constitute a reduction in the species' diversity.

Due to the permanency of habitat degradation caused by the proposed action, the aggregative quality of the habitat degradation that will occur under the proposed action over time, the high likelihood of additional permanent negative habitat effects from future floodplain development associated with the proposed action over time, and the effects of such habitat degradation on individual fish from all future cohorts and populations, NMFS determines that the proposed action is likely to cause a decrease in abundance, productivity, spatial structure, and diversity of MCR steelhead in the action area.

Furthermore, the effects of the proposed action would exacerbate anticipated habitat changes associated with climate change. Lawrence et al. (2014) predicted that changes in water temperature in streams lacking intact riparian vegetation may cause the near total loss of rearing habitat for stream-rearing juvenile salmonids and expand the distribution of warm-water predators (i.e., bass). The exacerbation of water temperature increases and associated expansion of predator species by the proposed action would further diminish MCR steelhead viability.

Oregon Coast Recovery Domain. There is one ESA-listed salmonid species that originates in this domain.

Oregon Coast coho salmon. This species is listed as “threatened” under the ESA. The OC coho salmon ESU is comprised of 56 populations (Table 2.2-17). All 56 populations that comprise this species originate in the action area and would be exposed to habitat changes associated with implementation of the proposed action (Table 2.4-4). A recovery plan has been proposed species (NMFS 2015c)

Life History. OC coho salmon currently exhibit a predominately stream-type life history and typically display a yearling life history strategy. To a lesser extent, individuals display a fry or sub-yearling life history strategy (Stout *et al*. 2012, p. 98).

Relevant Limiting Factors. The following relevant limiting factors, previously presented in the Status of the Species section of this opinion, have been identified for the species:

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood supply, stream substrate, stream flow, and water quality have been degraded.
- Fish passage barriers that limit access to spawning and rearing habitats (*e.g.*, culverts, dikes, tide gates).
- Loss of estuarine and tidal freshwater habitat.

The effects of the proposed action would contribute to these limiting factors (Table 2.4-4).

Individuals of this species may use freshwater and low-salinity portions of coastal estuaries for extended periods of rearing. Widespread estuarine and tidal freshwater wetland losses have “likely diminished the expression of sub-yearling migrant life histories within and among coho salmon populations” (Stout *et al*. 2012, p. 101). The greatest tidal wetland losses have “occurred across populations in the North Coast and Mid-South Coast strata” (Stout *et al*. 2012, p. 101). Habitat effects are likely to affect all life history stages, all life history strategies, and all populations of OC coho salmon in freshwater and estuaries. In evaluating areas within 100 meters (328 feet) of channels, Burnett *et al*. (2007) stated that recovery of OC coho salmon is “unlikely unless habitat can be improved in high-intrinsic-potential reaches on private lands.” High-intrinsic-potential reaches where characterized as being unconstrained and having a low slope (Burnett *et al*. 2007).

VSP Evaluation. Since a recovery plan has not been completed for this species, we assume all populations must maintain or decrease their current extinction risk for the survival and recovery of the species. Consequently, while not all populations likely must become viable, all populations must not experience further declines in their VSP parameters.

The effects of the proposed action would contribute to the limiting factors for all populations of OC coho salmon. Consequently, considering the nature and duration of the effects, which would affect multiple generations, we assume the proposed action would reduce the abundance and productivity of the OC coho salmon ESU. This reduction is likely to increase the extinction risk of at least some populations. Furthermore, the resulting reductions in population distribution and suitable spawning areas associated with the proposed action are likely to reduce the spatial structure of the species. The effect of the proposed action on juveniles rearing in freshwater would disproportionately affect the abundance and productivity of individuals displaying a yearling life history strategy. The reduction, and potential loss, of this species' yearling life history component would constitute a reduction in the species' diversity.

The proposed action would also contribute to the limiting factors associated with estuaries, which is likely to disproportionately affect the abundance and productivity of individuals displaying early life history strategies. The reduction, and potential loss, of this species' sub-yearling life history component would constitute a reduction in the species' diversity.

Due to the permanency of habitat degradation caused by the proposed action, the aggregative quality of the habitat degradation that will occur under the proposed action over time, the high likelihood of additional permanent negative habitat effects from future floodplain development associated with the proposed action over time, and the effects of such habitat degradation on individual fish from all future cohorts and populations, NMFS determines that the proposed action is likely to cause a decrease in abundance, productivity, spatial structure, and diversity of OC coho salmon in the action area.

Furthermore, the effects of the proposed action would exacerbate anticipated habitat changes associated with climate change. Wainwright and Weitkamp (2013) state that population declines of OC coho salmon are a likely outcome of climate change as a result of increasing stream and ocean temperatures, drier summers, higher incidence of flooding, and altered estuarine and marine habitats. The exacerbation of these effects by the proposed action would further diminish OC coho salmon viability.

Southern Oregon/Northern California Coasts Recovery Domain. There is one ESA-listed species in this domain that occurs in Oregon.

Southern Oregon and Northern California Coasts coho salmon. This species is listed as "threatened" under the ESA. The SONCC coho salmon ESU is comprised of 45 populations, of which 13 populations originate in the action area (Table 2.2-18) and would be exposed to habitat changes associated with implementation of the proposed action (Table 2.4-4). A recovery plan has been completed for this species (NMFS 2014a).

Life History. SONCC coho salmon currently exhibit a predominately stream-type life history and typically display a yearling life history strategy. Based on data from other Pacific Northwest coho salmon populations (NMFS 2011d, Stout *et al*. 2012, p. 98), individuals likely also display a sub-yearling life history strategy, albeit to a lesser extent.

Relevant Limiting Factors. The following relevant limiting factors, previously presented in the Status of the Species section of this opinion, have been identified for the species:

- lack of floodplain and channel structure,

- impaired water quality,
- altered hydrologic function (timing of volume of water flow),
- impaired estuary/mainstem function,
- degraded riparian forest conditions,
- altered sediment supply,
- increased disease/predation/competition, and
- barriers to migration.

The effects of the proposed action would contribute to these limiting factors, and affect the 15 populations of Southern Oregon and Northern California Coasts coho salmon that originate in the action area (Table 2.4-4).

Individuals of this species may use freshwater and low-salinity portions of coastal estuaries for extended periods of rearing. Widespread estuarine and tidal freshwater wetland losses may have diminished the expression of sub-yearling migrant life histories within and among coho salmon populations, as is the case with the OC coho salmon ESU (Stout *et al*. 2012, p. 101). Habitat effects are likely to affect all life history stages, all life history strategies, and all populations of SONCC coho salmon in freshwater and estuaries.

VSP Evaluation. Since a recovery plan has not been completed for this species, we assume all populations must maintain or decrease their current extinction risk for the survival and recovery of the species. Consequently, while not all populations likely must become viable, all populations must not experience further declines in their VSP parameters.

The effects of the proposed action would contribute to the limiting factors for all populations of SONCC coho salmon. Consequently, considering the nature and duration of the effects, which would affect multiple generations, we assume the proposed action would reduce the abundance and productivity of the SONCC coho salmon ESU. This reduction is likely to increase the extinction risk of at least some populations. Furthermore, the resulting reductions in population distribution and suitable spawning areas associated with the proposed action are likely to reduce the spatial structure of the species. The effect of the proposed action on juveniles rearing in freshwater would disproportionately affect the abundance and productivity of individuals displaying a yearling life history strategy. The reduction, and potential loss, of this species' yearling life history component would constitute a reduction in the species' diversity.

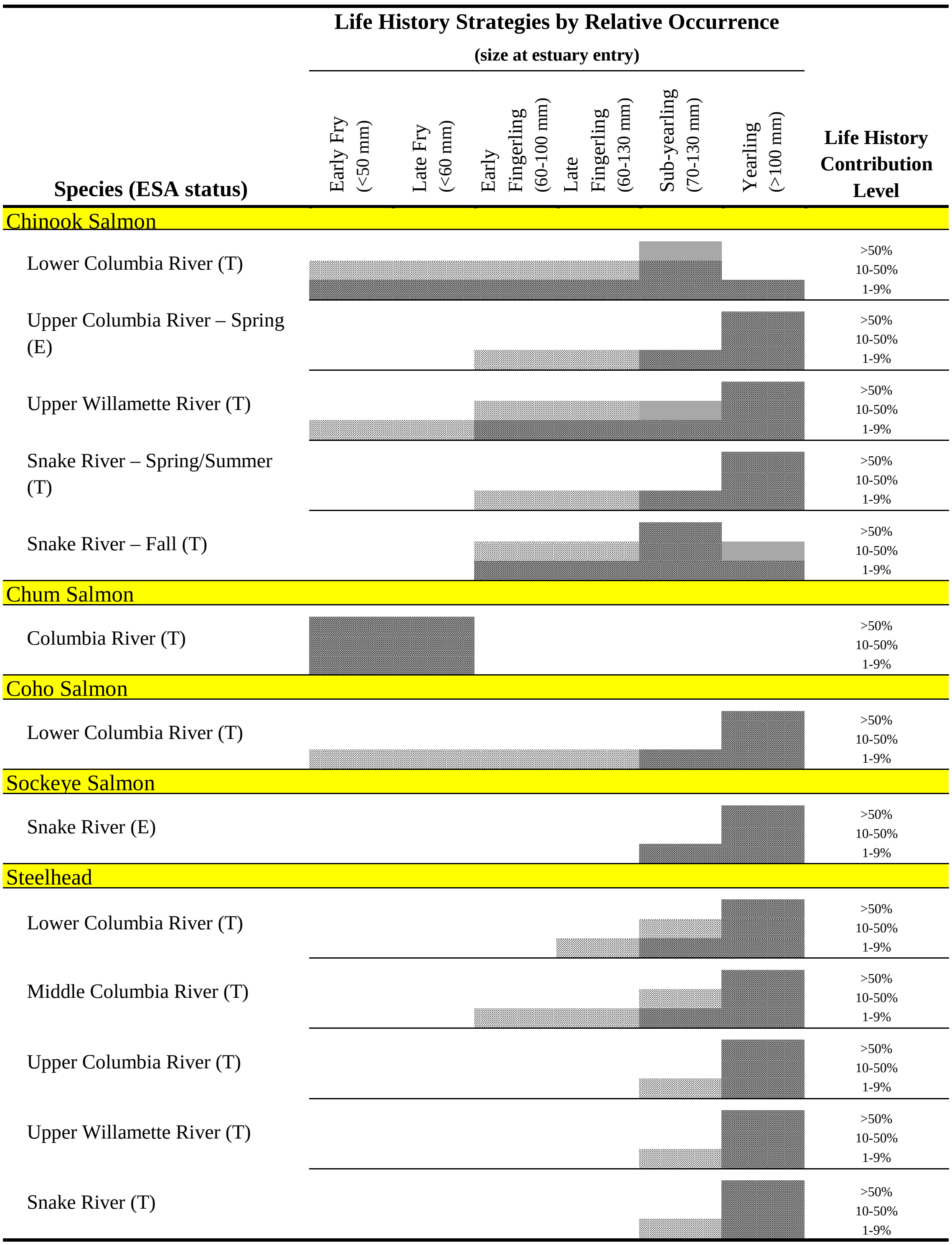
The proposed action would also contribute to the limiting factors associated with estuaries, which is likely to disproportionately affect the abundance and productivity of individuals displaying early life history strategies (*i.e.*, subyearling). The reduction, and potential loss, of this species' sub-yearling life history component would constitute a reduction in the species' diversity.

Due to the permanency of habitat degradation caused by the proposed action, the aggregative quality of the habitat degradation that will occur under the proposed action over time, the high likelihood of additional permanent negative habitat effects from future floodplain development associated with the proposed action over time, and the effects of such habitat degradation on individual fish from all future cohorts and populations, NMFS determines that the proposed action is likely to cause a decrease in abundance, productivity, spatial structure, and diversity of SONCC coho salmon in the action area.

Table 2.4-4. Populations present in the action area by habitat use and the relevant limiting factors adversely affected by the proposed action by habitat category.

	Populations (#)					Limiting Factors Adversely Affected		
		Action Area Use						
Species	Sp. Total	Spawning	FW Rearing	Migration	Nr-Shore Rearing	FW	Estuary	Nr-Shore
Willamette-Lower Columbia Domain								
LCR Chinook	32	12	32	32	32	X	X	X
LCR coho	24	8	24	24	24	X	X	X
LCR steelhead	23	6	23	23	23	X	X	X
CR chum	17	8	17	17	17	X	X	X
UWR steelhead	7	7	7	7	7	X	X	
UWR Chinook	4	4	4	4	4	X	X	
Interior Columbia Domain								
UCR sp Chinook	3	0	migration	3	3		X	
UCR steelhead	4	0	migration	4	4		X	
SR sp/su Chinook	28	6	6	28	28	X	X	
SR fall Chinook	1	1	1	1	1		X	X
SR sockeye	1	0	migration	1	1		X	
SR steelhead	24	5	5	24	24		X	
MCR steelhead	19	11	19	19	19	X	X	X
Oregon Coast Domain								
OC coho	56	56	56	56	56	X	X	
Southern Oregon & Northern California Coasts Domain								
SONCC coho	40	13	13	13	13	X	X	
Total	283	137	207	256	256			

Table 2.4-5. The life history strategies for ESA-listed salmon and steelhead in the Columbia River currently display less diversity than they historically did. Diagonal hashing indicates historical occurrence. Shading indicates current occurrence. Absence of hashing or shading indicates <1% contribution by that life history strategy. Adapted from Fresh *et al.* 2005.



2.4.5.2 Effects to Southern Green Sturgeon

Southern Green Sturgeon. The Southern Green Sturgeon DPS is listed as "threatened" under the ESA. The species includes all naturally-spawning populations of green sturgeon that occur south of the Eel River in California, with the only known spawning population in the Sacramento River (71 FR 17757). To our knowledge, individuals from all populations spend time in the action area. A recovery plan has not been completed for this species.

Life History. Adult and sub-adult life stages occur in the action area. In many Oregon coastal systems inadequate data exists to dismiss their presence, but presence has been established in Coos Bay, Winchester Bay (Umpqua River), Yaquina Bay, Nehalem Bay, and the Columbia River estuary.

Relevant Limiting Factors. The only identified limiting factor for this species that potentially applies to the action area is degradation of freshwater and estuarine habitat quality. The threat of contaminants is unknown, but is identified as a potentially serious threat (NOAA Fisheries 2011).

Abundance and Productivity. Southern green sturgeon consist of a single known spawning population. Unknown populations south of the Eel River may also exist. Individuals of all populations likely use estuaries and tidally-influenced reaches within the action area that may be impacted by the proposed action. However, population abundance and the proportion of the population that use estuaries in the action area are unknown. Some exposed sub-adult and adult individuals will be adversely affected by exposure to those habitat effects, particularly those that are repeatedly exposed over their long lifespan.

The species is well distributed, presence in the affected portion of the action area is spatially and temporally limited, and only a small proportion of the population occupies any given estuarine or tidally-influenced river reach within the action area at any given time. Therefore, because the population is well distributed, repeat exposure to detrimental changes in habitat associated with the proposed action is likely limited to a portion of the total population, and detrimental responses are likely further limited to a few of the exposed individuals, we conclude that changes in population abundance and productivity would be minor. Effects from floodplain development on freshwater environments would be most notable in habitat areas used by green sturgeon for reproduction, however those locations relied on by the Southern DPS are not within the action area for this consultation.

Spatial Structure and Diversity. Distribution of this species is wide ranging along the northwest coast of North America. Within their distribution in the action area, the proposed action may restrict access and prey source availability in specific forage sites. However, based on the information available, this would not significantly alter the population's spatial structure or diversity. Because the primary rearing locations within the action area are the Oregon coastal estuaries (Coos Bay, Winchester Bay, Yaquina Bay, and Tillamook Bay) and in the Columbia River (up to Bonneville Dam, but predimonantly in the lower 60 km) (Adams *et al.* 2002), individuals of this species will be exposed primarily to only the water quality impacts that occur with NFIP floodplain development, which are likely insufficient to inhibit the species use of these rearing areas.

2.4.5.3 Effects to Southern Eulachon

Southern Eulachon. This species is listed as "threatened" under the ESA. The species includes all naturally-spawned populations that originate in rivers south of the Nass River in British Columbia to the Mad River in California. The species is comprised of a single population. Only one subpopulation identified by the BRT occurs in the action area, Columbia River subpopulation. In many Oregon coastal systems inadequate data exists to dismiss their presence. While Southern eulachon may occur in coastal Oregon estuaries, they have not been identified as part a particular subpopulation. A recovery plan has not been completed for this species.

Life History. All life stages of populations that spawn in Oregon occur in the action area.

Relevant Limiting Factors. The following relevant limiting factors, previously presented in the Status of the Species section of this opinion, have been identified for the species:

- adverse effects related to water diversions,
- artificial fish passage barriers,
- increased water temperatures, insufficient streamflow,
- altered sediment balances, and
- water pollution.

Abundance and Productivity. Southern eulachon, like anadromous salmonids, return to their natal freshwater habitats to spawn. The species is comprised of a single population. Only one subpopulation identified by the BRT occurs in the action area, the Columbia River subpopulation. While Southern eulachon may occur in coastal Oregon estuaries, they have not been identified as part a particular subpopulation. Individuals of the population that occur in Oregon may be impacted by the proposed action, including segments of the Columbia River subpopulation that spawn in Washington State rivers. Some exposed individuals will be adversely affected by exposure to those habitat effects, including mortal injury or reduced reproductive success.

Species presence in the action area is temporally limited, as with anadromous salmonids, occurring in the early and late life history stages of any given individual's lifespan. For Southern eulachon, these life stages are as an egg, larval, and spawning adult. During spawning, individuals aggregate and occur in great numbers on spawning sites. Within the action area, spawning sites of the lower Columbia River subpopulation are limited to the mainstem Columbia River and estuary and the Sandy River. Other spawning sites for the subpopulation occur in Washington rivers that are outside of the action area. Individuals that occur elsewhere in Oregon (*i.e.*, coastal Oregon river basins) have spawning areas wholly within the action area.

Given that the population has a limited spatial distribution and aggregates in specific spawning sites, each spawning group that occurs in the action area is susceptible to exposure to detrimental changes in habitat quantity and quality related to the proposed action. Therefore, because the population is spatially limited and individuals aggregate in large numbers during spawning, numerous individuals of the population that occur in the action area, including substantial segments of the Columbia River subpopulation, will likely be exposed to detrimental changes in habitat associated with the proposed action, and among those individuals a substantial number are likely to exhibit a detrimental response to exposure, we conclude that population abundance and productivity would decline.

Spatial Structure and Diversity. As discussed above, the spatial structure of the Southern eulachon DPS within its estuarine and riverine distribution is limited. Estuarine and riverine occurrence of Oregon coastal groups wholly occurs within the affected portion of the action area. A significant proportion of the Columbia River subpopulation (*i.e.*, mainstem Columbia River and Sandy River spawners, and migrating adults and larvae from all segments) occurs within the affected portion of the action area. The proposed action may modify habitat suitability for exposed life stages, and therefore effectively restrict the population's spatial distribution within a significant portion of its habitat (*e.g.*, Sandy River). The species diversity of Southern eulachon is not well known. Therefore, the effect of habitat changes associated with the proposed action on species diversity is unknown.

2.4.5.4 Effects to Southern Resident Killer Whales

The best available information indicates that salmon are the primary prey of Southern Residents year round (Section 2.2), including in coastal waters, and that the whales predominantly consume Chinook salmon, likely including Oregon salmon stocks. Based on coded wire tag recoveries, Oregon salmon stocks are available to Southern Residents across their coastal range (Weitkamp 2010). The proposed action has the potential to affect Southern Residents indirectly by reducing prey quality, increasing persistent pollutants in the whales, and reducing availability of Chinook salmon. A decrease in the quality and availability of salmon, and Chinook salmon in particular, and an increase of persistent pollutants in individual whales, may adversely affect the entire DPS of Southern Resident killer whales.

In this analysis, NMFS considers effects of the proposed action on the Southern Residents by qualitatively evaluating the reduction of prey quality caused by the action as well as the potential accumulation of persistent pollutants in the whales, and the reduction of prey availability.

Effects of Reduced Prey Quality and Increased Exposure to Persistent Pollutants. A comprehensive analysis of the effects of the proposed action on anadromous fish is provided in the preceding section. We anticipate that the proposed action would reduce Chinook salmon fitness and increase the exposure to persistent pollutants. Consequently, Southern Residents would experience a reduction in prey quality and a potential increase in accumulation of persistent pollutants.

The quality of Chinook salmon is likely influenced by a variety of factors including size and caloric content of the fish and the contaminant load. As described above, floodplain development associated with the proposed action would reduce the general fitness of anadromous species in Oregon due to degradation of habitat functions. In part, that includes exposure to contaminants directly from inundation of developed areas during flood events and indirectly from stormwater runoff. Because Southern Residents consume mostly large Chinook salmon, a reduction in fish growth could affect the foraging efficiency of Southern Resident killer whales. However, the degree to which reduced fish growth could affect Southern Resident foraging is unknown.

The proposed action would continue to increase mass loading of toxic substances in the Southern Residents' primary prey with implications for toxic chemical accumulation in the whales. Depending on the land cover type, stormwater can consist of several different pollutants (*e.g.*, pesticides, herbicides, petroleum hydrocarbons, metals, nutrients, and persistent pollutants) (EPA 2002, Ecology and King County 2011). Some of these pollutants do not need to be in high concentration in a species to be toxic and have long been recognized as problematic. The Southern Residents are susceptible to compounds that biomagnify because even low concentrations in the prey can accumulate and magnify to high concentration levels in the body. Persistent pollutants that have the potential to biomagnify are likely to pose the greatest health risks to the Southern Residents. Metals can bioaccumulate in the aquatic environment, however, most metals (with the exception of methylmercury) do not appear to biomagnify and are regulated and excreted (Gray 2002, EPA 2007). In general, low levels of metals have been measured in marine mammal tissues (O'Shea 1999, Grant and Ross 2002, Das *et al.* 2003) and although threshold levels at which adverse health effects occur are currently unknown, the available data indicate that the low levels measured in their tissues do not pose a health risk to marine mammals (O'Shea 1999).

The accumulation of persistent pollutants in Pacific salmon is primarily determined by geographic proximity to contaminated environments, as well as by biological traits (*e.g.*, trophic status, lipid content, age, exposure duration, metabolism, and detoxification, Mongillo *et al*. in prep.). Because the majority of growth in salmon occurs while feeding in saltwater (Quinn 2005), the majority (greater than 96%) of these pollutants in adult salmon are accumulated while feeding in the marine environment (Cullon *et al*. 2009, O'Neill and West 2009). Therefore, the amount of persistent pollutants a juvenile salmonid accumulates from inundation of developed areas during flood events and from stormwater runoff is a low proportion of the total body burden in an adult salmon. Consequently, the accumulation of persistent pollutants in the Southern Residents from eating prey that were exposed to persistent pollutants contaminated as juveniles is not expected to cause a biologically meaningful increase in contamination in the whales and would have an insignificant effect on the Southern Residents. Furthermore, only a small proportion of the exposed juveniles would survive adulthood and be available as prey to the whales.

Effects of Reduced Prey Availability. We rely on the salmon determinations to ensure that the proposed action does not appreciably reduce the likelihood of survival and recovery of the Southern Residents in the long term. Later in this opinion, NMFS concludes that the proposed action is likely to appreciably reduce the likelihood of survival and recovery of the UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, LCR steelhead, UWR steelhead, MCR steelhead, UCR steelhead, SRB steelhead, LCR Chinook salmon, LCR coho salmon, SR fall-run Chinook salmon, SR sockeye salmon, CR chum salmon, OC coho salmon, SONCC coho salmon, and Southern eulachon. In other words, the proposed action appreciably increases the risk of extinction of these listed species. Furthermore, as with listed salmonid stocks, the effects of the proposed action are also likely to reduce the abundance of non-listed salmonid species (*e.g.*, MCR Chinook salmon) in the action area.

Mortality of Chinook salmon, and to a lesser degree other anadromous salmonid species (*e.g.*, steelhead, chum salmon), could affect the annual prey availability to the whales where the marine ranges of the affected salmonid stocks and the Southern Residents overlap. Mortality of adult Chinook salmon could affect the quantity of prey available to the whales in a given year, whereas mortality of juvenile Chinook salmon could affect prey availability in future years. While only a proportion of juveniles survive to adulthood, juvenile mortality reduces the number of adult Chinook salmon from a variety of runs three to five years after the juvenile mortality occurred (*i.e.*, by the time these juveniles would have grown to be adults and available prey of killer whales). This reduction would occur each year.

Given the total quantity of prey available to Southern Resident killer whales throughout their range, this annual reduction in prey is small, and although measurable, the percent reduction in prey abundance is not anticipated to be different from zero by multiple decimal places (based on NMFS' previous analyses of the effects of salmon harvest on Southern Residents; *e.g.*, NMFS 2008e, NMFS 2011). Because the annual reduction in prey availability associated with implementation of the proposed action is extremely small, NMFS anticipates that the short-term effect of reducing Chinook salmon would have an insignificant effect on Southern Resident killer whales.

Because the effects of the proposed action would accumulate over time, our analysis also focused on the long-term reductions in Chinook salmon available to the whales as a result of the proposed action. We qualitatively evaluated long-term effects on the Southern Residents from the anticipated appreciable reduction in the likelihood of survival and recovery of ESA-listed Chinook salmon species and the reduction in abundance of non-listed Chinook salmon species in the action area that would result from the effects of implementing the proposed NFIP in Oregon. We assessed the likelihood for localized depletions, and long-term implications for Southern Residents' survival and recovery, resulting from the increased risk of extinction of the subject ESA-listed Chinook salmon species and reduction in abundance of non-listed Chinook salmon species. In this way, we can determine whether the increased likelihood of reduction of prey species is also likely to appreciably reduce the likelihood of survival and recovery of Southern Residents.

A reduction in Southern Resident prey would occur over time as abundance declined for Chinook salmon that occur in estuarine and freshwater portions of the action area. Hatchery programs, which account for a portion of the production of these species, may provide a short-term buffer, but it is uncertain whether hatchery-only stocks could be sustained. The total 5-year geometric mean abundance for the five ESUs (UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, LCR Chinook salmon, and the SR fall-run Chinook salmon) is 128,534 total spawners. The loss of these ESUs would also preclude the potential for their future recovery to healthy, more substantial numbers. This reduction would be further reduced by declines in non-listed Chinook salmon species in the action area. Fewer populations contributing to Southern Residents' prey base would reduce 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 Southern Residents to withstand catastrophic events.

The long-term reduction of Chinook salmon can lead to nutritional stress in Southern Resident killer whales. Nutritional stress can lead to reduced body size and condition of individuals and can also lower reproductive and survival rates. Prey sharing would distribute more evenly the effects of prey limitation across individuals of the population than would otherwise be the case. Therefore, poor nutrition from the reduction of prey could contribute to additional mortality in this population. Food scarcity could also cause whales to draw on fat stores, mobilizing contaminants stored in their fat and affecting reproduction and immune function.

Differences in adult salmon life histories and locations of their natal streams likely affect the distribution of salmon across the Southern Residents' coastal range. The continued decline in available Chinook salmon prey, and consequent interruption in the geographic continuity of salmon-bearing watersheds in the Southern Residents' coastal range, is likely to alter the distribution of migrating salmon and increase the likelihood of localized depletions in prey, with adverse effects on the Southern Residents' ability to meet their energy needs. A fundamental change in the prey base originating from Oregon is likely to result in Southern Residents abandoning areas in search of more abundant prey or expending substantial effort to find depleted prey resources. This potential increase in energy demands should have the same effect on an animal's energy budget as reductions in available energy, such as one would expect from reductions in prey.

In summary, implementing the proposed NFIP in Oregon would increase the likelihood of the reduction of available prey in the long term, particularly the extinction of the ESA-listed Chinook salmon species present in the action area, which would increase the mortality of juveniles and reduce the breeding success of adult females resulting in a reduction in the reproductive success of the SRKW DPS.

2.4.6 Effects to Critical Habitat

Implementation of the NFIP in Oregon as proposed by FEMA will have adverse effects on critical habitat PCEs, particularly water quality and floodplain connectivity, which form and maintain the physical habitat conditions of freshwater and estuarine rearing sites that support juvenile growth and mobility of anadromous fish species.

Although ESA-listed species, particularly salmonids, periodically occupy floodplains and therefore floodplains are considered fish habitat, in most instances NMFS only designated critical habitat below the ordinary high water elevation. Therefore, for most of the listed anadromous fish species, designated critical habitat only occurs within a portion of the floodplain, generally the active channel portion. However, actions that occur outside of the active channel (*e.g.*, portion of floodplain above the ordinary high water elevation) may influence the quantity and quality of designated critical habitat in the active channel. We have consistently articulated this point. As underscored in previous critical habitat designations, the quality of aquatic habitat within stream channels is intrinsically related to the adjacent riparian zones and floodplain (70 FR 52630). This point was made again in our designation of critical habitat for Southern eulachon (76 FR 65324):

> As discussed in previous critical habitat designations for Pacific salmon and steelhead (70 FR 52630; September 2, 2005) and North American green sturgeon (74 FR 52300; October 9, 2009), the quality of aquatic and estuarine habitats within stream channels and bays and estuaries is intrinsically related to the adjacent riparian zones and floodplain, to surrounding wetlands and uplands, and to non-fish-bearing streams above occupied stream reaches.
>
> Human activities that occur outside of designated critical habitat can destroy or adversely modify the essential physical and biological features within these areas. In addition, human activities occurring within and adjacent to reaches upstream or downstream of designated stream reaches or estuaries can also destroy or adversely modify the essential physical and biological features of these areas. This designation will help to ensure that federal agencies are aware of these important habitat linkages.

Furthermore, recognizing that some river reaches move laterally across the landscape, as the active channel moves, so does the area designated as critical habitat. Consequently, in a floodplain containing a laterally moving channel, the location of designated critical habitat is a function of time, and the effects of an action must consider the duration of effect. Designated critical habitat only occurs within a portion of the floodplain at any given time, but the effects of floodplain development outside of critical habitat at the time of construction do affect the quantity and quality of designated critical habitat in the future.

It is likely that the rate of floodplain development and habitat loss will fluctuate from the levels observed during the last century, but floodplain development will persist into the future. The continuation of development will cause a corresponding loss in available off-channel habitat and provide declining functions to critical habitats in floodplain reaches. Spatially effects will be greatest where critical habitat occurs in floodplains and estuaries. Development effects will be permanent, substantial, pervasive, and increasing over time as floodplain development continues degrading the quality and function of PCEs.

Locally, where floodplain habitat restoration actions are implemented some habitat functions may be restored. However, in most instances the magnitude of those restored functions is likely to be overwhelmed by the scale of the more widespread development. In reaches where floodplain development is less prevalent and development pressures are low, restoration actions may locally improve habitat functions in a watershed. However, in the absence of more restrictive requirements than the NFIP standards, even in that context nothing precludes a landowner from constructing a large retail store or some other structure on their lands in a floodplain and negating some or all of the gains realized by the habitat restoration.

2.4.6.1 Effects to Salmonid Critical Habitat

Designated critical habitat within the action area for the 15 ESA-listed salmonid species consists of freshwater spawning, freshwater rearing sites, freshwater migration corridors, estuarine areas, and offshore marine areas, and their PCEs as listed below. The effects of the proposed action on these features are summarized below, and are presented as a subset of the habitat-related effects of the action that were discussed more fully in the preceding effects sections (Sections 2.4.3 to 2.4.5). In addition to the effects previously discussed, FEMA's regulations include provisions that circumvent the regulatory prohibition at 44 CFR 65.5(a)(7) (which disallows a revision of floodplain delination based on fill creating a floodway encroachment). At section 44 CFR 65.7, FEMA allows communities to request FEMA to remap an area so as to depict the floodway in a revised location in order to accommodate floodplain development adjacent to the subject river in the area that would normally convey flood flows. This adversely affects critical habitat PCEs by allowing further encroachment and conversion of adjacent floodplain areas, permanently reducing floodplain connectivity, and degrading multiple features of freshwater PCES for all lifestages.

While some of the likely effects of the proposed action, such as water quality impacts resulting from construction-derived sediment, or pollutant pulses from flooded development, would be intermittent or short-term (hours to days), most of the effects would be systemic, permanent, and would aggregate over time.

In this case, the conservation role of critical habitat for salmon and steelhead is to provide PCEs that support populations that can contribute to conservation of of ESUs and DPS. In our critical habitat designations for salmon, we noted the conservation value of critical habitat also considers "(1) the importance of the populations associated with a site to the ESU conservation, and (2) the contribution of that site to the conservation of the population either through demonstrated or potential productivity of the area." (68 FR 55926, September 29, 2003). This means that, in even just a small area within the total area of designated critical habitat, if habitat features are impaired, it could result in a significant impact on conservation value at the designation scale, when that particular habitat location serves an especially important population in terms of species' recovery needs, such as unique genetic or life history diversity, or critical spatial structure. In other words, because conservation value of habitat means that the habitat supports viability parameters of populations, where viability parameters are weakened through declines in habitat features or functions, conservation values may be considered impaired.

1. **Freshwater spawning sites.**
    a. ***Water quantity***. Effects include increased peak flow in channel due to loss of flood storage capacity in floodplains, increase in impervious surface, and increased conveyance of stormwater runoff. Also, reduced base flow are likely due to withdrawals for community water needs and reduced hyporheic flow due to floodplain and riparian disturbance, including reduced permeability and increased runoff. Freshwater spawning sites require water quantity conditions that support spawning, incubation, and larval development. Based on the distribution and density of development in freshwater floodplains, the distribution of effects summarized in Section 2.4.4.4, and the distribution of spawning of UWR Chinook salmon, LCR

steelhead, UWR steelhead, MCR steelhead, LCR Chinook salmon, LCR coho salmon, SR SS Chinook salmon, SR fall-run Chinook salmon, SRB steelhead, CR chum salmon, OC coho salmon, and SONCC coho salmon, we expect degraded water quality to coincide in time and space with spawning events, indicating that the value of this habitat to serve its conservation value for that lifestage will be diminished.

b. ***Water quality***. Effects include increased water temperature, suspended sediment, and contaminants, decreased dissolved oxygen, and a degraded biological community structure, including the composition, distribution, and abundance of prey, competitors, and predators due to floodplain, riparian, and channel disturbance and loss, and increased erosion, sedimentation, and contaminants. Freshwater spawning sites require water quality conditions that support spawning, incubation, and larval development. Based on the distribution and density of floodplain development, the distribution of effects summarized in Section 2.4.4.4, and the distribution of spawning of UWR Chinook salmon, LCR steelhead, UWR steelhead, MCR steelhead, LCR Chinook salmon, LCR coho salmon, SR SS Chinook salmon, SR fall-run Chinook salmon, SRB steelhead, CR chum salmon, OC coho salmon, and SONCC coho salmon, we expect degraded water quality to coincide in time and space with spawning events. The most severe effects to water quality within spawning sites will be those sites that are located in areas in close proximity to developed floodplains, for example municipal infrastructure or agricultural practices. Although spawning sites for UWR Chinook salmon, LCR steelhead, UWR steelhead, MCR steelhead, LCR Chinook salmon, LCR coho salmon, SR SS Chinook salmon, SR fall-run Chinook salmon, SRB steelhead, CR chum salmon, OC coho salmon, and SONCC coho salmon are generally above highly developed municipal areas they often overlap with agricultural related floodplain development, and the downstream effects of poor water quality upstream of spawning areas can reduce spawning success. For these reasons, the distribution and scope of developed freshwater floodplains, and the corollary distribution of effects as summarized in Section 2.4.4.4, indicates that the PCE *water quality* will be adversely affected, and will be degraded at the watershed or designation scales.

c. ***Substrate***. Effects include decreased substrate quality due to increase in contaminants from stormwater runoff from developed floodplains, and inundation of new floodplain development and existing developed areas from displaced flood waters. Also, decreased space and gravel supply, increased compaction and embeddedness, and impoverished community structure due mechanical compression and floodplain, riparian, and channel disturbance and loss, including loss of large wood are likely. Substrate will experience coarsening, scour, and increased bedload transport by increased velocities due to increases in stormwater runoff, peak flow, and channel simplification. For these reasons, the distribution and scope of developed floodplains in freshwater areas and the corollary distribution of effects as summarized in Section 2.4.4.4, indicate that the PCE *substrate* will be adversely affected, and will be degraded at the watershed and designation scales.

2. **<u>Freshwater rearing sites</u>.**

a. ***Water quantity***. Effects include increased peak flow in channel due to loss of flood storage capacity in floodplains, increase in impervious surface, and increased conveyance of stormwater runoff. Reduced base flow due to withdrawals for community water needs and reduced hyporheic flow due to floodplain and riparian disturbance, including reduced permeability and increased runoff are also likely. Because freshwater rearing sites must provide good water quality and abundant forage to support juvenile development, reductions in either can limit the existing and potential carrying capacity of rearing sites and subsequently reduce their conservation value. Based on the distribution and density of floodplain development, the distribution of effects summarized in Section 2.4.4.4, and the distribution of spawning of UWR Chinook salmon, LCR steelhead, UWR steelhead, MCR steelhead, LCR Chinook salmon, LCR coho salmon, SR SS Chinook salmon, SR fall-run Chinook salmon, SRB steelhead, CR chum salmon, OC coho salmon, and SONCC coho salmon, we expect degraded water quality to coincide in time and space with rearing periods, indicating that the habitat will be diminished and provide less conservation value to these species at this lifestage.

b. ***Floodplain connectivity***. Effects include reduced access to off-channel areas and loss of river length and habitat diversity due to restriction of lateral channel movement. Also, permanent reduction of hyporheic flow due to floodplain and riparian disturbance and loss, including reduced permeability and increased runoff are likely. Floodplain connection to the river, access by fish during periods of inundation, and unrestricted channel movement are required to create and maintain complex floodplain habitat for fish. Reductions in lateral connections between main channels, secondary channels, and floodplains which are essential for maintaining habitat dynamics and species responses, can limit the fulfillment of anadromous salmonid lifecycle requirements. Reductions in connectivity can limit exsting and potential carrying capacity of rearing siteds and subsequently reduce their conservation value. Based on the distribution and density of floodplain development, the distribution of effects summarized in Section 2.4.4.4, and the distribution of spawning of UWR Chinook salmon, LCR steelhead, UWR steelhead, MCR steelhead, LCR Chinook salmon, LCR coho salmon, SR SS Chinook salmon, SR fall-run Chinook salmon, SRB steelhead, CR chum salmon, OC coho salmon, and SONCC coho salmon, we expect degraded floodplain connectivity to coincide in time and space with rearing periods, indicating that the habitat will have impaired function for this PCE affecting conservation potential at this lifestage.

c. ***Water quality***. Freshwater rearing sites must provide good water quality and abundant forage to support juvenile development. Reductions in either, can limit the existing and potential carrying capacity of rearing sites and subsequently reduce their conservation value. Recovery of UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, LCR steelhead, UWR steelhead, MCR steelhead, UCR steelhead, SRB steelhead, LCR Chinook salmon, LCR coho salmon, SR fall-run Chinook salmon, SR sockeye salmon, CR chum salmon, OC coho salmon, SONCC coho salmon populations is tied closely to the success of juveniles to fully develop, mature, and grow during freshwater residency periods. Collectively, the effects of new impervious surfaces and uses related to urban and suburban development are sufficient to adversely affect water quality in affected watersheds, as they do not support the associated life history events, such as fry/parr growth and development, for UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, LCR steelhead, UWR steelhead, MCR steelhead, UCR steelhead, SRB steelhead, LCR Chinook salmon, LCR coho salmon, SR fall-run Chinook salmon, SR sockeye salmon, CR chum salmon, OC coho salmon, SONCC coho salmon. For these reasons, and the available toxicity data, the distribution and density of point-source discharges in freshwater, the fate, transport, chemical transformation, and chemical interactions of the compounds listed in Table 1.1, the PCE *water quality* will be adversely affected, and will be degraded at the watershed and designation scales.

d. ***Forage***. Decreased access to and loss of off-channel forage sources. Decrease in quantity and quality of forage due to reduced channel length, increased suspended sediment and contaminants, decreased space, decreased dissolved oxygen, loss of habitat diversity and productivity, increased scour, continued reduction in macrodetrital inputs to the estuary from floodplains, and impoverished community structure caused by floodplain, riparian, and channel disturbance and loss. Based on the data provided in the BE on fish and aquatic invertebrates, the stressors of the action will adversely affect food items for juvenile fishes. Reductions in food quantity can result in reduced calories for rearing and migrating fish, which is likely to reduce fitness, in watersheds where food is a limiting factor.Biomass quantity is not a substitute for prey suitability, as differing prey behavior patterns and micro-habitat needs can reduce the foraging efficiency of juvenile fishes. Pollution tolerant prey, which could be favored under the proposed action, may also be less palatable to juvenile fishes and therefore reduce actual food availability. For these reasons, the effects of new impervious surfaces and uses related to urban and suburban development, the PCE *forage* will be adversely affected, but will not be degraded at the watershed or designation scales.

e. ***Natural cover***. Decreased natural cover quantity and quality for thermal, velocity, and predator refugia by decreased channel length, loss of habitat diversity, reduced space, and increased temperature due to restriction of lateral channel movement, riparian and channel disturbance and loss, and impoverished community structure.

3. **Freshwater migration corridors.**

   a. ***Free passage***. Decreased access due to decreased space, water quantity and quality, floodplain connectivity, and channel incision. Decreased safe passage by impingement and entrapment due to stem-wall foundations and other development features constructed in the floodplain. Increased predation due to overwater structures and the inability to access floodplains and seek refuge during overbank flows, which assists the avoidance of larger predators that need to stay in the deeper water.

b. ***Water quantity***. Same as above.
c. ***Water Quality***. Freshwater migration corridors need to provide good water quality and abundant forage to support juvenile development. Reductions in either, can limit the existing and potential carrying capacity of migration corridors and subsequently reduce their conservation value. Collectively, the effects of new impervious surfaces and uses related to urban and suburban development are sufficient to adversely affect water quality in affected watersheds, as they do not support the associated life history events, such as smolt growth and development, for UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, LCR steelhead, UWR steelhead, MCR steelhead, UCR steelhead, SRB steelhead, LCR Chinook salmon, LCR coho salmon, SR fall-run Chinook salmon, SR sockeye salmon, CR chum salmon, OC coho salmon, SONCC coho salmon. For these reasons, the PCE *water quality* will be adversely affected, and will be degraded at the watershed and designation scales.
d. ***Natural cover***. Same as above.
e. ***Forage.*** Based on the data provided in the BE on fish and aquatic invertebrates, the stressors of the action will adversely affect food items for juvenile fishes. Reductions in food quantity can result in reduced calories for rearing and migrating fish, which is likely to reduce fitness, in watersheds where food is a limiting factor. Biomass quantity is not a substitute for prey suitability, as differing prey behavior patterns and micro-habitat needs can reduce the foraging efficiency of juvenile fishes. Pollution tolerant prey, which could be favored under the proposed action, may also be less palatable to juvenile fishes and therefore reduce actual food availability. For these reasons, the effects of new impervious surfaces and uses related to urban and suburban development, the PCE *forage* will be adversely affected, but will not be degraded at the watershed or designation scales.

4. **Estuarine areas.**
   a. ***Free passage***. Same as above.
   b. ***Water quality***. Estuarine areas require good water quality to support juvenile and adult physiological transitions between fresh water and salt water as well as areas to support growth and maturation. Collectively, the effects of new impervious surfaces and uses related to urban and suburban development are sufficient to adversely affect water quality in affected estuarine areas, as they do not support the associated life history events, such as smolt growth and development, for UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, LCR steelhead, UWR steelhead, MCR steelhead, UCR steelhead, SRB steelhead, LCR Chinook salmon, LCR coho salmon, SR fall-run Chinook salmon, SR sockeye salmon, CR chum salmon, OC coho salmon, SONCC coho salmon. For these reasons, the PCE *water quality* will be adversely affected, but will not be degraded at the watershed and designation scales.
   c. ***Water quantity***. Same as above.
   d. ***Salinity***. Altered salinity profile in coastal areas receiving increased peak flows due to runoff (peak), and decreased low flows due to increased water withdrawals and decreased infiltration and hyporheic flow (base).
   e. ***Natural cover***. Same as above.

f. ***Forage***. Based on the data provided in the BE on fish and aquatic invertebrates, the stressors of the action will adversely affect food items for juvenile fishes. Reductions in food quantity can result in reduced calories for rearing and migrating fish, which is likely to reduce fitness, in watersheds where food is a limiting factor. Biomass quantity is not a substitute for prey suitability, as differing prey behavior patterns and micro-habitat needs can reduce the foraging efficiency of juvenile fishes. Pollution tolerant prey, which could be favored under the proposed action, may also be less palatable to juvenile fishes and therefore reduce actual food availability. For these reasons, the effects of new impervious surfaces and uses related to urban and suburban development, the PCE *forage* will be adversely affected, but will not be degraded at the watershed or designation scales.

5. **Nearshore marine areas.**
   a. ***Free passage***. No effect.
   b. ***Water quality***. Increased contaminants and degraded community structure by altered freshwater and estuary inflows due to increased water temperature, suspended sediment, and contaminants, and decreased dissolved oxygen associated with floodplain, riparian, and channel disturbance and loss, and increased erosion, sedimentation, and contaminants.
   c. ***Water quantity***. Insignificant effect.
   d. ***Forage***. Decreased quantity and quality of forage due to degraded community.
   e. ***Natural cover***. Decreased natural cover quantity and quality due to reduced large wood.
6. **Offshore marine areas.**
   a. ***Water quality***. No effect because offshore marine habitat conditions are controlled by ocean conditions largely disconnected from terrestrial and nearshore conditions.
   b. ***Forage***. No effect because offshore marine habitat conditions are controlled by ocean conditions largely disconnected from terrestrial and nearshore conditions.

Based on the above assessment, the effects of the proposed action, in particular on the freshwater PCEs *water quality and substrate*, will appreciably diminish the conservation value of critical habitat at the designation scale for UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, LCR steelhead, UWR steelhead, MCR steelhead, UCR steelhead, SRB steelhead, LCR Chinook salmon, LCR coho salmon, SR fall-run Chinook salmon, SR sockeye salmon, CR chum salmon, OC coho salmon, SONCC coho salmon. The proposed action will cause a systemic, additive, and lasting decrease in the quality and function of critical habitat PCEs throughout the action area, though some locations may be less affected than others due to Federal land ownership of adjacent lands.

2.4.6.2 Effects to Southern Green Sturgeon Critical Habitat

Designated critical habitat within the action area for Southern green sturgeon consists of freshwater riverine system, estuarine areas, coastal marine areas, and their PCEs as listed below. The effects of the proposed action on these features are summarized here as a subset of the habitat-related effects of the action that were discussed more fully in the preceding effects sections (Sections 2.4.3 to 2.4.5). Some of the likely effects would be short-term (hours to days), while most are long-term or permanent, and aggregating.

1. **Freshwater riverine system.**
    a. ***Food resources***. Decrease in quantity and quality of forage to due to continued reduction in macrodetrital inputs, increased contaminants, loss of habitat productivity, and impoverished community structure caused by floodplain, riparian, and channel disturbance and loss.
    b. ***Migratory corridor***. Migratory passage is unlikely to be appreciably altered.
    c. ***Sediment quality***. Decreased sediment quality due to increase in contaminants from stormwater runoff from developed floodplains, and inundation of new floodplain development and existing developed areas from displaced flood waters.
    d. ***Substrate type and size***. Some changes in substrate type and size are likely in the tidal-freshwater reaches of tributary streams due to changes in erosion and deposition patterns. In tidal-freshwater reaches of larger mainstems, substrate type and size is unlikely to be appreciably altered.
    e. ***Water depth***. Site specific changes of water depth are likely in the tidal reaches of tributary streams. Where velocities increase, depths are likely to increase. Where velocities remain unchanged, deposition of sediment from increased erosion is likely to reduce depths. In tidal reaches of mainstems, detectable changes in water depth are likely limited to increases associated with dredging that is interrelated to floodplain development (*e.g.*, marine terminal or residential dock access).
    f. ***Water flow***. Increased peak flow due to loss of flood storage capacity, increase is impervious surface, and increased conveyance of stormwater runoff. Reduced base flow due to withdrawals for community water needs and reduced hyporheic flow due to floodplain and riparian disturbance, including reduced permeability and increased runoff.
    g. ***Water quality***. Increased water temperature, suspended sediment, and contaminants, decreased dissolved oxygen, and a degraded biological community structure, including the composition, distribution, and abundance of prey, competitors, and predators due to floodplain, riparian, and channel disturbance and loss, and increased erosion, sedimentation, and contaminants.

2. **Estuarine areas.**
    a. ***Food resources***. Same as above.
    b. ***Migratory corridor***. Same as above.
    c. ***Sediment quality***. Same as above.
    d. ***Water flow***. Same as above.
    e. ***Water depth***. Same as above.
    f. ***Water quality***. Same as above.

3. **Coastal marine areas.**
    a. ***Food Resources***. Decreased quantity and quality of forage due to degraded community.
    b. ***Migratory corridor***. No effect.

c. ***Water quality***. Increased contaminants and degraded community structure by altered freshwater and estuary inflows due to increased water temperature, suspended sediment, and contaminants, and decreased dissolved oxygen associated with floodplain, riparian, and channel disturbance and loss, and increased erosion, sedimentation, and contaminants.

Even though some of the likely effects described above would be short-term (hours to days), most are long-term to permanent, and aggregating. Because of this, the proposed action will cause a decrease in the quality and function of Southern green sturgeon critical habitat PCEs in the action area.

2.4.6.3 Effects to Southern Eulachon Critical Habitat

Designated critical habitat within the action area for Southern eulachon is located in the Columbia River below Bonnevile Dam, in the lower portion of the Umpqua River, and in Tenmile Creek. The action area contains roughly three-quarters of the full designation of critical habitat for the DPS. In the action area, critical habitat consists of freshwater spawning and incubation, freshwater migration, and their PCEs as listed above. The effects of the proposed action on these features are summarized below and are a subset of the habitat-related effects of the action that were discussed more fully in the preceding effects sections (Sections 2.4.3 to 2.4.5).

1. **Freshwater spawning and incubation.**
   a. ***Flow***. Increased peak flow due to loss of flood storage capacity, increase in impervious surface, and increased conveyance of stormwater runoff. Reduced base flow due to withdrawals for community water needs and reduced hyporheic flow due to floodplain and riparian disturbance, including reduced permeability and increased runoff.
   b. ***Water quality***. Increased suspended sediment, and contaminants, decreased dissolved oxygen, and a degraded biological community structure, including the composition, distribution, and abundance of prey, competitors, and predators due to floodplain, riparian, and channel disturbance and loss, and increased erosion, sedimentation, and contaminants.
   c. ***Water temperature***. Increased water temperature due to reduced riparian shading, hyporheic exchange, and shallowing of channels from deposition of eroded sediments and channel widening.
   d. ***Substrate***. Decreased substrate quality due to increase in contaminants from stormwater runoff from developed floodplains, and inundation of new floodplain development and existing developed areas from displaced flood waters. Decreased space and gravel supply, increased compaction and embeddedness, and impoverished community structure due mechanical compression and floodplain, riparian, and channel disturbance and loss, including loss of large wood. Substrate coarsening, scour, and increased bedload transport by increased velocities due to increases in stormwater runoff, peak flow, and channel simplification.

2. **Freshwater migration.**
    a. ***Flow***. Same as above.
    b. ***Water quality***. Same as above.
    c. ***Water Temperature***. Same as above.
    d. ***Food***. Decrease in quantity and quality of forage due to reduced channel length, increased suspended sediment and contaminants, decreased space, decreased dissolved oxygen, loss of habitat diversity and productivity, increased scour, continued reduction in macrodetrital inputs from floodplains, and impoverished community structure caused by floodplain, riparian, and channel disturbance and loss.

Some of the likely effects presented above would be short-term (hours to days), while most are long-term to permanent, and aggregating. Because of this, the proposed action will cause a decrease in the quality and function of Southern eulachon critical habitat PCEs in the action area.

2.4.6.4 Effects to Southern Resident Killer Whale Critical Habitat

The action area for the implementation of the NFIP in Oregon does not include any area designated as critical habitat for Southern Resident killer whales.

2.4.7 Effects Conclusion

We conclude that the proposed action would result in reductions in VSP parameters for all anadromous species that occur in the action area, except for Southern green sturgeon where the VSP parameters are not expected to be altered. The proposed action would also cause a decrease in the quality and function of critical habitat PCEs for anadromous species in the action area. In addition, the proposed action would increase the likelihood of a reduction in the availability of prey for Southern Resident killer whales, which would reduce the reproductive success of the species.

2.5 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

The contribution of non-Federal activities to the current condition of ESA-listed species and designated critical habitats within the action area was described in the Status of the Species and Critical Habitats and Environmental Baseline sections, above. Among those activities were agriculture, operation of non-Federal hydropower facilities, urban and suburban development, recreation, private timber harvest, fishing, road construction and maintenance, metals and gravel mining, water withdrawal, and habitat restoration. Those activities are driven by a combination of economic conditions that characterize traditional natural resource-based industries, general resource demands associated with settlement of local and regional population centers, and the efforts of social groups dedicated to the river restoration and use of natural amenities, such as cultural inspiration and recreational experiences. These activities are expected to continue for the foreseeable future in greater or lesser degree as human population increases, market patterns shift, and the economy contracts or expands.

Resource-based industries (*e.g.*, agriculture, hydropower facilities, timber harvest, fishing, and metals and gravel mining) caused many long-lasting environmental changes that harmed ESA-listed species and their critical habitats, such as state-wide loss or degradation of stream channel morphology, spawning substrates, instream roughness and cover, estuarine rearing habitats, wetlands, floodplains, riparian areas, water quality (*e.g.*, temperature, sediment, dissolved oxygen, contaminants), fish passage, and habitat refugia. Those changes reduced the ability of populations of ESA-listed species to sustain themselves in the natural environment by altering or interfering with their behavior in ways that reduce their survival throughout their life cycle. The environmental changes also reduced the quality and function of critical habitat PCEs that are necessary for successful spawning, production of offspring, and migratory access necessary for adult fish to swim upstream to reach spawning areas and for juvenile fish to proceed downstream and reach the ocean. Without those features, the species cannot successfully spawn and produce offspring.

The economic and environmental significance of Oregon's natural resource-based economy is declining in absolute terms and relative to a newer economy based on mixed manufacturing and marketing with an emphasis on high technology (Brown 2011). Nonetheless, resource-based industries are likely to continue to have an influence on environmental conditions within the action area for the indefinite future. The activity level of some industries, such as forest products, may increase in intensity as the nation's economy improves and export opportunities increase, raising the value of extracted materials.

While natural resource extraction within Oregon may be declining, general resource demands (*e.g.*, demands due to urban and suburban development, recreational activities, road construction and maintenance, shipping, and water withdrawals) are increasing with growth in the size and standard of living of the local and regional human populations. As of 2010, Oregon has a population of approximately 3.8 million residents (Table 2.5-1). During the most recent 50-year period (1960-2010), decadal growth averaged 16.9%, with a range of 7.9% (1980s) to 25.9% (1970s) (Table 2.5-1). During the latest census period (2000-2010), the population of Oregon grew 12% (Mackun *et al*. 2011, PSU 2012).

Growth from 2000 to 2010 was not equally distributed throughout the state of Oregon. Population estimates organized by NMFS' salmon recovery domains illustrate population change in terms of the listed resources. Numerically, the Upper Willamette and Lower Columbia domains had the largest change (Table 2.5-2). This change was driven by increased populations in the Willamette Valley, including the Portland metropolitan area (Metro). By 2030, the Metro area could reach between 2.9 and 3.2 million residents (Metro 2009). By 2060, the estimates are 3.7 to 4.4 million residents (Metro 2009), or roughly equivalent to the current state population total.

Table 2.5-1. Population of Oregon from 1960 to 2010 (US Census Bureau 2011, PSU 2012).

Year	Population	Percent Change
1960	1,768,687	16.3
1970	2,091,385	18.2
1980	2,633,105	25.9
1990	2,842,321	7.9
2000	3,421,399	20.4
2010	3,831,074	12.0

Table 2.5-2. Oregon population growth by recovery domain unit for the period of 2000 to 2010 (US Census Bureau 2011, PSU 2012).

	Approximate Population		Change 2000-2010 Period	
Recovery Domain Unit	**2000**	**2010**	**Percent**	**Numeric**
S. Oregon/N. Calif Coast	278,136	308,470	10.9	30,334
Oregon Coast	261,859	274,192	4.7	12,334
L. Columbia*	1,012,804	1,128,021	11.4	115,218
U. Willamette*	2,326,031	2,629,464	13.0	303,433
Mid-Columbia	187,089	209,239	11.8	22,150
Snake River	31,192	32,221	3.3	1,030
Not in a domain	232,046	267,365	15.2	35,318

* These domains overlap in the Clackamas River basin and Portland Metro area.

Oregon's population, particularly in the Willamette Valley and Portland Metro area, is likely to continue growing. Assuming a continued 12% decadal growth rate, Oregon's population in 2050 is estimated to be 6 million (Figure 2.5-1). Thus, NMFS assumes that future private and state actions will continue within the action area, and will increase as population density rises.

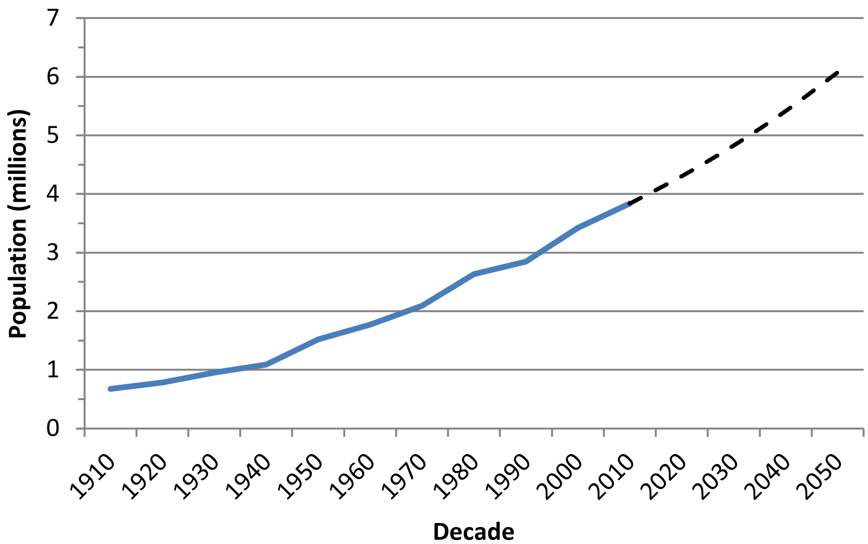


Figure 2.5-1. Population of Oregon by decade (1950-2010) and estimated future population based on the 2000-2010 rate of growth. Data source: US Census Bureau 2011.

Because of their additive and long-lasting nature, the adverse effects of non-Federal activities that are stimulated by general resource demands, and driven by changes in human population density and standards of living, are likely to compound in the future. These effects are likely to continue to a similar or reduced extent in the rural areas. Oregon's land use laws and policies related to long-range planning seek to control the rate of land use conversion and limit the magnitude of associated impacts to the environment by ensuring that protection of farms, forests, rivers, streams, and natural areas is considered when local or regional governments make decisions about land uses. In addition to land use planning, larger population centers also may reduce the detrimental effect of past economic activities, including development, and partly offset the adverse effects of their growing resource demands by implementing habitat restoration projects. However, the spatial distribution of adverse and beneficial effects may not necessarily align well. For example, actions with adverse effects may occur in mainstem rivers, but the beneficial effects of restoration actions may occur in tributary or mainstem reaches up or downstream of the adversely affected reaches. Therefore, non-Federal restoration may benefit different population segments or life history stages of ESA-listed species than those adversely affected by activities in human population centers.

Reduced economic dependence on traditional resource-based industries and increased awareness of resource depletion has been associated with growing public appreciation for the benefits of habitat protection and restoration. Due to public interest and other pressures, many non-Federal entities have adopted practices to avoid, minimize, or offset at least some of their adverse environmental impacts. Also, government, non-profit, and private sectors have completed many habitat restoration projects specifically designed to reverse the major factors now limiting the survival of ESA-listed species. Those restoration activities likely have incrementally improved the availability and quality of freshwater, estuarine, and to lesser degree near-shore habitats in the subject watersheds, in particular within the treated reaches. These improvements in habitat quality likely are associated with improvements in habitat condition and function such as floodplain connectivity, channel structure and complexity, riparian areas and large wood recruitment, stream substrates, stream flow, water quality, and fish passage. In this way, the goal of ESA-species recovery has become institutionalized as a common and accepted part of the state's economic and environmental culture. While we expect this trend to continue into the future as awareness of environmental and at-risk species issues increases, various economic factors, such as high unemployment or high deficits, can reduce both general public support and the availability of funds necessary to support restoration activities.

It is not possible to predict the future intensity of specific non-Federal activities in the action area due to uncertainties about the economy, funding levels for restoration activities, and individual investment decisions. However, the adverse effects of non-Federal activities in the action area are expected to continue in the future. To the degree that regulation of adverse effects becomes more stringent and more rigorously enforced in the future, the net adverse effect of resource-based, non-Federal activities is likely to decline slowly over time. The net adverse effects of other resource-based, non-Federal entities that have achieved less progress in the adoption of protective management practices is likely to remain flat. These effects, both negative and positive, will probably be expressed most strongly in rural areas where these industries largely occur, and therefore may occur somewhat in contrast to expected trends in human population density. However, the net adverse effect of urbanization is also likely to increase as population increases, urban growth boundaries expand, and rural lands are converted to urban and suburban uses (Hulse *et al*. 2002, Gregory 2008, Lettman *et al*. 2011). These future effects probably will be expressed most strongly in rural areas that border urbanized areas. The future effects of habitat restoration activities are less predictable, but their net beneficial effects may grow with the increased sophistication and size of projects completed and the additive effects of completing multiple projects in some watersheds. To the degree that habitat restoration efforts are implemented, it will likely lead to localized improvements to freshwater and estuarine habitat that may aggregate over time to improvements at larger spatial scales.

When these influences are considered collectively, we expect trends in habitat quality in the action area to generally remain flat with gradual declines or improvements in some areas depending on spatial scale (*e.g.*, site, reach, watershed, basin), level of development (*i.e.*, rural, suburban, urban), and variation in levels of economic activity in different geographic regions (*e.g.*, eastern, valley, coastal). At best, these trends will increase population abundance and productivity for the species affected by this consultation. However, given the degraded state of the environmental baseline, anadromous fishes are likely sensitive to additional negative effects. Small populations (*e.g.*, listed species) have a reduced degree of resilience and are likely to have a disproportionately larger response to negative effects than large populations (McElhany *et al*. 2000). Therefore, listed species exposed to additional negative effects in the action area are likely to be sensitive to those changes and exhibit a disproportionate adverse response, particularly those populations at an elevated risk of extinction (*i.e.*, high or very high extinction risk). Therefore, in most instances, we expect cumulative effects will have a neutral to negative effect on population abundance trends. Similarly, we expect the quality and function of critical habitat PCEs or physical and biological features generally to express a neutral trend over time as a result of the cumulative effects, with the possibility of a gradual positive or negative trend in discrete locations, depending on the balance between economic activity and habitat protection and restoration.

Furthermore, future changes in condition of the environmental baseline associated with climate change are likely to negatively influence trends in habitat quality and exacerbate the impact of cumulative effects, deepening the threat to anadromous fish populations (Ward *et al.* 2015). Based on the best available information and depending on the geographic area in question, flood areas are likely to expand (AECOM 2013). The predicted expansion of flood areas and increase in flood depths are likely to result in the inundation of areas of lesser habitat value (*e.g.*, developed areas) and increase redd failure and juvenile displacement. Ward *et al.* (2015) explain that Pacific Northwest ecosystems are particularly sensitive to climate change because snowpack and hydrology are heavily influenced by winter rainfall events. Their analysis revealed a negative correlation between productivity of Puget Sound Chinook populations and and the variation in winter flows: "Of the freshwater and marine environmental variables considered as drivers of population growth, the strongest estimated effect on Chinook salmon was the negative relationship between Chinook population growth and variation in winter daily flows." It is clear that shifting riverine hydrology due to climate change would constitute additional stressors on ESA-listed populations. The habitat deterioration associated with climate change will also make salmon conservation much more difficult (Battin *et al.* 2007).

2.6 Integration and Synthesis

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

FEMA's intent in developing the proposed action was to create a program that limited the duration of adverse effects in a near-channel zone and required no-net-loss of existing floodplain functions in the remainder of the floodplain. For the reasons we have presented above, we cannot be reasonably certain that the proposed program will produce FEMA's intended outcome. Specifically, we are uncertain that FEMA's proposal will allow FEMA to:

1. Know or reliably estimate the general and particular effects of the activities that would be implemented under the NFIP on the functionality of floodplain habitats in Oregon.

2. Take actions necessary to prevent the activities that would be implemented under the NFIP from individually or cumulatively degrading the functionality of floodplain habitats in Oregon.

3. Insure that ESA-listed species and designated critical habitat in Oregon are not likely to be exposed to:
    a. the direct or indirect adverse effects of the activities that would be implemented each year under the NFIP, or
    b. reductions in available habitat caused by or associated with those activities.

4. Insure that ESA-listed species and designated critical habitat do not suffer adverse consequences from exposure to:
    a. the direct or indirect effects of the activities that would be implemented each year under the NFIP, or
    b. reductions in available habitat caused by or associated with those activities.

2.6.1 Anadromous Fishes

There are 17 anadromous fish species that are listed in the action area. Of these 15 are listed under the ESA as threatened and two species are listed as endangered. Each of these 17 species occur in the non-marine portion (includes freshwater and estuaries) of the action area (Table 2.2-1). Comprising these species are 256 salmonid populations (Table 2.4-4), and an unknown number of green sturgeon populations and eulachon subpopulations[145] that all occur in the action area. Degraded floodplain connectivity and function has been identified as both a factor for decline, and a factor limiting recovery, for each of the salmonid species, including in the Columbia River estuary. In the Columbia River estuary, the modification of the food web to one that is less productive is also identified as a limiting factor for Columbia River salmonid species. Degraded freshwater and estuarine habitat quality has been identified as a limiting factor for Southern green sturgeon, though not the principal factor. In addition, contaminants are identified as a potential threat to Southern green sturgeon. Increased water temperatures, insufficient flow, and water pollution are among the limiting factors identified for Southern eulachon. Available information indicate some increases in salmonid abundance in recent years, but population trends for many populations have not been discernible, and the extinction risk for most populations remains high to very high.

The existing environmental baseline is degraded for all listed species and the quality of habitat in the non-marine portion of the action area has been substantially reduced. The effect of this baseline condition is a general and systemic reduction in carrying capacity for each of the anadromous species considered in this opinion. Land conversion due to urban and agricultural development has greatly affected the quantity and quality of freshwater and estuarine habitat. Habitat conversion has occurred in all four recovery domains. In Oregon, conversion to developed land use continues to increase. Between 2000 and 2009, the developed use acreage has increased approximately 75,000 acres. The average annual rate of change is currently 0.5% (2005 to 2009). If the current annual rate of change is maintained (0.5%), an additional 370,000 acres of land will be in developed use by 2050, or approximately 9,025 acres per year (Figure 2.3-1). If the rate declined to half of the current rate (0.25%), developed land use would increase on average approximately 4,300 acres each year.

[145] Individual populations have not been well identified for Southern green sturgeon and Southern eulachon at this time.

FEMA has mapped 11,681 miles and 1,838 square miles (1.2 million acres) of floodplain habitat in the action area (Table 2.3-1). In Oregon, there have been more than 5,230 flood damage claims filed and over $91 million paid out under the NFIP (Table 2.3-2). Over 35% of paid claims were for areas outside of the delineated floodplain. Western Oregon had a majority of the claims, but eastern Oregon had a higher percentage of claims outside of the mapped floodplain (Table 2.3-3). This indicates that FEMA has identified a substantial area in Oregon that is at risk of flooding during a 1% annual-chance flood event and yet many flood-prone areas remain unidentified.

The environmental baseline also includes the anticipated impacts of all Federal actions in the action area that have undergone formal consultation. NMFS has conducted hundreds of formal consultations within the action area, all of which had some form of associated take, and most of which had some element of habitat degradation, either temporary or permanent in nature. Between 1995 and August of 2015, NMFS issued approximately 37 consultations that concluded that proposed actions would jeopardize the listed species and adversely modify their designated critical habitat (Table 2.3-4). These consultations included reasonable and prudent alternatives that could be implemented to avoid the jeopardy and/or adverse modification. The impacts to the environmental baseline from previous Federal actions include a wide range of short and long-term effects that may be adverse or beneficial depending on the type of activities involved (*e.g.*, development, restoration). In all cases, adverse effects associated with these Federal actions have been minimized, but not wholly avoided. In some cases, Federal actions have included restoration of freshwater salmon habitat in tributaries and the estuary that are designed to mitigate for adverse effects. The future effects of continued floodplain development would be added to this baseline.

Floodplains are important to anadromous fish, and directly and indirectly influence the quantity and quality of their habitat. Healthy floodplains contribute to the biological processes necessary for anadromous fish survival, particularly salmonids, by:

- allowing the river to naturally migrate and form a diversity of habitat types critical to different species of salmon at various life stages;
- facilitating exchange of nutrients and organic material between land and water, thus increasing habitat complexity via food subsidies and large woody debris;
- providing off-channel areas with a high abundance of terrestrial and aquatic food sources;
- creating shallow habitat with cover for small salmonids to hide from larger predators;
- improving riparian habitat for species such as aquatic insects, beaver, and bear that are important elements of salmon ecology;
- providing slow-water refuge for juvenile salmon to avoid high flow volume, allowing them to rear as long as necessary and conserve energy for their entry to the ocean;
- providing coarse beds of sediment through which water flows, filtering excess nutrients and other chemicals to maintain high water quality;
- providing an expanded area for depositing and storing excess sediment, particularly fine sediment, reducing the effects of turbidity on fish; and
- providing water storage and recharging functions that ensure a source of cold water in summer months and warmer water during winter months.

When considering that the proposed action allows, incentivizes, and even offers technical guidance for development, including fill, in floodplains, and that its restrictive elements largely are building standards intended to minimize damage to structures, NMFS must then add the effects of floodplain development that occur pursuant to the proposed action to the baseline. Floodplain development results in the degradation and loss of in-channel and off-channel habitat by clearing vegetation, placing fill, covering with impervious surfaces, rerouting stormwater pathways, providing sources of aquatic pollution, and channelizing rivers. These actions have directly and indirectly adversely affected the quantity and quality of aquatic habitats used by the listed fish species subject to this consultation. The in-channel effects of NFIP floodplain development include:

- reduced channel length and area,
- reduced habitat complexity,
- reduced prey availability and modified food web,
- modified hydrology,
- increased peak flow volumes and velocities,
- decreased low flow volumes,
- reduced cover,
- increased bank instability,
- increased lateral and vertical erosion,
- increased suspended sediment and turbidity,
- modified sediment loads,
- reduced large wood,
- increased pollution,
- increased water temperature,
- decreased dissolved oxygen,
- increased bed coarsening,
- increased embeddedness,
- increased risk of downstream displacement,
- increased predation, and
- modified salinity gradients.

The off-channel effects of NFIP floodplain development include:

- reduced habitat complexity,
- reduced cover,
- reduced access to small tributary and off-channel areas,
- increased exposure to pollution,
- reduced prey availability,
- reduced refuge from high velocities,
- reduced refuge from high water temperatures, and
- increased risk of entrapment and impingement.

Floodplains not only serve an important role in the freshwater phase of the anadromous fish life cycle, but they also contribute to the health of the larger ecosystem. Salmon, for instance, is the primary food source for numerous other species, including killer whales. Nutrients released from the bodies of adult salmonids after spawning also fertilize the aquatic and riparian environment, thus maintaining biological productivity for the next generation of salmonids. Thus, while not a connection obvious to many, it is clear that floodplain development has an effect even on some marine species that will never be present in the riverine environment.

FEMA proposes to implement the NFIP in Oregon consistent with national policy with some modifications in an attempt to address concerns regarding ESA-listed salmonids. However, the proposed action has several weaknesses:

- The accuracy of floodplain mapping remains problematic.
- The proposed conservation measures do not appear to be mandatory or enforceable.
- The proposed mitigation standards are vague and subjective.
- The regulatory floodplain management criteria are inadequate to limit the adverse effects of floodplain development.
- The CRS program fails to require minimum credits for beneficial floodplain functions for the lower six ratings classes.
- The CRS program continues to provide credits to structural development and other floodplain management practices that are detrimental to natural floodplain functions.
- FEMA relies on communities to provide FEMA with the assurance that program implementation meets FEMA's ESA obligation even though the ultimate duty to comply with ESA section 7 lies with FEMA.
- FEMA does not provide a reasonable pathway for local communities to meet the NFIP requirements regarding ESA compliance.
- FEMA's proposal includes insufficient program oversight.
- FEMA does not provide measurable performance standards or development limits.
- FEMA provides infrequent program monitoring.

These program weaknesses mean that the result of carrying forward the NFIP in Oregon will still result in the continued loss and degradation of aquatic systems relied upon by ESA-listed anadromous species in the action area. Program effects are consistent with the effects identified in Section 2.4.3, Floodplain Development Effects to Fish Habitat. The proposed action will continue to reduce the quantity and quality of off-channel floodplain habitats and to contribute to the loss and degradation of in-channel habitat in the action area. This will exacerbate factors that are currently limiting species recovery, and extend the negative influence of factors for decline that already exist as a baseline condition.

Cumulative effects are reasonably certain to occur within the action area. We expect trends in habitat quality in the action area to generally remain flat with gradual declines or improvements in some areas depending on spatial scale (*e.g.*, site, reach, watershed, basin), level of development (*i.e.*, rural, suburban, urban), and variation in levels of economic activity in different geographic regions (*e.g.*, eastern, valley, coastal). At best, these trends will increase population abundance and productivity for the species affected by this consultation. However, given the degraded state of the environmental baseline and the small population levels of the listed species, listed species exposed to additional negative effects in the action area are likely to be sensitive to those changes and exhibit a disproportionate adverse response, particularly those populations at an elevated risk of extinction (*i.e.*, high or very high extinction risk). Therefore, in most instances, we expect cumulative effects will have a neutral to negative effect on population abundance trends. Similarly, we expect the quality and function of critical habitat PCEs or physical and biological features generally to express a neutral trend over time as a result of the cumulative effects, with the possibility of a gradual positive or negative trend depending on the balance between economic activity and habitat protection and restoration.

For the foreseeable future, individuals from every cohort from each of the 256 populations of anadromous fish that occur in the non-marine portion of the action area would be exposed to the habitat effects of implementing the NFIP in Oregon. Most habitat effects would be permanent and accumulate over time. While the listed species have been exposed and survived periodic catastrophic disturbances for centuries, historically these disturbances have been balanced with extended periods of ecosystem recovery. The life history adaptations of these anadromous species have allowed them to persist in this dynamic environment (*e.g.*, diverse life history strategies) (Reeves *et al*. 1995, Waples *et al*. 2009). However, existing disturbance regimes have been dramatically altered by human caused changes to the environment and in many places exist outside the range of the historical template, which likely compromises the resilience of the anadromous fishes that occur there (Waples *et al*. 2009).

The addition of the permanent disturbance associated with floodplain development that accumulates without long periods of ecosystem recovery constitutes a press disturbance that interrupts the natural cycles of habitat disturbance and recovery that the listed species require for their survival and recovery. While the rate of accumulation likely differs slightly across the state, all recovery domains would continue to experience reductions in the quantity and quality of remnant off-channel floodplain habitat and in-channel habitat. The further reduction of this habitat within the action area is likely to result in ever increasing mortality and decreased fitness of anadromous fishes that occupy floodplains and the adjacent stream or river, both within the associated river reach and downstream. The proposed action fails to provide the necessary assurances that the likely effects would be limited in duration, magnitude, or intensity. The magnitude of the associated decreases in survival and productivity would vary across the state, but would accumulate over time.

While it is true that some habitat aspects of the environmental baseline have improved in the last 30 to 40 years as environmental regulations and land management practices have reduced the magnitude and intensity of environmental insults relative to past practices, species' abundance, productivity, spatial distribution, and diversity have been considerably degraded over that same time scale. In fact, these species are likely to have reduced resilience as a result and are therefore less capable of enduring additional press effects that impair their survival and recovery. Also, many components of past environmental degradation have not been rectified in any meaningful degree, as indicated by the associated limiting factors for the affected species.

NMFS must also consider anticipated habitat changes associated with climate change. The effects of the proposed action would exacerbate anticipated habitat changes associated with climate change. Lawrence *et al*. (2014) predicted that changes in water temperature in streams lacking intact riparian vegetation may cause the near total loss of rearing habitat for stream-rearing juvenile salmonids and expand the distribution of warm-water predators (*i.e*., bass). Salmonid species that exhibit a stream-type life history are likely to be exposed to progressively greater stressors (*e.g.*, increased water temperatures, higher peak flows, lower summer flows, disease) resulting in greater dependence on early life history strategies (*i.e.*, fry, fingerling, and sub-yearling strategies). The proposed action would contribute to, and be compounded by, those climatic stressors. The increased exposure of freshwater rearing juveniles to habitat stressors associated with climate change and the proposed action is likely to result in a corresponding reduction in the viability of the yearling life history strategy. The reduction, and potential loss, of the species' yearling life history component would constitute a reduction in the species' diversity. Because the proposed action is also likely to contribute to the limiting factors in the estuary, this increased reliance on individuals exhibiting early life history strategies (*i.e.*, fry, fingerling, and sub-yearling) would have an additional negative effect on species abundance and productivity, and the extinction risk of this species would again increase.

Put briefly, our analysis indicated that the effects of the proposed action are negative, and they would largely be permanent, occur across the range of ESA-listed anadromous species in Oregon, and aggregate over time. These effects would contribute considerably to the limiting factors associated with 16 of the 17 anadromous species occurring in the action area (all except Southern green sturgeon) and cause a decrease in the VSP parameters for each of the exposed populations. The exposed populations each represent a significant proportion of each species. Due to the persistent reductions in the species' VSP parameters, particularly abundance and productivity, the proposed action will reduce the viability of those species and increase their extinction risk. Therefore, the effects of the proposed action are likely to appreciably delay or prevent the recovery of 16 anadromous species occurring in the action area, and may prevent the survival of some of those species.

The effects of the proposed action are unlikely to appreciably reduce the viability of Southern green sturgeon, largely because the population is well distributed, spawning does not occur in the action area, the duration of their presence in estuaries within the action area varies, and is limited to rearing (sub-adults) and over-summering (sub-adults and adults), and the exposure pathways are predominately limited to substrate and prey. Furthermore, we assume exposure is limited to a portion of that population, that repeated exposure is necessary to result in adverse effects in exposed individuals, and that repeat exposures sufficient to adversely affect individuals is limited to only a small portion of the population. Therefore, the proposed action is not likely to appreciably reduce the survival and recovery of this species, as it is unlikely to reduce its numbers, reproduction, or distribution.

Critical habitat has been designated in the action area for all 17 anadromous species. The specific PCEs that occur in the action vary depending on the species, but there is considerable overlap. The quality and function of critical habitat in Oregon varies, with most remaining high quality habitat located on Federal lands.

As appropriate for the life stages that occur in the action area, the PCEs focus on suitable freshwater spawning, freshwater rearing, and freshwater migration, estuarine areas, and to a lesser extent nearshore marine areas. The proposed action would occur in all watersheds in

Oregon, many of which are occupied by anadromous fish and have been identified by NMFS as having a high conservation value. Based on our analysis, adverse effects from the proposed action will negatively affect the quality, quantity, and function of multiple PCEs at the watershed scale, across all watersheds to a greater or lesser degree, with the overall effect of diminishing conservation values at the designation scale for affected critical habitats of all salmonid species, and eulachon. Therefore, the effects of the action will appreciably diminish and impair the purpose for which critical habitats were designated, namely to satisfy the requirements essential to the survival and recovery of 16 of the 17 anadromous species (all except Southern green sturgeon).

Based on our analysis, adverse effects from the proposed action will cause a slight decline in the quality and function of Southern green sturgeon PCEs in the action area. However, given the characteristics of Southern green sturgeon critical habitat within the action area (large coastal bays and the Columbia River below Bonneville Dam) and the specific life history needs it supports (sub-adult rearing and adult over-summering), the predominant effects of the action (diminishment of water quality) will not reach a scale sufficient tot appreciably diminish the value of critical habitat to the conservation of Southern green sturgeon at the designation scale.

Future changes in hydrology and climate associated with climate change are expected. Based on the best available information and depending on the geographic area in question, changes may favor specific life history strategies to the detriment of species diversity (*e.g.*, favor ocean-type life histories in freshwater reaches, favor ocean-type life histories in estuarine reaches). Furthermore, flood areas are likely to expand (AECOM 2013). The predicted expansion of flood areas and increase in flood depths are likely to result in the inundation of areas of lesser habitat value (*e.g.*, developed areas) and increase redd failure and juvenile displacement. These effects would constitute additional stressors on ESA-listed populations.

2.6.2 Southern Resident Killer Whales

Based on the predicted long-term effects on Chinook salmon occurring in the estuarine and riverine portions of the action area, particularly the potential extinction of UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, and LCR Chinook salmon, the proposed action is likely to affect the productivity and abundance, spatial distribution, and long-term viability of Southern Resident killer whales.

Several factors identified in the final recovery plan for Southern Resident killer whales may be limiting recovery. These are quantity and quality of prey, toxic chemicals that accumulate in top predators, and disturbance from sound and vessels. Oil spills are also a risk factor. It is likely that multiple threats are acting together. For example, reduction in prey availability makes it harder for the whales to locate and capture prey, which can cause them to expend more energy and catch less food. Although it is not clear which threat or threats are most significant to the survival and recovery of Southern Residents, all of the threats are important to address.

The Southern Resident killer whale DPS is composed of one small population (approximately 80 whales) which is currently at 20 to 60% of its likely previous size (140 to as many as 400 whales). The effective population size (based on the number of breeders under ideal genetic conditions) of 26 whales is very small, and this in combination with the absence of gene flow from other populations may elevate the risk from inbreeding and other issues associated with genetic deterioration. This population has a variable growth rate (28-year mean=0.3% ± 3.2% s.d), and risk of quasi extinction that ranges from 1% to more than 66% over a 100-year horizon, depending on the population's survival rate and the probability and magnitude of catastrophic events. Because of this population's small size, it is susceptible to demographic stochasticity and genetic deterioration, as described in the Status of the Species section. The influences of demographic stochasticity and potential genetic issues in combination with other sources of random variation combine to amplify the probability of extinction, known as the extinction vortex.

The larger the population size, the greater the buffer against stochastic events. It also follows that the longer the population stays at a small size, the greater its exposure to demographic stochastic risks and genetic risks. In addition, as described in the Status of the Species section, small populations are inherently at risk because of the unequal reproductive success of individuals within the population. The more individuals added to a population in any generation, the more chances of adding a reproductively successful individual. Random chance can also affect the sex ratio and genetic diversity of a small population, leading to lowered reproductive success of the population as a whole. For these reasons, the failure to add even a few individuals to a small population in the near term can have long-term consequences for that population's ability to survive and recover into the future. A delisting criterion for the Southern Resident killer whale DPS is an average growth rate of 2.3% for 28 years (NMFS 2008a). In light of the current average growth rate of 0.3%, this recovery criterion and the risk of stochastic events and genetic issues described above underscore the importance for the population to grow quickly.

The effects of the proposed action on Southern Resident killer whales are an increase in exposure to persistent pollutants and a reduction in prey quality and quantity. Only a small proportion of the exposed juvenile Chinook salmon would survive to adulthood and be available as prey to the whales, and the accumulation from eating prey contaminated by the proposed action is extremely small. Based on the low levels of consumption of exposed prey and low levels of accumulation of persistent pollutants, the proposed action is not expected to cause a biologically meaningful increase in contamination in Southern Resident killer whales and would have an insignificant effect on the Southern Residents.

The permanent reduction of Chinook salmon associated with the proposed action would result in a significant reduction in adult equivalent prey resources for Southern Resident killer whales. Moreover, the reduced availability of Chinook salmon prey originating from the Columbia Basin and coastal Oregon rivers over the long term, particularly the increased risk of extinction of UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, and LCR Chinook salmon stocks, and could affect the availability of prey in other ways (*i.e.*, spatially or temporally). Fewer populations contributing to Southern Residents' prey base would reduce 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 Southern Residents to withstand catastrophic events. These reductions increase the extinction risk of Southern Residents.

The extinction of any one of UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, or LCR Chinook salmon ESUs would reduce prey availability and increase the likelihood for local depletions of prey in particular locations and times. If extinction were to occur in multiple species, this effect on Southern Resident prey base would be even more pronounced. In response to prey reductions, the Southern Residents would increase foraging effort or abandon areas in search of more abundant prey. Reductions in prey or a resulting requirement of increased foraging efficiency increase the likelihood of physiological effects. The Southern Residents would likely experience nutritional, reproductive, or other health effects (*e.g.*, reduced immune function from drawing on fat stores and mobilizing contaminants in the blubber) from this reduced prey availability. These effects would lead to reduced body size and condition of individuals and can also lower reproductive and survival rates and thereby diminish the potential for Southern Residents to recover.

In summary, implementation of the proposed NFIP in Oregon would: (1) increase the exposure of Southern Residents to persistent pollutants through Chinook salmon prey, however, bioaccumulation and biomagnification is expected to be relatively low, and exposure is not anticipated to cause a meaningful accumulation in the whales; (2) reduce the prey availability associated with the proposed action and result in an insignificant annual reduction in adult equivalent prey resources for Southern Resident killer whales; (3) increase the risk of a permanent reduction in the availability of Chinook salmon prey resources originating from the Columbia Basin and coastal Oregon rivers over the long term, particularly the loss of LCR Chinook salmon, UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon due to their likely extinction, and increases the likelihood for local depletions of prey in particular locations and times; and (4) appreciably diminish the potential of survival and recovery of Southern Resident killer whales due to the loss of LCR Chinook salmon, UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon. The permanent reduction of Chinook salmon associated with the proposed action would result in a significant reduction in adult equivalent prey resources for Southern Resident killer whales. However, the reduced availability of Chinook salmon prey originating from the Columbia Basin and coastal Oregon rivers over the long term, particularly the increased risk of extinction of UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, and LCR Chinook salmon stocks, affects predator-prey interactions outside of the designated critical habitat. Thus, while reduced prey increases extinction risk to Southern Resident killer whales, this same reduction in prey base would not affect the PCEs or conservation value of the designated critical habitat.

2.7 Conclusion

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent actions, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of Southern green sturgeon or to destroy or adversely modify its designated critical habitat.

However, after reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent actions, and cumulative effects, it is NMFS' biological opinion that the proposed action is likely to jeopardize the continued existence of the 17 species listed below and to destroy or adversely modify designated or proposed critical habitat for the 16 species listed below.

ESA- Listed Species Jeopardized by the Proposed Action

1. Lower Columbia River Chinook salmon
2. Upper Willamette River spring-run Chinook salmon
3. Upper Columbia River spring-run Chinook salmon
4. Snake River spring/summer-run Chinook salmon
5. Snake River fall-run Chinook salmon
6. Columbia River chum salmon
7. Lower Columbia River coho salmon,
8. Oregon Coast coho salmon
9. Southern Oregon/Northern California Coasts coho salmon
10. Snake River sockeye salmon
11. Lower Columbia River steelhead
12. Upper Willamette River steelhead
13. Middle Columbia River steelhead
14. Upper Columbia River steelhead
15. Snake River Basin steelhead
16. Southern eulachon
17. Southern resident killer whale

Critical Habitat Destroyed or Adversely Modified by the Proposed Action

1. Lower Columbia River Chinook salmon
2. Upper Willamette River spring-run Chinook salmon
3. Upper Columbia River spring-run Chinook salmon
4. Snake River spring/summer-run Chinook salmon
5. Snake River fall-run Chinook salmon
6. Columbia River chum salmon
7. Lower Columbia River coho salmon
8. Oregon Coast coho salmon
9. Southern Oregon/Northern California Coasts coho salmon
10. Snake River sockeye salmon
11. Lower Columbia River steelhead
12. Upper Willamette River steelhead
13. Middle Columbia River steelhead
14. Upper Columbia River steelhead
15. Snake River Basin steelhead

16. Southern eulachon

2.8 Reasonable and Prudent Alternative

"Reasonable and prudent alternatives" refer to alternative actions identified during formal consultation that can be implemented in a manner consistent with the intended purpose of the action, that can be implemented consistent with the scope of the Federal agency's legal authority and jurisdiction, that are economically and technologically feasible, and that 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 opinion has concluded that FEMA's proposed action for implementation of the NFIP in Oregon is likely to jeopardize the continued existence of ESA-listed species under the jurisdiction of NMFS and is likely to result in the destruction or adverse modification of critical habitat that has been designated or proposed for these species. The phrase "jeopardize the continued existence of" means "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02).

2.8.1 Reasonable and Prudent Alternative Overview

Our analysis indicates that FEMA has not structured its proposed implementation of the NFIP in Oregon so that FEMA is positioned to know or reliably estimate the general and particular effects of the program on ESA-listed species or their designated critical habitat.

To satisfy its obligation pursuant to section 7(a)(2) of the Endangered Species Act of 1973, as amended, FEMA must place itself in a position to: (1) monitor the direct, indirect, and cumulative impacts of the activities implemented under the NFIP in Oregon, (2) effectively determine program compliance, (3) take timely and effective corrective actions when the consequences of NFIP activities exceed measurable standards and criteria, and (4) structure the program in a manner that allows assurances that floodplain activities will not jeopardize ESA-listed species or their designated critical habitat.

The reasonable and prudent alternative that follows contains six elements that are designed to achieve these outcomes.

1. **Notice, Education, and Outreach.** The first element of the reasonable and prudent alternative requires FEMA to develop an education andoutreach strategy for RPA implementation and to provide notice to all NFIP participating communities in Oregon regarding the outcome of the agency's consultation and the substance of the RPA.

2. **Interim Measures.** Given that most of the RPA elements will take a period of years to fully implement, the second element of the reasonable and prudent alternative includes measures for more immediate implementation that FEMA should promptly carry out to reduce the loss of floodplain habitat features and functions as the long-term measures are phased in.

These measures are intended to slow the rate at which development permanently alters habitat conditions that are otherwise necessary for species survival and recovery, but by themselves these measures are inadequate to avoid jeopardy and adverse modification over the long term.

3. **Mapping Flood and Flood-Related Hazard Areas.** The third element of the reasonable and prudent alternative requires FEMA to implement specific program standards to identify and map more comprehensively, accurately, and timely, both flood hazard areas, and flood-related erosion hazard areas.

4. **Floodplain Management Criteria.** The fourth element of the reasonable and prudent alternative includes revisions to FEMA's regulatory floodplain management criteria so as to avoid, minimize, and mitigate the adverse effects of floodplain development on remaining habitat functions and processes.

5. **Data Collection and Reporting.** The fifth element of the reasonable and prudent alternative requires FEMA to systematically monitor all participating communities and collect and report floodplain development information.

6. **Compliance and Enforcement.** The sixth element of the reasonable and prudent alternative requires FEMA to ensure that participating communities are compliant with the floodplain management criteria as revised by this RPA.

2.8.2 Reasonable and Prudent Alternative Specific Elements

This RPA applies to all river sub-basins (HUC 4) in Oregon that contain ESA-listed anadromous fish[146] determined in this opinion to be jeopardized by the implementation of the NFIP, or containing critical habitat determined to be destroyed or adversely modified by the implementation of the NFIP. The statutory authorities under which this RPA may proceed include: 42 U.S.C. 4001(e); 42 U.S.C. 4002(b)(3); 42 U.S.C. 4011(a)-(b); 42 U.S.C. 4022(a)(1); 42 U.S.C. 4024; 42 U.S.C. 4101;42 U.S.C. 4101a; 42 U.S.C. 4101b; 42 U.S.C. 4102(c); 42 U.S.C. 4104; 42 U.S.C. 4121(c); 42 U.S.C. 4128; and 16 U.S.C. 1536(a)(1)-(2).

When NMFS determines that a proposed Federal action is likely to violate the standards of ESA section 7(a)(2), NMFS is required to devise a Reasonable and Prudent Alternative (RPA) to the proposed action. An RPA is intended to provide an alternative to the proposed action that can be implemented consistent with the intended purpose of the proposed action, that can be implemented consistent with the scope of the Federal agency's legal authority and jurisdiction, that is economically and technologically feasible, and that will avoid jeopardy and adverse modification. Given that throughout the action area, some floodplains retain much of their natural condition, while others have been altered through extensive development, the RPA includes provisions to protect to existing habitat conditions and features. As explained in this opinion,

[146] We define the geographical scope of this RPA as HUC 4 river sub-basins in order to ensure that this RPA applies both to sub-basins containing listed salmonids and to sub-basins where listed salmonids are not present but where floodplain development results in downstream effects to natural floodplain functions and, consequently, to listed salmonids.

protection and restoration of floodplain habitat and functions are necessary in order for the listed salmonids, and Southern Resident killer whales, to survive and recover. FEMA's current implementation of the NFIP has contributed to and continues to exacerbate the existing existing degraded conditions.

This RPA recommends revisions to FEMA's implementation of the NFIP in Oregon intended to provide protections for floodplain functions and features that support listed salmonids. NMFS has framed these recommendations based upon lessons derived from extensive efforts by FEMA, NMFS, and local governments in western Washington to reshape the implementation of the NFIP in that region based upon NMFS' 2008 jeopardy opinion and RPA for Puget Sound, Washington. This RPA focuses on the same basic improvements as were recommended in the 2008 opinion, specifically: (1) updated maps to more accurately depict the floodplain; (2) updated development and mitigation standards to guide development away from the most sensitive habitat areas and to reduce the impacts of new development or redevelopment in floodplains; and (3) strengthened systems of accountability to track and report on RPA implementation.

FEMA's implementation of the Puget Sound RPA evolved into heavy reliance on local compliance, resting largely on the discretion of the enrolled communities to choose their preferred method of compliance, often on a permit-by-permit basis, and upon the ability of FEMA staff to provide significant technical assistance to those communities to support and track implementation. The results to date are mixed, with ongoing efforts by FEMA and NMFS to improve outreach and technical assistance to local communities and to improve reporting and tracking. However, the lack of local technical expertise in floodplain hydrology and function in some communities, highly mixed and ultimately unreliable reporting, and the inability of a small FEMA staff to track implementation across a wide geography, means that, despite FEMA's best efforts, NMFS remains concerned with the Puget Sound approach. The Puget Sound approach's reliance on local communities to discern effects to salmonid resources places a scientific burden upon many with limited capacity to implement such a standard successfully, making it uncertain that FEMA can ensure that NFIP implementation is, in fact, avoiding jeopardy.

The major difference in this RPA relative to the 2008 RPA is to clarify that the locus of accountability for these ESA duties rests upon FEMA to programmatically ensure that the NFIP in Oregon avoids jeopardy through strengthened NFIP standards, enhanced use of jointly developed guidance and technical support to assist local jurisdictions in complying with the revised standards, and strengthened partnership between FEMA and NMFS and with Oregon communities to protect important floodplain functions over the long term. Accordingly, this RPA articulates a set of specific recommendations on mapping, development, and mitigation standards to achieve the goal identified in FEMA's proposed action of "no net loss or a net beneficial gain" of floodplain functions through avoidance, minimization, and mitigation requirements.

Because NMFS anticipates that several years will be needed to incorporate and implement these programmatic revisions to the NFIP, this RPA recommends a phased approach to implementation. The first (interim) phase calls for FEMA and participating communities to implement improvements using existing guidance and administrative tools with substantially enhanced technical support from both FEMA and NMFS. The second phase calls for FEMA to revise its floodplain management regulations and/or associated guidance and technical documents as needed to implement the RPA's mapping, development, mitigation, and reporting standards. NMFS notes that FEMA's Federal Register notice of May 16, 2012 (77 FR 28891), indicated that FEMA was preparing an EIS on the NFIP and stated that FEMA intends to "[m]odify the NFIP based upon changes identified through the evaluation process to enhance floodplain management standards including provisions to address endangered species and habitat concerns," providing an opportunity for FEMA to refine its regulations if needed to assure successful implementation of this RPA.

NMFS therefore strongly advises that FEMA revise its regulations, policies, procedures, and/or guidance to ensure that the mapping, floodplain management, reporting, and enforcement protocols identified in this RPA are effectively implemented for the state of Oregon at the programmatic level. These measures are identified as necessary to ensure that the NFIP avoids jeopardy to listed species and avoids destruction and adverse modification of critical habitat for those species.

Timeline: In order to meet the expected outcomes of this RPA, except as otherwise provided below, all changes to regulations, policies, procedures, and/or guidance as needed to implement this RPA must be in place by:

- **September 15, 2016**, for Element 1.
- **March 15, 2018**, for Element 2, Elements 3.A and 3.E, and Element 5.
- **January 1, 2019**, for any components of Element 4 that FEMA determines can be implemented without regulatory revisions.
- **September 15, 2019**, for any components of Elements 3.B, 3.C, 3.D, 3.F, 3.G, and 6 that FEMA determines can be implemented without regulatory revisions.
- **January 1, 2021**, for any components of this RPA that FEMA determines require regulatory revisions.

RPA Element 1: Notice, Education, and Outreach

FEMA will develop, with NMFS's assistance, an education and outreach strategy to assist the Oregon DLCD and Oregon NFIP communities in implementing both the interim and long-term measures contained in this RPA. As a first step in this strategy, FEMA and NMFS will prepare a notice for all Oregon NFIP participating communities subject to this RPA informing them of the results of the consultation and the objectives and contents of the RPA. The notice shall be provided to NFIP communities within 60 days of the issuance of this opinion and should include, at a minimum, the following information:

A. A summary of the opinion's conclusions and a description of the types of floodplain development activities that have been found to harm listed species (see RPA Element 4.F). The notice should inform communities that these activities impair *natural* *floodplain functions*,*[147] and thereby negatively impact the survival and recovery of the ESA-listed species.

B. The list of interim measures for prompt implementation found at RPA Element 2 and FEMA and NMFS's joint recommendation that communities implement these measures at the earliest possible time.

C. FEMA and NMFS' joint recommendation that new *structures** placed in the SFHA should be elevated by methods other than fill, and that proponents of projects that involve adding fill exceeding 50 cubic yards should pursue CLOMR-Fs prior to LOMR-Fs to ensure ESA compliance. FEMA shall include appropriate guidance on how to elevate structures in a manner that minimizes adverse effects to natural floodplain functions.

D. Notice to the communities of a pending requirement to report to FEMA information on all new development occurring in floodplains (see RPA Element 5.A).

E. A recommendation that participating communities provide to FEMA within 120 days of the notice their available information, if any, on locally identified flood-related hazards due to erosion or inundation, including data on anticipated flooding patterns influenced by build-out, climate change, or sea level rise, which are not currently reflected on maps adopted by FEMA, per 44 CFR 65.1.

FEMA and NMFS will commence development of the education and outreach strategy as soon as possible upon the issuance of this opinion, utilizing the expertise of DLCD and other state and local partners as appropriate, with the objective of providing clear, concise, and timely information to Oregon NFIP participants on the need for and objectives of this RPA and how they may achieve and document compliance with both the interim and long-term measures.

RPA Element 2: Interim Measures

Given that FEMA's implementation of RPA Elements 3-6 may take several years, this RPA includes the following steps for interim implementation. These measures are intended to ensure that existing natural floodplain functions are maintained pending full RPA implementation. FEMA's PBA states that FEMA has already notified communities of their responsibility to comply with the ESA, including the requirement that they either: (1) prohibit all NFIP-related actions in the SFHA during the implementation phase, or (2) determine the presence of fish or critical habitat, assess permit applications for potential impacts to species and habitat, and require that any actions with potential adverse effects be fully mitigated with no net loss of habitat function. Accordingly, NMFS anticipates that FEMA and NFIP communities, with NMFS' support and assistance, will begin implementing the following measures as soon as possible, and that all communities will be implementing these measures within 2 years of the date of this opinion.

[147] Italicized terms that are noted with an asterisk are defined in a glossary at part for their specific meaning as used in this document. The glossary is found at part 2.8.3.

A. Require that all development in the SFHA be mitigated to achieve no net loss of natural floodplain functions. Pending FEMA's completion of a long-term mitigation strategy (see RPA Element 4.F below), FEMA will require, through guidance or otherwise, mitigation per the ratios below[148]:
   i. In the larger of: the 25 year floodplain (where an FIS has been performed), the floodway (if designated), the *channel migration zone (CMZ)**(if designated); or, in FEMA's proposed *riparian buffer zone (RBZ)**; mitigate for lost flood storage and vegetation removal at the following ratios:
      a. 2 to 1 for lost flood storage (located and designed consistent with Element 4.F, below),
      b. 3 to 1 for trees of or exceeding 6 inch dbh.
   ii. In the remainder of the floodplain at the following ratios:
      a. 1.5 to 1 for lost flood storage (located and designed consistent with Element 4.F, below),
      b. 2 to 1 for trees of or exceeding 6 inch dbh.
   iii. Use pervious pavement where possible. Mitigate for the placement of new impervious surface (*e.g*., roofs, driveways, sidewalks, roads, patios, etc.) in order of preferred method as follows:
      a. By removing an equal amount of impervious surface, and/or
      b. By infiltration of stormwater using *low impact development (LID)** or *green infrastructure** practices (*e.g.*, rain gardens, bioswales), or, where not possible because of impermeable soils or high water table, then
      c. Stormwater detention is required to ensure no increase in peak volume or flow, and treatment is required to minimize pollutant loading.
   iv. <u>Exception</u>. Where implementation of the mitigation standards set forth above is impracticable, a community may propose alternative mitigation standards, which will be acceptable if both FEMA and NMFS agree that the alternative standards provide resource protection equivalent to that provided by the measures above.

B. As described in FEMA's proposed action for this consultation, identify a riparian buffer zone (RBZ) measured 170 feet horizontally from the ordinary high water mark of perennial or intermittent streams, and limit the types of development allowed in the RBZ to: (1) *water-dependent uses**; (2) *habitat restoration activities**; (3) activities that result in a beneficial gain for the species or habitat; and (4) activities that will have no adverse effects on listed species or habitat, *i.e.*, activities that will not degrade or limit natural floodplain functions in any way[149] (FEMA PBA 2-41). Require mitigation per Element 2.A for development types (1) and (3) above.

[148] These ratios were identified per the best available science concerning the use of mitigation to achieve "no net loss" of aquatic habitat resources, which indicates that in the United States and Canada, mitigation practices over the last 30 years have often been insufficient to replace the amount and function of the impaired resources (*e.g.* Harper and Quigley 2005).

[149] During consultation, FEMA provided a list of activities that would be considered to have "no adverse effect," as follows: (A) repairs or remodels of an existing structure provided that the repair/remodel are not a substantial improvement or a repair of substantial damage; (B) expansion of an existing structure that is no greater than 10% beyond its existing footprint provided the pairs or remodeling are not a substantial improvement or repair of substantial damage; also, if the structure is in the floodway, there shall be no change in the dimensions perpendicular to flow without a floodway analysis; (C) activities the sole purpose of which is to create, restore, or

C. For all SFHA development occurring 90 days or more after the issuance of this Biological Opinion, FEMA shall deny or decline to process requests for LOMR-Fs that fail to demonstrate to FEMA that all impacts of development to natural floodplain functions were avoided or mitigated,[150] *e.g.*, by restoration of flood storage, vegetation, and hydrologic processes, consistent with the ratios identified in Element 2.A above. Alternatively the applicant may demonstrate to FEMA that the ESA was otherwise satisfied separately via section 7, 10, or 4(d).

D. FEMA shall review all requests for CLOMRs and CLOMR-Fs and determine whether the proposed project will adversely affect natural floodplain functions. FEMA may seek NMFS' assistance in making this determination. If FEMA makes a positive determination, FEMA shall seek NMFS' assistance in identifying appropriate mitigation measures to ensure that the project does not adversely affect natural floodplain functions and require that such measures be carried out as a condition of CLOMR and future LOMR issuance.[151]

E. Track all permitted development activities and associated mitigation and report to FEMA per RPA Element 5 as soon as practicable. Reporting during the interim period may rely on FEMA Region X's newly revised reporting tool.

F. Where multiple repeat-damage buyout opportunities exist, FEMA, with NMFS's technical assistance, shall recommend that the State prioritize floodplain development buyouts based on presence of high priority salmonid populations.

These measures, while protective of habitat and listed species as interim measures, are a subset of, and less protective of important habitat features and processes than, the full RPA and are insufficient by themselves to avoid jeopardy or adverse modification over time. These requirements will sunset when Elements 3-6 are fully implemented and supersede these requirements to provide more permanent protections for the natural floodplain functions that serve ESA-listed species.

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enhance natural floodplain functions, provided the activities do not include structures, grading, fill, or impervious surfaces; (D) development of open space and recreational facilities, such as parks, trails, and hunting grounds, that do not include structures, fill impervious surfaces, or removal of more than 5% of native vegetation on that portion of the property within the SFHA; and (E) repair to on-site septic systems, so long as ground disturbance is kept to the minimum necessary. NMFS agrees with FEMA's description of activities that qualify as "no adverse effect" with one exception. For categories A and B, any expansion of the structure's existing footprint should be considered an adverse effect that requires mitigation, for the reasons discussed earlier in this opinion.

[150] "Given the nationwide trend in urbanization and higher peak flows, a true 1 percent floodplain is likely larger than a mapped effective floodplain. The LOMC standards and guidance should acknowledge this condition and at least scrutinize in more detail requests that lower floodplains, while continuing land development leads to increased runoff, higher flood flows, and increased flood damages, as well as loss of floodplain habitat." (Galloway *et al.* 2006.)

[151] See Galloway *et al.* 2006, pp. 122-127.

RPA Element 3: Mapping Special Hazard Areas to Fully Identify Floodplain Resources

As was noted in the hearings on HR 6525, the Flood Disaster Protection Act of 1973, which expanded the NFIP, "local officials in many flood-prone communities…like to think that a major flood is unlikely to happen to them, and thus they defer coming into the program until local developers have had a chance to build on the community's remaining undeveloped lands without land use controls."[152] FEMA noted in its 2001 report, that "[f]lood hazards may change significantly in areas experiencing urban growth or changes in physical conditions caused by such geologic processes as subsidence and erosion" (FEMA 2001a). FEMA's 2013 CRS Coordinator's Manual (p. 410-2) further explains that "[d]evelopment regulations need thorough and accurate mapping of Special Flood Hazard Areas (SFHAs) and related flood hazard data." FEMA's CRS Coordinator's Manual (p. 220-9) also notes that "[t]he faster an area grows, the more important it is to regulate development to prevent flood losses."

As noted by FEMA, adoption of maps is prerequisite to effective management of flood-related hazard areas. "Outdated mapping hinders sound floodplain management. The map a community uses for floodplain management can and should be updated frequently to account for annexations, new divisions, site-by-site analyses, better ground elevation data, and incorporation of new hazard data. To make the map more useful and easier to use, it should include detailed topography, building footprints, natural features, and other data that can help relate the floodplain information to conditions on the ground and to other programs." 2013 CRS Coordinator's Manual at 440-2. NOAA Fisheries strongly concurs with these observations.

NMFS is in agreement with FEMA that incomplete, out of date, and/or inaccurate mapping of flood hazard prone areas prevents local government officials from understanding how severe flood risk is and thus from implementing restrictive zoning and land use regulations and comprehensive planning. Thus, this Element of the RPA provides program-level revisions to ensure that all *special hazard areas** (defined for this RPA to include the SFHA, *area of future conditions flood hazard* (AFCFH)*, and E Zones) are fully and accurately reflected on FEMA's maps, as these dictate where floodplain development restrictions and construction standards apply.

Accurate mapping of those areas likely to experience flood hazards, such as flood inundation and flood-related erosion, will provide valuable co-incidental information on, and protections for, floodplain functions and processes associated with important habitat features that support listed species. Accurate knowledge of important habitat features is essential to avoid jeopardy and to enable recovery. Thus flood hazard mapping must occur in both developed areas and areas of possible population growth, and should not be overly limited by the size of the watershed drainage area.

Therefore, in order to avoid the likelihood of jeopardy and the likelihood of adverse modification of designated critical habitat, this RPA calls for FEMA to ensure that all Oregon NFIP

[152] Expansion of the National Flood Insurance Program, House of Representatives, Subcommittee on Housing, of the Committee on Banking and Currency, Tuesday May 8, 1973. 93rd Congress, 1st Session. Statement of George K. Bernstein, Federal Insurance Administrator, Department of Housing and Urban Development.

participating communities adopt FIRMs in accordance with the criteria below and meet the mapping benchmarks described in RPA Element 6.A(ii), Compliance Benchmarks. This is compatible with authorities at 42 U.S.C. 4101 (a)(1) ("to identify and publish information with respect to all floodplain areas within 5 years of August 1, 1968"), and (b) ("to accelerate the identification of risk zones within flood-prone and mudslide-prone areas…in order to make know the degree of hazard within each such zone at the earliest possible date"). Regulations which are applicable or pertinent to this RPA Element include: 44 CFR 59.1, 59.23, 60.1, 60.2(c), 60.3(d)(2), 60.5, 60.24-26, 64.1, 64.3(a)(2), 65.1-3, 65.6(a)(3), and 65.7.

NMFS provides these specific mapping recommendations in full recognition of the work of FEMA's Technical Mapping Advisory Committee (TMAC), which has fashioned a broader suite of recommended improvements to FEMA's mapping program. NMFS representatives to the TMAC have reviewed the recommendations below, and have indicate that they are more detailed than but consistent with the broader TMAC recommendations.

A. Modify Flood Hazard Mapping Protocols

FEMA's maps are intended to, based on the best available science, indicate the likelihood of exposure of certain lands to inundation in order to evaluate flood-related risks to life and property and thereby provide insurance for structures that are located in flood-prone areas, and discourage new construction in flood-prone areas. Therefore, consistent with 42 U.S.C. 4101(a)-(d) and with recommendations developed under 42 U.S.C. 4101a(d)(1)(A) and (d)(2), and obligations under the Biggert-Waters Act to identify, update, and maintain maps of all areas of possible population growth within both the 100 and 500-year floodplain, FEMA will incorporate when mapping, the best available data that indicates both current risk and reasonably anticipated future risk (see 42 U.S.C. 4101b(a), 4101b(b)(3)(C), and 4101b(c)(1)(ii)). To accomplish this, FEMA will implement the following measures:

i. Ensure that the models and methods used for mapping are based on the best available science and appropriate for the area being mapped, including:[153]
    a. Calibrate flood maps to historic flood events by using stage-discharge relationship at USGS gaging stations; or, where gage data is unavailable, to historic high water marks. This is an economical and efficient method to correct older maps.
    b. Use maximum probable roughness coefficient (e.g., Manning's n) during flood modeling that corresponds to the anticipated riparian vegetation condition, consistent with the land use zoning for the area, and the season of highest roughness. This is intended to ensure maps reflect vegetation maturation over the duration of the map, as mature riparian vegetation provides important habitat functions for listed species.
    c. Use unsteady-state hydraulic models, or an equally accurate modeling method, for conditions of significant floodplain storage and/or tidal flow. Areas of significant flood storage, and areas affected by tidal flooding both provide important areas for juvenile salmonid refuge/survival.

[153] NAS 2009; Galloway *et al*. 2006.

   d. Use multi-dimensional hydraulic models, or an equally accurate modeling method, where site conditions have uncertain or changeable flow paths or complex overbank flow, and for locations where flows have significant lateral flow compression (e.g., bridges).

ii. To reduce the risk of reliance on BFE estimates that are too low and therefore underestimate likely flood levels, and consistent with the recommendation in Rosenbaum and Boulware (2006),[154] present the range of modeled BFE values in the FIS and use the 90th percentile value of the modeled 100 year flow as the BFE (see also 2013 CRS Coordinator's Manual at 410-18).

iii. When mapping or remapping, include all watersheds of 160 acres and larger, as small watersheds may have areas of largely intact floodplain function which provide important features for listed species.

iv. Depicting a larger floodway would reduce the amount and type of development that can be placed within the special flood hazard area near the river channel, and thus preserve natural floodplain functions upon which listed species depend. To better protect the important habitat functions and features adjacent to the waterway and to minimize channelization, scour, and erosion, define and depict the regulatory floodway as

   a. The 1 foot rise floodway, expanded to include all locations where depths of flood water reach or exceed 3 feet, and all locations where the velocity of floodwater reaches or exceeds 3 feet per second (see 2013 CRS Coordinator's Manual at 410-21[155]), or
   b. A 6-inch rise floodway.

B. <u>Map Riverine Erosion Zones</u>

The NFIA requires FEMA to depict flood hazards, and includes flood-related erosion within the definition of flood, and also requires that map updates include any relevant information on land subsidence and other flood-related hazards. Flood-related erosion areas pose high risk to human life and property and also provide important habitat forming processes that support listed salmonids. Thus, consistent with authorities at 42 U.S.C. 4101(a)-(f), 4101b, 4121(c); 44 CFR 9.7(b)(v)(B), 59.1, 60.2(a), 60.5, 64.3 (a)(2) and (b), 65.1; FEMA's 1999 Riverine Erosion Hazard Areas Mapping Feasibility Study; and the TMAC's 2015 Future Conditions Risk Assessment and Modeling Report Recommendation 4, FEMA will:

i. Identify the full range of flood-related erosion hazards on FIRMs, including CMZs, per Appendix 2.8-B, CMZ Mapping Priorities and Protocols, and designate as E Zones, using one of the following methods:

   a. The mapping methodology identified by Rapp and Abbe 2003 (outlined in Appendix 2.8-B), or

[154] Rosenbaum and Boulware (2006) recommend "using the upper limit of a 95-5 or 90-10 confidence interval in calculating the BFE" "to ensure that 1 percent chance protection is provided to most properties" (Recommendation DEI-5, pp. 24-25, 74).

[155] The Coordinator's Manual explains: "Because the entire SFHA benefits from the implementation of a more restrictive floodway surcharge, a FWS [floodway standard] includes the entire width of that reach of the SFHA, not just the area of the floodway. A higher floodway standard helps prevent development within the SFHA, thereby reducing increases in flood elevations on existing structures." 2013 Coordinator's Manual at 410-21.

b. Another methodology of comparable value (*e.g.*, Olson *et al*. 2014), or
c. A proxy using the method described in Appendix 2.8-B (based on Sikder 2012), or
d. Use the entire SFHA as the E Zone.

ii. Where the CMZ is disconnected by existing infrastructure and development in floodplains, as determined pursuant to a CMZ delineation methodology consistent with Rapp and Abbe (2003), or another methodology of comparable value (*e.g*, Olson *et al*. 2104), the disconnected area may be excluded from the CMZ/Zone E.

C. <u>Depict the High Hazard Area on FIRMS</u>
Per "Guidelines for Implementing EO 11988, Floodplain Management, and EO 13690, Establishing a Federal Flood Risk Management Standard," issued October 8, 2015:

> High-hazard areas are those portions of riverine and coastal floodplains nearest the source of flooding. These are the frequently flooded areas that become arenas of major flood dynamics during large floods. Here, floodwaters exert their maximum pressures, erosion is greatly accelerated, and the potential loss to lives and property is increased. Additionally, these are the areas of coastal and riverine floodplains within which many of the most critical floodplain values are concentrated. In riverine situations, the high-hazard area is that portion of the floodplain where impedance to flood flow resulting from human activity can increase flood heights and consequently the area subject to flooding. In coastal floodplains, the high-hazard area is usually confined to the beach area in front of high bluffs or the crest of primary or foredunes, where wave impact is the most significant inducing factor.

In light of the high potential for flood damages and the high likelihood of significant adverse effects to natural floodplain functions associated with development in areas closest to the flood source and at greatest risk of flood-related erosion, FEMA shall depict on FIRMs a subset of the floodplain referred to herein as the *high hazard area*.* This will ensure that that local land use decisions are fully informed of risk and will aid in guiding development away from flood hazards, as provided in Element 4 of this RPA.

For this RPA, the high hazard area (HHA) is defined and measured by the furthest landward extent of:

i. Floodway (as defined by this RPA), and
ii. E Zones (as identified per Element 3.B., above).

D. <u>Depict the Area of Future Conditions Flood Hazard</u>
A report provided by AECOM (2013) indicates that in the Pacific Northwest the combination of shifting rainfall and snowfall patterns due to climate change, when coupled with future land use changes associated with increasing human population

growth, will significantly increase the BFEs of riverine areas in the next 85 years.[156] Thus FIRMs shall depict the AFCFH.

i. As required by the Biggert-Waters Act at section 100215(d)(2) and to meet the intended outcomes of this RPA, FEMA shall incorporate future conditions risk assessments in map revisions or updates, consistent with the TMAC report's recommendations on mapping future conditions, within 36 months of receiving the report. Consistent with the Biggert-Waters Act 2012, future conditions mapping shall be based upon the best available science, including projections for the year 2050 and to be updated to incorporate new data every 10 years thereafter, and shall include:
    a. Climate change in both coastal and riverine areas, and sea level rise in coastal areas (42 U.S.C. 4101b(b)(3)(D) and EO 13653; 42 U.S.C. 4101a(d)), and
    b. Build out/land cover change (42 U.S.C. 4101a(d)).

ii. If available data are inadequate to estimate future conditions, or if needed to address uncertainty, a 2-foot freeboard, or the 0.2 percent chance floodplain are acceptable proxies for the AFCFH, as identified by the Federal Flood Risk Management Standard. See also 42 U.S.C. 4101b(b)(1)(A)(ii).

E. Revise Map Adoption Procedures

Replacing outdated maps with more accurate maps is beneficial only if the updated maps are expeditiously adopted by communities and used as a basis for implementing the NFIP's requirements. Frequently, communities continue to rely on outdated maps long after new maps have been prepared, due to the lengthy process for appeals and general time lag between FEMA's issuance of a preliminary map and a letter of final determination (LFD). To ensure that floodplain management and concomitant habitat protections are applied based on the best information available, FEMA must ensure that all timelines provided in 42 U.S.C. 4104, 4104-1, and 44 CFR part 67 are adhered to, and:

i. Issue an LFD within 90 days of the date that any appeals process is resolved in favor of FEMA.

ii. When a new map is not appealed, issue an LFD within 45 days of the date upon which the appeal period expired.

F. Map Residual Flood Hazards and Risks Behind Levees

Consistent with FEMA's obligations under the Biggert-Waters Act to identify, update, and maintain maps of areas of residual risk that are protected by levees, dams, and other flood control structures, FEMA will apply the following criteria:

i. Do not omit any areas from the SFHA based on the presence of a non-accredited levee, as residual risk persists despite the presence of levees; and, do not delay the finalization of flood insurance rate maps, irrespective of the presence of non-accredited levees. Provisional accreditation of shall be limited to a single term of 18 months.

ii. Depict the level of residual risk behind accredited levees via methods selected by FEMA.

[156] See opinion at Section 2.2 and section 2.4.3.2

iii. Ensure that there is coordination or consultation with NMFS prior to levee accreditation or approving map changes based on the construction of new levees or improvements to existing levees. Joint consultation with another federal entity such as the Corps of Engineers at the time of levee construction or levee improvements is preferred.

G. <u>Provide Accurate Maps Based on the Best Available Data for All Oregon NFIP Communities</u>
FEMA shall work with NMFS and the State of Oregon to develop a schedule for producing updated maps consistent with this Element for all Oregon NFIP communities subject to this RPA. The schedule shall be completed within one year of the issuance of this opinion, and FEMA will thereafter implement this RPA Element consistent with the agreed schedule. In addition to FEMA's existing prioritization factors to be considered in developing the schedule, FEMA shall include the prioritization factors for mapping/remapping provided in Appendix 2.8-A, ESA Mapping Priority, and Appendix 2.8-B, CMZ Mapping Priorities and Protocols. At a minimum, the schedule will provide for 10 new or updated maps completed per year until all requisite mapping has been completed.

RPA Element 4: Floodplain Management Criteria for Special Hazard Areas that Avoid, Minimize, and Mitigate Program Level Impacts

Once flood risks are mapped, restrictive land use and development standards are appropriate. Such restrictions achieve two positive outcomes: they reduce exposure of life and property to flood risk and preserve natural floodplain functions, as described in the CRS Coordinator's Manual at 120-6 and at 42 U.S.C. 4121(a)(12)(A)-(B), 44 CFR 9.4, and 44 CFR 9.10(d)(2).

The purpose of the NFIA is to "require States or local communities, as a condition of future Federal financial assistance, to participate in the flood insurance program and to adopt adequate flood plan [sic] ordinances with effective enforcement provisions consistent with Federal standards to reduce or avoid future flood losses" (42 U.S.C. 4002(b)(3)). As no flood insurance coverage is to be provided unless jurisdictions "have adopted adequate land use and control measures" (42 U.S.C. 4022(a)(1)), FEMA is authorized to establish comprehensive criteria for land management and use that states or local communities must adopt in order to participate in the NFIP. The criteria are intended to encourage communities to constrict the development of land exposed to flood damage, guide development away from flood hazard areas, reduce flood-related damage, and improve long-range land management and use of flood-prone areas. 42 U.S.C. 4102.

As stated by Congress, "A most important public purpose which the [NFIP] will serve will be to encourage State and local governments to adopt and enforce appropriate land use provisions to restrict future development of land which is exposed to flood hazard." H.R. Rep. No. 1585, reprinted in 1968 U.S.C.C.A.N. 2873, 2966. The NFIP's goal of reducing future damage to life and property and minimizing disaster costs co-incidentally preserves floodplain resources needed for the survival and recovery of listed fish. Conversely, standards that allow unmitigated development throughout floodplains impair natural floodplain functions and are at odds with the goals of the Unified National Program for Floodplain Management and the ESA.

For this consultation, FEMA proposed to modify the NFIP floodplain management criteria for Oregon to better preserve floodplain habitat for listed species. FEMA's proposal consists of dividing the floodplain into two components: (1) a riparian buffer zone, measured 170-feet laterally from either side of a water course, and (2) the remainder of the floodplain. FEMA proposes that within the riparian buffer zone (RBZ) only certain types of development would be allowed, specifically: development that will not adversely affect listed species or critical habitat; functionally dependent uses; habitat restoration activities; and, activities that result in a beneficial gain for species or habitat. FEMA would require mitigation for any short-term adverse effects associated with these uses. FEMA proposes that in the remainder of the floodplain, mitigation would be required for all adverse effects to floodplain functions so that no net loss or a beneficial gain is achieved. Further, based on discussions with FEMA during this consultation, FEMA intends that the mitigation requirement include, sequentially, avoidance, minimization, and compensation for unavoidable impacts.

NMFS understands the underlying intent of FEMA's proposed measures to be "no adverse effects" to or "beneficial gain" of habitat functions within the riparian buffer zone and "no net loss" of functions within the remainder of the floodplain; NMFS strongly supports these objectives. NMFS also agrees with and supports FEMA's proposal for more stringent development limitations, including limits on acceptable types of development, within the RBZ. However, based on experience in Puget Sound, Washington and for the reasons explained previously and in Appendix 2.4-A of this opinion, NMFS has concerns regarding the ability of local communities to effectively implement these technically complex concepts absent greater specificity regarding acceptable uses, likely impacts on floodplain function, and appropriate mitigation requirements. Also, the state of Oregon DLCD has expressed its preference for clear and specific mitigation requirements to facilitate local implementation.

NMFS has developed the following modifications to FEMA's proposed action in order to ensure that development impacts will be avoided, minimized, and compensated for, as intended by FEMA. These criteria are similar to the standards that FEMA has been implementing in Puget Sound, Washington since September 2008, and to the higher regulatory standards advocated by FEMA in the 2013 CRS Coordinator's Manual. This RPA element is designed with the understanding that development in urbanized floodplains will incur less degradation and likely require less mitigation than development in floodplains with more rural characteristics, because fewer natural functions remain in previously developed locations.

In order for FEMA to meet the ESA's requirement that its program avoid jeopardy to listed species and adverse modification of critical habitat, FEMA must require that communities adopt the criteria outlined below as a condition of continued participation in the program, and FEMA must enforce community compliance, *i.e*., by initiating probation/suspension for communities that fail to timely adopt and implement the criteria. Compliance with this RPA element will better guide the development of proposed future construction away from locations which are threatened by flood and flood-related hazards,[157] and will protect and may reestablish some degree of natural and beneficial floodplain functions as defined by statute (42 U.S.C. 1421(12)), and by regulation (44 CFR 9.4), *e.g*., "Natural values of floodplains…include but are not limited to (b) living resource values."

A. Regulatory Revisions to Enhance ESA Compliance
FEMA shall revise its regulations at 44 CFR part 60 to incorporate an ESA performance standard into the regulatory floodplain management criteria required as a condition of NFIP eligibility. NMFS understands that FEMA intends to initially implement an ESA performance standard through guidance, but ultimately will codify it as part of the regulatory floodplain management criteria (*e.g*., see the proposed regulatory revision provided in Section 2.10, Conservation Recommendations). The ESA performance standard must be sufficiently detailed to allow FEMA to ensure community compliance with the floodplain management criteria set forth in this RPA Element through the issuance of additional guidance or otherwise. FEMA shall also craft guidance and provide technical support as needed for successful implementation of the ESA performance standard and this RPA Element.

B. Avoid Impacts by Guiding Development Away from Land Which is Exposed to High Hazards[158]
Due to the importance of protecting riparian habitat and functions within the high hazard area, [159] apply the following criteria within the HHA:
   i. Except as provided in paragraph (iv) below, allow no new development or substantial improvements (as defined by this RPA) in the high hazard area (see *e.g*., 44 CFR 9.11(d)(1)).
   ii. A designated floodway may not be redrawn for the purposes of accommodating new structures.[160]
   iii. Designate the E-Zone setback "to create a safety buffer consisting of a natural vegetative or contour strip" as provided in 44 CFR 60.5(b)(2) as the greater of:
      a. The 60-year erosion setback (44 CFR 59.1) or,
      b. One-half again the distance of the depicted "high" or "severe" erosion risk.

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[157] Compliance with this RPA will co-incidentally satisfy the GAO recommendation in its climate change report that FEMA should consider amending the NFIP minimum standards to incorporate forward looking standards (GAO 2014).

[158] "Within the 1 percent floodplain, natural and beneficial functions are generally more prevalent closer to the stream where overbank flooding is frequent and complex habitat exists along the aquatic-terrestrial boundary. Disturbances to habitat are typically much greater from activities that occur closer to the stream channel than along the outer limits mapped for the 1 percent flood" (Galloway *et al.* 2006).

[159] "The preservation strategy focuses on the immediate impacts of the proposed floodplain actions. This strategy involves prevention of alteration to the natural and beneficial floodplain values or maintenance of the floodplain environment as close to its natural state as possible using all practicable means. This strategy is most effectively applied to floodplains showing little or no previous disruption by man, but may be appropriate for other floodplains. The best strategy for preserving and protecting the remaining natural values of floodplains is avoidance..." (FEMA 1986).

[160] "Disruption of natural floodplain terrain and vegetation within a floodway adjacent to the stream channel can affect some of the highest quality habitat and represents a significant impact to the natural and beneficial functions of floodplains" (Galloway *et al.* 2006).

c. Allowed uses within the safety buffer are those identified at 44 CFR 60.5(b)(2), *i.e.*,“ agricultural, forestry, outdoor recreation and wildlife habitat areas, and for other activities using temporary and portable structures only.”

iv. Exceptions

a. The following uses may be allowed in the high hazard area: (1) *open space** uses (see CRS Coordinator’s Manual at 420-6 to -7); (2) habitat restoration activities; (3) *low intensity recreational uses**; (4) *water-dependent uses*,* and (5) *bioengineered bank protection*.* In that portion of the HHA outside of the 10 year floodplain, agriculture and forestry are additional uses that may be allowed.

b. Development that qualifies for grandfathering per Element 4.G may proceed despite being located in the high hazard area.

c. Any development allowed as an exception must meet the mitigation requirements of Elements 4.F, except for habitat restoration activities, which are considered self-mitigating and therefore do not require additional mitigation.

C. Minimize Impacts by Constricting the Development of Land Which Is Exposed to Flood Damage[161] – Division of Lots and Lot Coverage

FEMA shall, in consultation with the Oregon Department of Land Conservation and Development:

i. For properties that are located partially within special hazard areas, develop clear and measurable spatial standards,[162] governing the creation of new development parcels to ensure that newly created lots reserve sufficient land outside of special hazard areas to accommodate future construction and disallow partitioning that will create new parcels fully within special hazard areas.

ii. Develop clear and measurable spatial standards governing the minimum permissible size of new development parcels to minimize densification and preserve natural floodplain functions.

iii. Limit the footprint of new structures to 10% or less of total lot size for both residential and commercial development in order to reduce impervious surfaces in floodplains and minimize impacts to natural floodplain functions.

iv. Ensure that any lots or parcels created by division are able to accommodate development consistent with the applicable zoning and this RPA, including any necessary mitigation, without requiring any variance from local or state land-use requirements.

[161] This language found at FEMA’s legislative authorities 42 USC 4102(c)(2), and is part of the larger section, 4102, entitled “Criteria for land management and use.” Section 4012 calls for the Administrator of FEMA to develop comprehensive criteria, which, to the maximum extent feasible, will constrict development of land, and guide development of proposed construction away from locations threatened by flood hazards.

[162] To avoid problems associated with the Puget Sound RPA’s “lack of clarity, and…development standards [that] were not tailored to help communities understand their NFIP and ESA compliance obligations” (*NWF v FEMA*, 10/24/14), NMFS refers FEMA to the standards identified in the 2013 CRS Coordinator’s Manual at 420-26 to -27 as an example of a clear and measurable standard. FEMA shall work in concert with DLCD and local authorities to develop a clear, measurable standard appropriate for Oregon.

v. Within urban growth boundaries in effect on January 1, 2019, the protective measures in paragraphs (i)-(iii) above may be met by employing alternative methods that preserve hyporheic function, riparian vegetation, and flood refugia for listed fish, such as or using *cluster development/open space zoning** that places development landward of the 50 year flood interval. A conservation easement or deed restriction shall be utilized to preserve unimpaired flood processes in the undeveloped area (see *e.g.*, 2014 CRS Manual at 420-21).

vi. Partitioning for the purpose of habitat restoration activities in special hazard areas is excluded from provisions (i)-(iii) above.

D. <u>Minimize Impacts by Requiring Encroachment Analyses Prior to Floodway Development</u>
An equal degree of encroachment analysis must occur prior to approval of floodplain development in any participating jurisdiction that lacks a mapped floodway,[163] to ensure that the de facto floodway that would be identified consistent with RPA Element 3.A(iv) is not encroached in a manner detrimental to natural floodplain values or functions.

E. <u>Minimize Stormwater and Hyporheic Impacts from Impervious Surfaces</u>
Minimize the impacts of new impervious surface in floodplains by requiring the use of pervious surface to the maximum extent feasible. Where use of pervious surface is not feasible, minimize impacts by requiring the removal of existing impervious surface up to an amount equal to the new impervious surface to the maximum extent feasible. Require mitigation per Element 4.F below for any remaining impacts.

F. <u>Compensatory Mitigation for Adverse Impacts Associated with Floodplain Development</u>
NMFS fully supports FEMA's objective for implementation of the NFIP in Oregon, that all development impacts to natural floodplain functions be fully mitigated. Accordingly, FEMA, with NMFS' technical assistance, will develop detailed mitigation standards, with the objective of achieving "no net loss or beneficial gain"[164] of natural floodplain functions, which take into consideration the following factors: the likelihood of underperformance; the timing of mitigation performance relative to the accrual of impacts and compensation for delayed realization; the value of on-site versus off-site mitigation; the value of in-kind versus out-of-kind mitigation; and, the need for assurances and performance monitoring to ensure that the mitigation will function in perpetuity.

i. The mitigation standards shall identify the specific development activities that require mitigation, including, at a minimum:
   a. The addition of fill, structures, levees, and dikes, which reduces flood storage and fish refugia, impedes habitat forming processes, increases flow volume and velocity thereby eroding stream banks and beds, and alters peak flow timing thereby increasing risk of injury to redds, fry, and alevin;

[163] FEMA 1979. Community Assistance Series No. 4: "The Floodway: A Guide for Community Permit Officials." See also 44 CFR 60.3(c)(10).

[164] See also Presidential Memorandum: Mitigating Impacts on Natural Resources from Development and Encouraging Related Private Investment, November 3, 2015. "Agencies' mitigation policies should establish a net benefit goal or, at a minimum, a no net loss goal for natural resources the agency manages that are important, scarce, or sensitive, or wherever doing so is consistent with agency mission and established natural resource objectives."

b. The addition of impervious surfaces, which reduces hyporheic function and stream recharge, increases storm water, pollutant loading, water temperature, velocity, and scour, and modifies peak and base flows;
c. Vegetation removal, which reduces shade, detrital input, velocity refuge, and habitat complexity and increases storm water and erosion; and
d. Bank armoring, which reduces instream habitat values and impedes habitat forming processes.

ii. If FEMA wishes to provide a variance process that allows communities to adopt alternative mitigation standards that differ from the standards developed by FEMA under Element 4.F(i), FEMA will ensure that such alternative standards are consistent with the intent of this RPA sub-element through one of the following procedures:
a. Require that the community proposing the alternative obtain an ESA section 10 permit from NMFS; or
b. Require that the community proposing the alternative provide its proposal to FEMA for a preliminary finding of adequacy. If FEMA finds that the proposal is adequate, FEMA shall seek NMFS' agreement that the alternative provides resource protection comparable with that provided by RPA Element 4.F(i). and determine whether additional steps are required for ESA compliance.

iii. Alternatively, or pending FEMA's completion of mitigation standards per Element 4.F(i), FEMA may utilize the criteria set forth below, as supplemented by Appendix 2.8-C, which NMFS considers adequate to offset development impacts.
a. Location. Locate all mitigation on site, except when precluded by geomorphic or spatial constraints or when off-site mitigation will clearly provide a greater benefit to listed species; financial cost is not a basis for allowing required mitigation to occur at an off-site location.
b. Assurances. Require the mitigation proponent to provide appropriate assurances that the mitigation will function in perpetuity, as provided in Appendix 2.8-C.
c. Timing. Where delayed realization is anticipated, increase the required mitigation ratios, as provided in Appendix 2.8-C.
d. Displaced flood volume. Provide compensatory storage for displacement of flood storage volume/loss of accessible floodplain refugia for listed fish due to fill or structural displacement. This balanced cut and fill requirement applies to all floodplain development except habitat restoration activities. When mitigating lost storage by creating compensatory storage, the compensatory storage must be:
    1. Hydrologically connected to the waterbody which is the flooding source,
    2. Designed so that there is no increase in velocity,
    3. Designed to fill and drain in a manner that does not trap fish,
    4. Within the same *hydraulic reach** as the proposed development to minimize impact to affected fish populations,
    5. Measured in one foot elevation increments relative to the amount and location of fill placed, and
    6. Provided at a 1.5 to one ratio laterally, or greater, in order to guarantee no loss of beneficial floodplain functions, including conveyance.

e. Increased impervious surface. Where minimization per Element 4.E above does not fully compensate for lost functions, mitigate any remaining impacts to natural floodplain functions from the increase of impervious surface by requiring the following measures:
   1. Incorporate low impact development (LID) features or methods in new structures,
   2. Incorporate green infrastructure development standards at the community planning scale,[165] and
   3. Require treatment for any storm water generated despite use of the above measures.

f. Decreased riparian vegetation. Mitigative planting must replace the lost vegetation in a manner that provides equivalent area, diversity, and function and must be located to benefit the same fish population(s) affected by the development.

G. Grandfathering

Development for which the *start of construction** occurs on or before September 15, 2016 is grandfathered. However, when a grandfathered structure is substantially damaged or substantially improved, the structure must come into compliance with Elements 4.B-4.F as applicable, *e.g.*, mitigation is required for any adverse impacts to natural floodplain functions associated with the substantial improvement (expanded footprint, vegetation removal, placement of fill, etc.). Substantial damage and substantial improvement shall be calculated at 50% of the value of the structure, measured cumulatively over a 10 year time frame. Also, improvements that increase the footprint of the structure 10% or more (based on the square feet of the lowest floor) measured cumulatively over 10 years shall constitute "substantial improvement" (See 2013 CRS Coordinator's Manual at 430-1).

H. Alternative Compliance for Special Circumstances

If a community demonstrates to FEMA that full compliance with Element 4 is impracticable due to exceptional circumstances (*e.g.*, geomorphic constraints, wildfire risk, or community located fully within the floodplain), a community may propose an alternative scheme (through regulations or enforceable procedures) for complying with the intended outcomes of Element 4 through one of the procedures described below. NMFS expects that such situations will be extremely limited and that alternative compliance will only be approved by FEMA where the community clearly demonstrates that the intended protective outcomes of Element 4 will be achieved through the proposed alternative.

i. A community may propose an alternative scheme to FEMA; FEMA will make an initial determination whether the alternative is consistent with Element 4, and if FEMA makes a positive determination, FEMA will seek NMFS' agreement that the alternative provides comparable resource protection prior to approving the alternative.

[165] "Green stormwater infrastructure or similar pollution prevention methods should be incorporated to the maximal extent practicable, at the watershed scale, for all future development and redevelopment projects, particularly those involving transportation infrastructure" (Spromberg *et al.* 2016).

ii. A community may seek an incidental take permit from NMFS under ESA section 10; if NMFS grants the permit, FEMA may accept the associated habitat conservation plan as the alternative method of compliance.
iii. A community may pursue authorization under ESA section 4(d), Limit 12 (50 CFR 223.203(b)(12)).

RPA Element 5: Data Collection and Reporting

"Water and the adjacent floodplain exist in nature in a state of dynamic equilibrium; when coastal or riverine systems are disturbed, the environmental effects may affect areas far from the original site of the disturbance and can last for decades. Thus, floodplain actions must be viewed with caution and a careful assessment made of their impact on natural and beneficial floodplain values."[166]

In order to document that FEMA is carrying out the NFIP, and NFIP participating communities complying with NFIP minimum standards are managing floodplain development in a manner that preserves natural floodplain functions to meet the objectives of this RPA, FEMA must systematically collect and analyze information from all participating communities in Oregon so as to document impacts, including: (a) how many floodplain development activities are permitted by participating communities subject to this RPA; (b) where and when the development occurs; (c) a basic description of the development, including mitigation; (d) the impact of the development on natural floodplain functions,[167] and (e) information that allows an evaluation of community compliance with the NFIP requirements as modified by this RPA. NMFS is aware of the difficulties in tracking implementation of the Puget Sound RPA reliably and is therefore seeking to strengthen the tracking and accountability mechanisms in this RPA. NMFS desires a speedy and efficient system of tracking and reporting and will work with FEMA, Oregon's DLCD, and local authorities towards this end.

A. Permit Reporting
FEMA shall require that participating communities report to FEMA on each permit issued for development in special hazard areas, including the following information:
i. The amount of fill or structural displacement of flood storage, and the amount of compensatory storage measured by volume and area (both surface area and cross sectional area). This reporting element effectively describes loss of refugia for rearing fish, and indicates factors that increase the BFE and flood velocities.
ii. The amount of new impervious surface (indicates loss of hyporheic function) and any projected change in the timing, velocity, or peak flows of storm water runoff and the types and amounts (if applicable) of mitigation provided.
iii. The area in which clearing and/or grading occurred (*e.g.*, within the HHA, SFHA, or AFCFH)

[166] FEMA 2015. Guidelines for implementing EO 11988 Floodplain Management, and EO 13690 Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input. 80 FR 64008; Oct. 22, 2015.

[167] "Where location in the floodplain is the only practicable alternative, care must be taken to identify both the beneficial and the adverse impacts to existing natural and beneficial floodplain values and to design or modify the action to avoid or minimize potential harm to or within the floodplain." FEMA 1986.

iv. The number of trees equal to or greater than 6” dbh removed (indicates loss of riparian function and reduction of source of large wood recruitment) and the number and timing of trees planted to meet mitigation requirement (indicative of the duration of lost functions).

v. If a project disconnects land from the floodplain (*e.g.*, by accreditation of levees or recognition of non-accredited levees), identify the type of project and the amount of land disconnected from the floodplain. This reporting element effectively describes loss of refugia for rearing fish, and indicates factors that increase the BFE and flood velocities.

vi. If a project reconnects land to the floodplain (*e.g.*, by the removal or setback of a levee) identify the type of project and amount of land reconnected to the floodplain. This reporting element is indicative of effectiveness of mitigation or of beneficial habitat restoration actions.

vii. The location of the project and of the corresponding mitigation (*e.g.*, within the high hazard area, the SFHA, or AFCFH); for projects in the HHA identify which exception from Element 4.B(iv) applies. This reporting element indicates the quality of mitigation based on the relative role the mitigation area performs in terms of inundation frequency.

FEMA, with NMFS’ assistance, will finalize a reporting form or electronic reporting system incorporating the requirements above by March 15, 2018, so that reporting by NFIP communities may commence by July 1, 2018. Thereafter, FEMA will require that communities submit a quarterly report to FEMA indicating issuance of each floodplain development permit in the reporting period. FEMA may develop its own standardized reporting form, or NMFS has prepared a Google Form that could be used for reporting as required by this component of the RPA. NMFS estimates that communities could complete the form in fewer than 10 minutes for each permit issued.

B. Annual Reporting

FEMA will prepare and submit a report to NMFS annually, based on the calendar year, on RPA implementation status. NMFS recommends that these annual reports be publically available so that the public can track efforts to protect public health and safety and important floodplain functions and other indicators of the successful implementation of this RPA. FEMA will:

i. Confer with NMFS to mutually agree upon a due date for submission of the annual report, but no later than September 1 of each year. The first report shall be prepared for calendar year 2017.

ii. Annually meet with NMFS to review the most recent report and program performance. The interagency meeting purpose will be to discuss program compliance, identify what additional actions by FEMA are warranted, and determine whether re-initiation of this consultation is warranted.

iii. Include in the report, at a minimum, the following:

   a. A list of communities that have adopted ordinances or enforceable procedures that implement the revised floodplain management criteria required by this RPA.

   b. A list of completed maps that comply with RPA Element 2.

c. The mapping status of each Oregon NFIP participating community (*i.e.,* dates of effective maps, status of preliminary maps including status of any appeals, and anticipated dates for Letters of Final Determination).
d. The number of CLOMCs (specify how many are CLOMR-Fs) and LOMCs (specify how many are LOMR-Fs) issued by FEMA.
e. Sum by participating community: fill area and volume values based on the community reported fill placed within special hazard areas excluding fill associated with habitat restoration activities.
f. Sum by participating community: the number of times and amount of mitigation required for loss of riparian vegetation.
g. Sum by participating community: increase in impervious surface.
h. Sum by participating community: the amount of floodplain disconnected and/or reconnected to the floodplain.
i. A summary of items (e)-(h) aggregated by county.
j. A summary of the CAVs initiated and completed that year, including the community progress toward compliance benchmarks (below).
k. A brief description of any compliance problems or issues and resulting FEMA enforcement actions.

RPA Element 6: Compliance and Enforcement

In order for this RPA to function as intended, it is critical that FEMA effectively monitor community implementation of and compliance with these amended criteria and promptly undertake appropriate enforcement actions if needed to ensure community compliance. FEMA must ensure both that communities adopt the required ordinances and/or enforceable procedures and that communities enforce their ordinances/procedures so as to achieve the intended outcomes of this RPA, *i.e*., preservation of all remaining natural floodplain functions.

A. <u>Community Implementation</u>
  i. Early Implementation Incentive. Because compliance with this RPA will prevent destruction and adverse modification of critical habitat by reducing or avoiding degradation and loss of floodplains and natural floodplain functions; and because the preservation of floodplains and natural floodplain functions will avoid the likelihood of jeopardy to listed species; in order to encourage jurisdictions to independently pursue compliance with the RPA in advance of stated timelines, which would confer an early and permanent benefit to the listed species and their habitat, this RPA directs FEMA, as authorized by 42 U.S.C. 4022(b), to modify the CRS so that when, prior to FEMA's own compliance with the provisions of this RPA, a community:
    a. Adopts a regulatory floodway per RPA Element 3.A(iv), it receives 200 points under CRS part 410.
    b. Adopts a map depicting flood related erosion zones or uses an accepted scientific method to confirm no CMZ is present per RPA Element 3.B, it receives 100 points under CRS part 410.
    c. Adopts a map depicting the HHA per RPA Element 3.C, it receives 100 points under CRS part 410.

d. Adopts a map depicting the AFCFH per RPA Element 3.D, it receives 100 points under CRS part 410.
e. Regulates to a preliminary map even though the letter of final determination has not yet been issued, it receives 100 points under CRS parts 430 and 510.
f. Adopts a zero rise/zero increase in velocity standard for development receives 100 points under CRS parts 430.
g. Restricts division of lots per RPA Element 4.C, it receives 150 points under CRS parts 420 and 430.
h. Requires use of LID and/or green infrastructure for all new development per RPA Element 4.F, it receives 200 points under CRS part 450.
i. Limits new development in the HHA per RPA Element 4.B, it receives 300 points under CRS parts 420 and 430.

ii. Compliance Benchmarks. To demonstrate that it is achieving the expected outcomes of this RPA, FEMA must ensure that participating communities adopt maps and regulate development corollary to those maps. Thus, FEMA may demonstrate that this RPA is being successfully implemented by showing that:
a. Within 18 months of the date of this opinion, FEMA shall demonstrate substantial progress on any guidance materials needed to implement this RPA.
b. For any regulatory revisions that FEMA determines are necessary to implement this RPA, FEMA shall provide proposed rule for public comment within 2 years of the date of this opinion.
c. Within 18 months of a LFD indicating a community's revised FIRM, the jurisdiction shall have revised its code to meet all minimum criteria consistent with hazards identified on that FIRM.
d. By September 1, 2024, FEMA must demonstrate that all NFIP participating jurisdictions in Oregon subject to this consultation have adopted and implemented all requirements from Elements 3 and 4 of this RPA. This deadline also applies to any jurisdiction pursuing alternative compliance per RPA Element 4.G.

B. Enforcement. In order to meet the requirements of this RPA, by September 1, 2024, FEMA will demonstrate full program compliance by those communities subject to this RPA, based on the data from local permits reported to FEMA and from CAVs or comparable means of auditing community compliance. FEMA must conduct CAVs or otherwise audit compliance with this RPA in 25 communities each year beginning in 2023. NMFS further recommends that FEMA prioritize for CAVs for or otherwise audits those communities which:
i. FEMA is aware or has reason to believe (*e.g.*, based on permit reporting data) are not fully implementing the RPA requirements.
ii. Have mapped floodplains that retain low density characteristics and are subject to possible population growth.
iii. Show an increasing number of floodplain development permits.
iv. Have growth boundaries, comprehensive plans, or zoning that allow development in special hazard areas.

FEMA shall implement appropriate compliance efforts directed at those communities that do not achieve and maintain compliance with the above benchmarks. For example, when development reporting reveals that a jurisdiction has permitted development within special hazard areas without mitigation, then FEMA will put that jurisdiction on notice for probation within 12 months of the date of the violation unless corrective action has been taken. Communities automatically out of compliance are those that fail to have in place ordinances and other enforceable procedures that comply with the revised floodplain management criteria in this RPA. Should a participating community placed on probation fail to come into substantial compliance within 24 months of being placed on probation, FEMA will suspend the community from the NFIP, and the community's take coverage shall lapse.

2.8.3 Glossary of Terms as Used in this RPA

Area of future conditions flood hazard (AFCFH) – The land area that would be inundated by the 1-percent-annual-chance (100-year) flood based on future conditions hydrology (44 CFR 59.1), inclusive changes due to climate change.

Avulsion – "Described by Allen (1965 5:119) as 'the sudden abandonment of a part or the whole of a meander belt by a stream for some new course.' Channels may avulse into an abandoned channel or create a new channel depending on the pre-existing boundary conditions that initiate the avulsion" (Rapp and Abbe 2003).

Avulsion hazard zone (AHZ) – "The area not included in the Historic Migration Zone that is at risk of avulsion over the timeline of the channel migration zone" (refer to Section 4.2 of Rapp and Abbe 2003).

Bioengineered bank protection – Methods of stream bank or shoreline protection, other than rip-rap bank armoring, which incorporate fish habitat design elements or fish habitat features. See, *e.g. http://www.fema.gov/pdf/about/regions/regionx/Engineering_With_Nature_Web.pdf*; and *http://www.fs.fed.us/publications/soil-bio-guide/guide/chapter5.pdf*.

Channel migration zone (CMZ) – "The area where a stream or river is susceptible to channel erosion" (refer to Rapp and Abbe 2003). The CMZ may extend beyond the 100-year floodplain. Where the delineated CMZ extends beyond artificial revetments, bulkheads, and levees, all such areas are included within the CMZ unless they are designated as disconnected migration areas, as these structures have a high risk of failure.

Cluster development/open space zoning – An alternative site planning technique that concentrates dwelling units in a compact area to reserve undeveloped space elsewhere on the site. In this technique, lot sizes, setbacks, and frontage distances are minimized to allow for open space. The basic principle of cluster development is to group new homes onto part of the development parcel, so that the remainder can be preserved as unbuilt open space. See http://water.epa.gov/polwaste/nps/openspace.cfm.

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 (44 CFR 59.1), and expanded for the purpose of this RPA to include removal of vegetation or other alteration of natural site characteristics (including any remnant natural characteristics existing in a degraded site). For this RPA, development does not include the maintenance, repair, or remodel of existing buildings, facilities, and utilities within their existing footprints (except for substantial repairs and improvements); resurfacing of roads; lawn care, gardening, removal of noxious weeds, replacement of non-native vegetation with native vegetation, or removal of hazard trees; or, plowing and similar agricultural practices that do not involve filling, grading, or construction of levees or structures.

Erosion hazard area (EHA) – "The area, not included in the HMZ, or the AHZ, that is at risk of bank erosion from stream flow or mass wasting over the timeline of the CMZ. The EHA has two components: the Erosion Setback (ES) and the Geotechnical Setback (GS). The ES is the area at risk of future bank erosion by stream flow; the GS is defined by channel and terrace banks that are at risk of mass wasting (due to erosion of the toe). The GS projects from the ES at a side slope angle that forms a stable bank configuration, thereby accounting for mass wasting processes that will promote a stable angle of repose" (refer to Sections 4.3 and 4.5 of Rapp and Abbe 2003). At a minimum, that portion of the Coastal and Riverine Erosion Zones posing "high" and "severe" risk of subsidence, avulsion, or channel migration – identified using protocols from Rapp and Abbe (2003) Section 4.5, must be included in the EHA.

Extreme high tide – The elevation of the highest predicted astronomical tide expected to occur at a specific tide station over the National Tidal Datum Epoch.

Future-conditions hydrology – The flood discharges associated with projected land-use conditions based on a community's zoning maps and/or comprehensive land-use plans and without consideration of projected future construction of flood detention structures or projected future hydraulic modifications within a stream or other waterway, such as bridge and culvert construction, fill, and excavation (44 CFR 59.1), and expanded for the purpose of this RPA to include projected changes in future riverine hydrology associated with climate change and changes in sea level, storm surge, and wave heights due to climate change as of 2100.

Green Infrastructure – Use of natural hydrologic features to manage water, and provide environmental and community benefits. Green infrastructure uses management approaches and technologies that utilize, enhance, and/or mimic the natural hydrologic cycle processes of infiltration, evapotranspiration, and reuse. At a large scale, green infrastructure is an "interconnected network of green space that conserves natural systems and provides assorted benefits to human populations" (See McMahon and Benedict, 2006). At a local scale, green infrastructure manages stormwater by infiltrating it in the ground where it is generated using vegetation or porous surfaces, or by capturing it for later reuse. See additional information available at *http://www.epa.gov/smartgrowth/green-infrastructure.html*; Benedict, Mark A. and McMahon, Edward T. Green Infrastructure: Linking Landscapes and Communities. Benedict, Mark A. and McMahon. Washington, D.C., Island Press, 2006; see also McIntyre *et al.* (2014) re biological improvements from use of green infrastructure.

Habitat – All habitat used by or that supports listed species, not only habitat designated as critical habitat.

*Habitat restoration activiti*es – Includes those actions that re-establish or improve natural conditions and functions of aquatic and floodplain areas, including, but not limited to, side channels, oxbows, and adjacent wetlands. Restoration does not include those activities the primary purpose of which is to provide, or repair, flood or erosion protection structures, even when those activities include habitat enhancement features. See Fish-Habitat Relationships and the Effectiveness of Habitat Restoration (Roni et al 2014). Available at: http://www.nwfsc.noaa.gov/assets/25/7422_08122014_141405_FishHabRelationshipsTM127WebFinal.pdf.

High hazard area (HHA) – The area comprised of and measured to the furthest landward extent of: (1) V zones; (2) LiMWA; (3) floodway (as revised by this RPA); and (4) E Zones (as revised by this RPA).

Historical migration zone – The collective area the channel occupied in the historical record (refer to Section 4.1 of Rapp and Abbe 2003).

Hydraulic reach – The reach of a stream between the nearest features controlling the flood water elevations upstream and downstream from the proposed development site. In the absence of determining the flood elevation controlling features, a default length equivalent to 14 times the bankfull channel width of the stream or river at the project site may be used.

Limit of moderate wave action (LiMWA) – The inland limit of the area affected by waves greater than 1.5 feet (covered by Procedure Memorandum 50).

Low impact development (LID) – LID is an approach to land development (or re-development) that works with nature to manage stormwater as close to its source as possible. LID employs principles such as preserving and recreating natural landscape features, minimizing effective imperviousness to create functional and appealing site drainage that treat stormwater as a resource rather than a waste product. LID refers to designing and implementing practices that can be employed at the site-level to control stormwater and strive to replicate the pre-development hydrology of the site. See http://water.epa.gov/polwaste/green/; see also EPA 841-R-13-004 (2013).

Low intensity recreational use – Includes pedestrian trails, natural turf ball fields, tent camping, temporary/transient structures such as campers/trailers.

Mitigation – All steps necessary to minimize the potentially adverse effects of the proposed action, and to restore and preserve the natural and beneficial floodplain values (44 CFR 9.4). Mitigation requires sequential implementation of measures that first avoid effects to the degree possibile, then minimize remaining effects, then replace and/or otherwise compensate for, offset, or rectify the residual adverse effects to natural floodplain functions.

Natural floodplain functions – All natural floodplain functions which support fish and wildlife, including the listed species subject to this consultation. Natural floodplain functions include all functions associated with the natural undisturbed floodplain that moderate flooding; retain flood waters; reduce erosion and sedimentation; mitigate the effect of waves and storm surges; maintain water quality and recharge of ground water; and provide fish and wildlife habitat. Natural floodplain functions include large wood recruitment and other habitat forming processes. See, *e.g.*, 42 U.S.C. 4121(a)(12).

Open space – Used as a descriptive term; includes areas legally designated and encumbered as open space, but may also include other land use designations or zoning districts or overlays that restrict development and maintain areas in a condition that is largely devoid of structures or infrastructure regardless of ownership or access (private or public). For example, open space may include the follow provided development is indefinitely set aside:

1. A natural area containing only minor improvements.
2. A park that was "reclaimed" from a previously developed area.
3. A playground or playfields with natural turf.
4. An agricultural field or pasture.

Riparian buffer zone (RBZ) – As defined in FEMA's proposed action for this consultation, the outer boundary of the RBZ is measured from the ordinary high water line of a fresh waterbody (lake; pond; ephemeral, intermittent, or perennial stream[168]) or mean higher-high water line of a marine shoreline or tidally influenced river reach to 170 feet horizontally on each side of the stream. The RBZ includes the area between these outer boundaries on each side of the stream, including the stream channel.

Riparian vegetation – Native vegetation, especially trees, within 200 feet of the ordinary high water mark.

Special hazard area – An area having special flood, mudslide (*i.e.*, mudflow), or flood-related erosion hazards, and shown on an FHBM or FIRM as Zone A, AO, A1-30, AE, AR, AR/A1-30, AR/AE, AR/AO, AR/AH, AR/A, A99, AH, VO, V1-30, VE, V, M, or E (44 CFR 59.1), and expanded for the purpose of this RPA to include the AFCFH.

Start of construction – Includes substantial improvement, and means the date the building permit was issued, provided the actual start of construction, repair, reconstruction, rehabilitation, addition placement, or other improvement was within 180 days of the permit date. The actual start means either the first placement of permanent construction of a structure on a site, such as the pouring of slab or footings, the installation of piles, the construction of columns, or any work beyond the stage of excavation; or the placement of a manufactured home on a foundation. Permanent construction does not include land preparation, such as clearing, grading and filling; nor does it include the installation of streets and/or walkways; nor does it include excavation for

[168] Perennial Stream: A stream that flows year round, even during periods of no rainfall. Intermittent Stream: A stream that flows only during certain times of the year, including ephemeral streams.

a basement, footings, piers, or foundations or the erection of temporary forms; nor does it include the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or not part of the main structure. For a substantial improvement, the actual start of construction means the first alteration of any wall, ceiling, floor, or other structural part of a building, whether or not that alteration affects the external dimensions of the building (44 CFR 59.1).

Structure – A walled and roofed building, including a gas or liquid storage tank, that is principally above ground, as well as a manufactured home (44 CFR 59.1).

Water-dependent uses – As defined in FEMA's proposed action, a use that cannot perform its intended purpose unless located or carried out in proximity to water (*e.g*., pier, bridges). For NFIP insurable structures, "[t]he term includes only docking facilities, port facilities that are necessary for the loading and unloading of cargo or passengers, and ship-building and ship repair facilities, but does not include long-term storage or related manufacturing facilities" (44 CFR Part 59.1). For structures other than NFIP insurable buildings (*e.g*., utility crossings, bridges), the locational dependence is determined by two tests (Interagency Task Force on Floodplain Management, 1984). First, is the purpose of the activity involved directly in the business of inserting and extracting goods into and out of waterborne vessels or inserting and extracting the vehicles themselves to and from the water, or to provide public access and use of the shoreline for recreation? Second, for an industry classified as functionally-dependent under the first question, is an individual structure vital to day-to-day production?

2.8.4 Findings on the Reasonable and Prudent Alternative

As stated in the introduction of Section 2.8 above, a reasonable and prudent alternative to the proposed action is one that avoids jeopardy by ensuring that the action is undertaken in a manner so that its effects do not appreciably reduce the species' likelihood of survival or the species' potential for recovery (50 CFR 402.02). It also must avoid destruction or adverse modification of designated critical habitat.

This RPA is designed to address the deficiencies of the NFIP as implemented in Oregon and identified in this opinion – these deficiencies contribute to the degradation of critical habitat for listed species, reduce the likelihood of survival, and increase the likelihood of extinction of listed species. By addressing deficiencies in FEMA's mapping protocols and development standards, the RPA will significantly reduce the effects of future floodplain development and thus avoid adverse effects on anadromous fish and their habitat in the action area. Compliance with the NFIP revisions proposed by the RPA will also ensure that any adverse impacts to relevant habitat features are mitigated. By doing so, the RPA would prevent the exacerbation of identified limiting factors for listed anadromous fish and avoid the future loss of population abundance and productivity caused by the direct, indirect, and cumulative effects of floodplain development. Similarly, the RPA will prevent additional loss of critical habitat quality and function resulting from floodplain development. Implementation of the RPA will avoid jeopardy to SRKW because, for those listed fish species that are prey for SRKW and the subject of this opinion, the RPA will ensure that the impacts of the proposed action are minimized and mitigated so as not to increase the salmonid species' risk of extinction.

A reasonable and prudent alternative must: (1) be consistent with the intended purpose of the proposed action; (2) be within the scope of the Federal agency's legal authority and jurisdiction; (3) be economically and technologically feasible; and (4) avoid the likelihood of jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of their critical habitat (50 CFR 402.02). As explained in the preamble to the ESA consultation regulations:

> An alternative, to be reasonable and prudent, should be formulated in such a way that it can be implemented by a Federal agency consistent with the scope of its legal authority and jurisdiction. However, the Service notes that a Federal agency's responsibility under section 7(a)(2) permeates the full range of discretionary authority held by that agency; i.e., the Service can specify a reasonable and prudent alternative that involves the maximum exercise of Federal agency authority when to do so is necessary, in the opinion of the Service, to avoid jeopardy.

51 FR 19926, 19937 (June 3, 1976).

2.8.4.1. Collectively, the Elements of the RPA Will Avoid Jeopardy

The six elements of the RPA work together to minimize habitat degradation associated with FEMA's current implementation of the NFIP, avoiding jeopardy and advese modification of designated critical habitat by:

- Making affected communities aware of the consultation outcome, and their need to avoid detrimental effects to floodplain habitats from development (RPA Element 1). Although NMFS cannot predict how much beneficial impact will result from community notification, education, and outreach, we expect that raising awareness among community permitting and planning officials of the link between floodplain function and the conservation of listed species will result in some additional protection of natural floodplain functions.
- Providing interim measures to put in place habitat protections through development restrictions and mitigation requirements for all floodplain development impacts to natural floodplain functions (RPA Element 2). Element 2 establishes minimum mitigation requirements for floodplain development and limits FEMA's authorization of map revisions that do not comply with the mitigation standards. We expect the measures in Element 2 to result in fewer impacts to natural floodplain functions until the more protective requirements of Elements 3-6 can be fully implemented.
- Improving the accuracy, thoroughness, and timeliness of FEMA's mapping activities to ensure that habitat features need to support listed salmonids are identified and protected (RPA Element 3). Correctly identifying flood-prone and flood-related hazard prone areas, and reducing the risk that such areas are not identified and protected, when coupled with the remaining elements of the RPA, will avoid most adverse effects in areas identified as high hazard areas, which are the areas that, due to their frequency of inundation and pattern of erosion, serve the most valuable habitat functions for salmonids. Accurate mapping required by Element 2, together with limits on division of property and

mitigation requirements for development in the remainder of floodplain areas, will minimize the adverse effects of floodplain development on remaining floodplain habitat, preserving natural floodplain functions and ensuring that adverse impacts of development are adequately offset or rectified. Over time, NMFS expects these significant changes to implementation of the NFIP in Oregon will lead to a 'no-further loss' approach to preserving floodplain function. This is expected to slow and eventually halt the loss of population productivity and abudance resulting from habitat degredation caused by floodplain development.

- Revising the regulatory floodplain management criteria required as a condition of community participation in the NFIP to: (1) avoid increasing density of floodplain development, (2) require compensatory mitigation for fill in floodplains, (3) require green infrastructure and LID to reduce stormwater generated by development in floodplains, and require treatment of any generated stormwater to address impacts associated with development in floodplains, (4) provide enhanced protections for the most important habitat areas (floodways and channel migration zones) to limit future loss of floodplain habitat features and functions (RPA Element 4). This element provides a suite of development protocols that will reduce the number of structures built in floodplains, manage effects from the structures that are built, and mitigate effects that cannot be otherwise managed. Mitigation ratios are greater than 1-to-1 to compensate for temporal loss of riparian functions, and in anticipation of underperformance of the mitigation, which has been identified as a common complication. Consequently, we expect that future floodplain development will avoid or successfully offset most adverse impacts on listed species' habitat.
- Systematically collecting and reporting floodplain development information to reveal whether FEMA's revisions to the NFIP pursuant to the RPA are being effectively implemented by the participating communities (RPA Element 5). Accurate reporting will allow NMFS and FEMA to track progress over time and identify patterns of non-performance. This accountably element allows the Federal agencies to intervene if local non-performance is identified, and thus will ensure the RRP will be implemented appropriately to provide sufficient protection to listed species and their component populations.
- Providing incentives to communities for early implementation of the RPA's habitat protections, describing compliance benchmarks to monitor RPA implementation, and requiring that FEMA take necessary steps to enforce any community non-compliance (RPA Element 6). By linking RPA compliance to probation and suspension, local communities' compliance with aspects of the NFIP related to preserving natural floodplain functions will be reviewed and managed by FEMA and DLCD with the same level of scrutiny as other standards of the NFIP. RPA Element 6 outlines FEMA's obligation to monitor local compliance with the standards of the RPA as components of the NFIP.

2.8.4.2 Consistency with Purpose of the Proposed Action

This RPA is consistent with the purpose of FEMA's proposed action and the National Flood Insurance Program as authorized by the NFIA and described in Section 1.3 of this opinion. The purposes of the NFIA are to provide affordable flood insurance throughout the nation, encourage appropriate land use that will minimize the exposure of property to flood damage, and thereby reduce federal expenditures for flood losses and flood disaster assistance (see *National Wildlife Fed'n v. FEMA*, 2014 WL 5449859, at *1 (W.D. Wash., Oct. 24, 2014) (citations omitted). Specifically, the NFIP is a voluntary Federal benefit program that allows property owners in communities that choose to participate to obtain certain Federal benefits in exchange for agreeing to implement land use controls at least as restrictive as those promulgated by FEMA.[169] NFIP communities are eligible to purchase insurance as a protection against flood losses and to receive federal flood disaster assistance. To the extent that the RPA requires FEMA to adopt stricter land use provisions than it has previously promulgated, this is consistent with the intended purpose of FEMA's proposed action, which included conservation measures specifically intended to satisfy ESA requirements. It is also consistent with the NFIA and FEMA's regulations, because the RPA will limit future construction in areas exposed to flooding, as well as decrease over time the number of structures vulnerable to flood losses, thereby reducing federal flood expenditures. The NFIA provides:

> 42 U.S.C. 4001(c): The Congress further finds that (1) a program of flood insurance can promote the public interest by providing appropriate protection against the perils of flood losses and encouraging sound land use by minimizing exposure of property to flood losses; and (2) the objectives of a flood insurance program should be integrally related to a unified national program for flood plain management. . .
>
> 42 U.S.C. 4001(e): It is the further purpose of this chapter to (1) 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, (2) guide the development of proposed future construction, where practicable, away from locations which are threatened by flood hazards, (3) encourage lending and credit institutions, as a matter of national policy, to assist in furthering the objectives of the flood insurance program, (4) assure that any Federal assistance provided under the program will be related closely to all flood-related programs and activities of the Federal Government, and (5) authorize continuing studies of flood hazards in order to provide for a constant reappraisal of the flood insurance program and its effect on land use requirements.
>
> 42 U.S.C. 4102(c): …the Administrator shall from time to time develop comprehensive criteria designed to encourage…the adoption of adequate State and local measure which, *to the maximum extent feasible*. will – (1) constrict the development of land…(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) othwerise improve the long-range land management and use of floodprone areas[.]

[169] "There has been little progress toward curtailing disastrous flood losses by planning for and controlling the uses of flood-prone lands. Development of such lands has continued, making the [national flood insurance] program's objective more difficult to achieve." Comptroller General 1975.

44 CFR codifies FEMA's obligations under the NFIA as follows:

> 44 CFR 60.1 Purpose of subpart.
>
> (a) The Act provides that flood insurance shall not be sold or renewed under the program within a community, *unless the community has adopted adequate flood plain management regulations consistent with Federal criteria. Responsibility for establishing such criteria is delegated to the Federal Insurance Administrator*.
>
> (b) This subpart sets forth the criteria developed in accordance with the Act by which the Federal Insurance Administrator will determine the adequacy of a community's flood plain management regulations. *These regulations must be legally-enforceable, applied uniformly throughout the community to all privately and publicly owned land within flood-prone, mudslide (i.e., mudflow) or flood-related erosion areas*, and the community must provide that the regulations take precedence over any less restrictive conflicting local laws, ordinances or codes. Except as otherwise provided in § 60.6, *the adequacy of such regulations shall be determined on the basis of the standards set forth in § 60.3 for flood-prone areas, § 60.4 for mudslide areas and § 60.5 for flood-related erosion areas.*
>
> (c) Nothing in this subpart shall be construed as modifying or replacing *the general requirement that all eligible communities must take into account flood, mudslide (i.e., mudflow) and flood-related erosion hazards*, to the extent that they are known, in all official actions relating to land management and use.
>
> (d) *The criteria set forth in this subpart are minimum standards for the adoption of flood plain management regulations by flood-prone, mudslide (i.e., mudflow)-prone and flood-related erosion-prone communities*.

The NFIP is intended to be implemented by FEMA as part of a larger "unified national program for floodplain management." [170] 42 U.S.C. 4001(c). 1n 1986, FEMA stated that "'A Unified National Program for Floodplain Management' calls for continuing efforts that seek to reduce and keep flood losses at acceptable levels while recognizing, preserving, and restoring the floodplain's natural values through wise use of water and related land resources" (FEMA 1986), and made a general statement regarding floodplain use: "Development in or adversely affecting floodplains should be avoided unless it is considered necessary from a public interest standpoint and unless no suitable alternative exits. Avoidance of development in high hazard areas is the preferred approach for minimizing losses to people, property, and natural floodplain values."

In 1994 the Federal Interagency Floodplain Management Task Force (FIFMTF) stated in its document "The Unified National Program for Floodplain Management," "if uncontrolled development and use of floodprone lands by unsuspecting or ill-informed people is allowed – we

[170] "A Unified National Program for Managing Flood Losses" in August 1966 concluded that the Nation needed a broader and more unified national program to manage flood losses. It noted that structural measures had helped, but addtional measures directed to *land use planning* were required." Comptroller General 1975.(emphasis added).

end up with unacceptable loss of life and property, and often irreparable harm to the natural functions of floodplains upon which we rely. Wise land use practices – delineation of sensitive areas, planning, management and restoration – are essential for allowing the continued use of valuable floodplain assets while at the same time safeguarding them against abuse" (FIFMTF 1994). The 1994 Unified Program report outlined several goals, among them a goal to "[r]educe, by at least half, the risks to life, property, *and the natural resources of the nation's floodplains*" (emphasis added). The Unified National Program defines natural resources of floodplains as "all of the resources and benefits provided by floodplains under natural (or nearly natural) conditions, along with the biologic and hyrologic functions that floodplains normally perform." "Objective d." of this goal is to "[r]educe by at least half the risk of degradation of the most important natural resources of the Nation's floodplains, by 2020." Given the priority that Congress placed on preserving the ecosystems upon which endangered and threatened species depend, it stands to reason that those floodplains which provide habitat values for ESA-listed species should be construed as among those that the Unified Program identified as needing a 50 percent reduction in degradation by 2020.

All elements of the RPA, when adopted by FEMA, will promote wise use,[171] encourage appropriate land use adjustments to constrict the development of land in flood-prone areas, guide the development of proposed future construction away from flood hazard areas, require state and local communities as a condition of NFIP participation to adopt adequate floodplain ordinances with effective enforcement provisions consistent with Federal standards to reduce and avoid future flood losses, and accurately identify flood risks and provide flood risk information to the public. While the RPA was specifically designed to protect habitat values needed to support listed fish species, it will co-incidentally serve the NFIA's purposes of reducing tax-payer funded flood expenditures. As explained in the 1994 Unified National Program report, preservation and restoration of natural floodplain resources "reduces the risk to human resources because many of the normal hydrologic and biologic functions of natural floodplains act to mitigate the intensity, extent, and damaging aspects of flooding" (FIFMTF 1994). Also, as stated by the Interagency Task Force on Floodplain Management (2007), "Natural and beneficial values also include the floodplain's capability to convey and store floodwaters, recharge groundwater, and preserve water quality. These values can have a direct and significant impact on public health and safety, property damages, and economic well-being of a community" (p. 17).

The RPA will also fulfill FEMA's objective of implementing the NFIP in Oregon in a manner that does not jeopardize ESA-listed species or destroy or adversely modify their critical habitat. The RPA, while crafted to preserve natural floodplain functions that provide habitat for listed species in Oregon, could be implemented within the framework of the program to more fully achieve the NFIP's primary purposes in any, or every, NFIP participating community.

[171] "**Wise use** of floodplain means enjoying the benefits of floodplain lands and waters while still minimizing the loss of life and damage from flooding **and at the same time** preserving and restoring the natural resources of floodplains as much as possible. Wise use thus is any activity or set of activities that is compatible with both the risks to the natural resources of the floodplains and the risks to human resources (life and property)." FIFMTF 1994 (emphasis in original).

2.8.4.3 Within the Scope of Action Agency's Authority and Jurisdiction

The RPA is within the scope of the Federal Agency's legal authority and jurisdiction as set forth by the NFIA:

42 U.S.C. 4002(b) - Purpose:

(1) substantially increase the limits of coverage authorized under the national flood insurance program;
(2) provide for the expeditious identification of, and the dissemination of information concerning, flood-prone areas;
(3) require States or local communities, as a condition of future Federal financial assistance, to participate in the flood insurance program and to adopt adequate flood plan ordinances with effective enforcement provisions consistent with Federal standards to reduce or avoid future flood losses; and
(4) require the purchase of flood insurance by property owners who are being assisted by Federal programs or by federally supervised, regulated, or insured agencies or institutions in the acquisition or improvement of land or facilities located or to be located in identified areas having special flood hazards.

42 U.S.C. 4102 – Criteria for land management and use[172]
(c) The Director shall from time to time develop comprehensive criteria designed to encourage, where necessary, the adoption of adequate State and local measures which, to the maximum extent feasible, will:

(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, and he shall work closely with and provide any necessary technical assistance to State, interstate, and local governmental agencies, to encourage the application of such criteria and the adoption and enforcement of such measures.[173]

[172] " Congress knew this was not a sound actuarial program but agreed to take the that risk only because we could get land use." Statement of Mr. Bernstein, p 36 …. "We are encouraged that the administration proposal continues a firm position with repsect to adequate and responsive land use control measures. We consider such requirements to be absolutely essential to the long-range success of the flood insurance program. Without such provisions to control future development of flood-prone area, continuance of a viable flood insurance program could very well be in jeopardy." Statement of Robertson Mackay, Chairman, National Flood Insurers Association. Excerpted from Hearings on the Expansion of the National Flood Insurance Program, May 1973.

[173] 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 1975 Comptroller's Report indicated that "The Flood Disaster Protection Act of 1973, should provide greater incentive to localities *to regulate the development of flood-prone lands if FIA (1) properly implements the provisions of the act*."(p 47); and the NFIP's "provisions provide powerful incentives and sanctions for the local recognition of the extent of flood hazards and the adoption of local *measures designed to restrict the use of land in flood-hazard areas."* Appendix II, p 55 (emphasis added).

These sections of the NFIA appear to give FEMA broad discretion in developing the federal floodplain management standards, including discretion to fashion criteria to protect listed species, as has been noted by several federal courts: "In developing the minimum eligibility criteria, the NFIA authorizes FEMA to guide development of proposed construction away from locations threatened by flood hazards and to 'otherwise improve the long-range land management and use of flood-prone areas.' . . . Pursuant to either of these purposes, FEMA has the discretion to revise the minimum eligibility criteria to benefit [ESA listed] salmon." *National Wildlife Fed'n v. v. FEMA*, 345 F. Supp. 2d 1151, 1173-74 (W.D. Wash. 2004); *see also Florida Key Deer v. Paulison*, 522 F.3d 1133, 1142 (11th Cir. 2008) (the NFIA's "purposes are broad and contemplate restriction of land development and consideration of whether a locality's land-use measures will 'otherwise improve' land management and use. Therefore, although FEMA is required to issue flood insurance to localities that satisfy certain criteria, FEMA itself is charged with developing those criteria and enjoys broad discretion in so doing."); *Florida Key Deer v. Stickney*, 864 F. Supp. 1222, 1239 (S. D. Fla. 1994) ("The NFIA [] gives FEMA broad discretion to establish specific criteria of eligibility for communities to participate in the NFIP.").

Furthermore, the RPA is consistent with EO 13653,[174] EO13690, EO 11988, the requirement by regulation that FEMA restore and preserve the natural and beneficial values served by floodplains (44 CFR 9.2), and the requirement by regulation that FEMA take into account environmental considerations when authorizing or approving major actions[175] that significantly affect the environment (44 CFR 10). NMFS identifies floodplain connectivity, flood storage, fish refugia, hyporheic function, and complex riverine habitat, among others, as natural and beneficial functions of floodplains that simultaneously provide valuable benefit to listed salmonids and to their critical habitat where designated. To the degree that the RPA requires FEMA to adopt standards, revise protocols, modify procedures, and alter policies to better preserve natural and beneficial values of floodplains, this is consistent with FEMA's codified authority and policy:

44 CFR 9 Floodplain Management and Protection of Wetlands

§ 9.2 Policy

> (a) FEMA shall take no action unless and until the requirements of this regulation are complied with.
>
> (b) It is the policy of the Agency to provide leadership in floodplain management and the protection of wetlands. Further, the Agency shall integrate the goals of the

[174] "…all agencies shall…reform policies and Federal funding programs that may, perhaps unintentionally, increase the vulnerability of natural or built systems, economic sectors, natural resources, or communities to climate change related risks." EO13653, Preparing the United States for the Impacts of Climate Change, Section 2, Modernizing Federal Programs to Support Climate Resiliant Investement.

[175] 44 CFR 9.4 defines "action" to include "conducting Federal activities and programs affecting land use, including, but not limited to, water and related land resources, planning, regulating and licensing activities." FEMA's regulations further define "actions affecting or affected by floodplains or wetlands" as "actions which have the potential to result in the long- or short-term impacts associated with (a) the occupancy or modification of floodplain, and the direct or indirect support of floodplain development."

Orders [*Executive Order 11988, Floodplain Management, and Executive Order 11990, Protection of Wetlands*] to the greatest possible degree into its procedures for implementing NEPA. The Agency shall take action to:

(1) Avoid long- and short-term adverse impacts associated with the occupancy and modification of floodplains and the destruction and modification of wetlands;

(2) Avoid direct and indirect support of floodplain development and new construction in wetlands wherever there is a practicable alternative;

(3) Reduce the risk of flood loss;

(4) Promote the use of nonstructural flood protection methods to reduce the risk of flood loss;

(5) Minimize the impact of floods on human health, safety and welfare;

(6) Minimize the destruction, loss or degradation of wetlands;

(7) Restore and preserve the natural and beneficial values served by floodplains;

(8) Preserve and enhance the natural values of wetlands;

(9) Involve the public throughout the floodplain management and wetlands protection decision-making process;

(10) Adhere to the objectives of the Unified National Program for Floodplain Management; and

(11) Improve and coordinate the Agency's plans, programs, functions and resources so that the Nation may attain the widest range of beneficial uses of the environment without degradation or risk to health and safety.

44 CFR 10 Environmental Considerations - Subpart A - General

§ 10.2 Applicability and scope.

The provisions of this part apply to the Federal Emergency Management Agency, (hereinafter referred to as FEMA) including any office or administration of FEMA, and the FEMA regional offices.

§ 10.4 Policy.

> (a) FEMA shall act with care to assure that, in carrying out its responsibilities, including disaster planning, response and recovery and hazard mitigation and flood insurance, it does so in a manner consistent with national environmental policies. Care shall be taken to assure, consistent with other considerations of national policy, that all practical means and measures are used to protect, restore, and enhance the quality of the environment, to avoid or minimize adverse environmental consequences, and to attain the objectives of:
>
> > (1) Achieving use of the environment without degradation, or undesirable and unintended consequences;
> >
> > (2) Preserving historic, cultural and natural aspects of national heritage and maintaining, wherever possible, an environment that supports diversity and variety of individual choice;
> >
> > (3) Achieving a balance between resource use and development within the sustained carrying capacity of the ecosystem involved;

Additional discussion regarding FEMA's authority to implement the RPA is provided in NMFS' In-Consultation Memorandum, Responses to Action Agency Comments on Reasonable and Prudent Alternative, included in the record for this consultation. Finally, NMFS notes that, under the ESA, FEMA is required to use the full extent of its statutory authority to conserve listed species. 16 U.S.C. 1531(b); *Tennessee Valley Auth. v. Hill*, 437 U.S. 153, 185 (1978); 51 FR at 19937. NMFS finds relevant the reasoning of the Eleventh Circuit Court of Appeals in its decision in *Florida Key Deer v. Paulison*, 522 F.3d at 1144: "Here, FEMA has the authority in its administration of the NFIP, as discussed above, 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.

2.8.4.4 Economic and Technical Feasibility

The RPA is economically feasible because, while FEMA (and local communities) will see some increased administrative costs from implementation of the RPA, including compliance with the monitoring and reporting requirements, those costs will be insignificant in terms of the FEMA budget and will be balanced by the financial benefits provided by the RPA. The financial benefits of the RPA include: (1) avoiding the costs associated with floodplain development actions covered by the incidental take statement included in this consultation that would otherwise warrant ESA consultation; (2) contributing to the solvency of the NFIP by reducing the risk of flood damage in Oregon by limiting the siting of structures in high flood hazard areas and requiring mitigation for loss of natural floodplain functions; (3) ensuring communities have sustainable economies resistant to disruption due to flooding; (4) reducing community liability associated with inducing additional flood impacts on other properties by permitting development in the floodplain; (5) reducing the rate at which local communities are increasing their reliance on Federal resources; (6) providing participating communities the opportunity to receive additional CRS credits that contribute to potential premium reductions for landowners throughout the community (not just those in the floodplain); (7) providing monetized benefits associated with improved ecosystem services, including protections provided by non-structural flood mitigation features; (8) contributing to the restoration of commercial and recreational fisheries that provide support to local and national economies, and providing associated tax revenues; and (9) avoidance of aggravating flood risk with build-out by employing floodplain mitigation.[176] Some associated costs (e.g., use the most accurate topography and elevation data available) are otherwise required by existing legislation (Biggert-Waters Flood Insurance Reform Act of 2012, Homeowner Flood Insurance Affordability Act of 2014) and thereby are not attributable to the RPA.

With regard the economic feasibility of the RPA elements related to mapping in particular, we point to FEMA's own statement in 1988, that "[m]aping of future conditions floodplains should result in fewer necessary revisions to the NFIP maps, therefore lowering FEMA's costs in the long-term…The costs to produce the hydraulic analysis, review the future conditions hydrologic and hydraulic analyses, and map the future conditions floodplain would not differ greatly from current average Flood Insurance Study costs" (FEMA 1988). While these statements address only two aspects of modified mapping in the RPA, for the remainder we point to a 2013 report that provides a cost analysis for flood mapping, which indicates that providing more accurate maps for the entire nation could be achieved within a 10 year period at a cost of roughly 7 billion dollars[177] (ASFPM 2013b). Adequate mapping can be done in many areas using new processes for about $300/mile (pers. comm. 10/3/14, Larry Larson, PE CFM, Senior Policy Advisor ASFPM). "[T]he state of North Carolina has demonstrated that lidar mounted on vehicles can be used to determine individual structure elevations on a large scale and at low cost. It has also shown that a digital environment that displays information on flood hazard, structure vulnerability, and flood risk management options for individual structures can be created at relatively low cost ($3,000–$12,000 per county in North Carolina)" (NAS 2015).

Similarly, a study prepared as part of an overall evaluation of the NFIP indicates that revising the NFIP to anticipate future flood conditions would be cost effective: "An obvious observation is that building in the watershed does change the flood conditions and can greatly increase the damage to structures. Increasing the flood conditions will change the design level base flood elevation (BFE) and/or alter the 100-year floodplain. This in turn can expose more buildings, especially existing buildings, to damage. As this study demonstrates the increased damage to buildings can be multiple orders of magnitude depending on the flood conditions. Even in the areas with only minor differences in the flood elevations and subsequent flood depth, estimated savings [of future conditions floodplain management] could easily be in the millions of dollars…" (Blaise *et al.* 2006). Where the RPA requires mapping previously unmapped areas

[176] The benefit-cost ratio of FEMA Hazard Mitigation grants is illustrative of this assertion. The Flood Mitigation Assistance Program created with the National Flood Insurance Reform Act of 1994 funds flood hazard reduction grants. One study revealed that "[a]ll individual flood grants [it evaluated] had benefit-cost ratios greater than 1.0, with an average benefit-cost ratio of 5.1, a minimum of 3.0, amaximum of 7.6, and a standard deviation of 1.1." (Rose *et al.* 2007).

[177] "Direct average annual flood damages have jumped from approximately $5.6 billion per year in the 1990s to nearly $10 billion per year in the 2000s, with some years much more that. But the costs of flooding go far beyond these direct losses." (ASFPM 2013b.)

based on size of watershed or application of 6 inch inundation rather than 1 foot inundation, FEMA may choose to use other mapping protocols that are more efficient and cost effective, such as those described by Sangwan and Merwade (2015).

With regard to elements of the RPA restrict development in high hazard areas as defined by the RPA, and that require mitigation for loss of flood storage, this steps are fiscally sound. Again, an evalauation of the costs and benefits of flood hazard mitigation grants revealed that those "projects also reduce the societal impacts of flooding by reducing injuries to the residents of the properties. For the flood project grant stratum, 22 grants had enough data to estimate casualty reduction benefits. The grants varied in size, with some mitigating many properties and others only a few. Overall, buying these properties reduced approximately 68 injuries for a total benefit of $12.3 million." (Rose *et al.* 2007.) Given the above, we conclude that the RPA is economically feasible because ultimately the benefits are greater than the costs associated with not implementing the RPA (Kousky and Walls 2013; Trautman 2014).

The RPA is technologically feasible because many of the measures in this RPA are: (1) based on similar measures already being implemented in the region (*e.g.*, CMZ mapping, development restrictions in a riparian buffer area, CLOMR review, mitigation requirements, balanced cut and fill (FEMA 2012; FEMA 2013a)); (2) consistent with measures proposed by FEMA in the BA and other agency documents (*e.g.*, FEMA 1999; TMAC 2000; FEMA 2002; FEMA 2010b); and (3) addressed in other scientific and technical literature on the subject (*e.g.*, Rapp and Abbe 2003; ASFPM 2007; ASFPM 2008) and NMFS' recovery plans (*e.g.*, ODFW and NMFS 2011; NMFS 2011d; NMFS 2013a). "[T]echnological advances (*e.g.*, increased computing power; availability of lidar and webbased mapping; new techniques for providing greater spatial resolution in hazard modeling) are enabling analyses that were not practical in the early 1970s, when NFIP methods were developed" (NAS 2015).

Specifically addressing the mapping of riverine erosion/channel migration zones, we again point to a FEMA document on this topic: "there are analytical procedures that can be used to characterize riverine erosion and that, depending on the application, can yield reliable results. For example, because of limititations in data availabilities [in 1999] it is extremely difficult to reproduce detailed time variation of stream movement*; however it is entirely feasible to analyze channel history and infer trends in the stream alignment and average migration rates*" (emphasis added) (FEMA 1999). The technical feasibility of flood-related erosion zone mapping is demonstrated by the State of New Hampshire's Innovative Land Use Planning Techinicques; A Handbook for Sustainable Development Chapter 2.9 Fluvial Erosion Hazard Area Zoning, which demonstrates mapping methods developed by the State with funding from FEMA in 2008. The State of Vermont has developed and adopted regulations that combine NFIP floodplain and Fluvial Erosion Hazard zone regulations. The Washington State Department of Ecology has employed a "planning level" channel migration zone mapping construct that has allowed them to map almost 600 miles of channel migration areas in 4 months (Pers. comm. Patricia Olson 5/21/15). Finally Pierce County Washington has mapped several channel migration zones and currently manages the high risk channel migration areas with the same development restrictions as apply in the designated floodway.

Regarding the feasibility of increasing restriction on land use, we find the statement of the Comptroller General in 1975 still relevant:“[t]here are several ways of regulating the use of flood plains. For example, to avoid flood damage from a 100-year flood level, one of the following techniques could be used: – eliminate construction in the 100-year flood area – restrict land use to functions, such as recreationand farming, that will not be severly damaged by floods...” (Comptroller General 1975).

2.8.4.5 Comparison with 2008 Jeopardy Biological Opinion for Puget Sound

While several components of the RPA differ from those of the RPA prepared in 2008 (see Appendix 2.4-A for greater detail) as part of the jeopardy biological opinion on the effects of the NFIP on listed species in Puget Sound (NMFS 2008c), the NFIP itself has been revised and requires both study and accompanying regulatory revisions, with its re-authorization via the Biggert-Waters Flood Insurance Reform Act of 2012 (Biggert-Waters Act). For example:

1. Sec. 100215(d) Future Conditions Risk Assessment and Modeling Report,
2. Sec. 100216 National Floodplain Mapping – parts (b)(1)(A); (2); (3)(C); & (D),
3. Sec. 100226 Flood Protection Structure Accreditation Task Force – parts (b)(3)(B) & (c),
4. Sec. 100231 Studies and Reports – parts (e)(1)(B)(iii)&(iv), and
5. Sec. 100248 Flood Protection Improvements Constructed on Certain Properties – parts (b)(1)(A),(B),&(C).

The NFIP has also been revised by the Homeowner Flood Insurance Affordability Act of 2014 (HFIAA), which requires both study and accompanying regulatory revisions:

1. Sec. 14 Accounting for Flood Mitigation Activities in Estimates of Premium Rates,[178]
2. Sec. 17 Flood Insurance Rate Map Certification,
3. Sec. 22 Exemption From Fees For Certain Map Change Requests,[179]
4. Sec. 27 Mapping of Non-Structural Flood Mitigation Features,
5. Sec. 28 Clear Communications,
6. Sec. 30 Mapping.[180]

Other factors that influenced unique aspects of RPA development in Oregon include:

1. The ESA consultation on NFIP implementation applies statewide in Oregon, but was limited in Washington to Puget Sound;
2. FEMA has revised the CRS (FEMA 2013) since the time of the Puget Sound consultation;
3. FEMA’s proposed action differed from the proposed action presented for Puget Sound;

[178] Requires FEMA give consideration to land use measures and flood forecasting when determining flood insurance premiums.

[179] Exempts the fee requirement for flood insurance rate map change requests for habitat restoration projects that are funded in whole or in part with Federal or state funds, including dam removal, culvert redesign or installation, or the installation of fish passage.

[180] Requires FEMA to provide notification of the flood model they intend to use and an explanation of why the model is appropriate.

4. Experience with implementing the Puget Sound RPA indicates that some RPA provisions would benefit from more clear assignment of responsibility, accountability, applicability, and/or level of detail;
5. An interest to providing increased clarity regarding mitigation and compliance;
6. Recognition that floodplain development cannot be wholly avoided; and
7. An awareness of issues raised in litigation between FEMA and third parties on RPA implementation and ESA compliance.

2.9 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). For this consultation, we interpret "harass" to mean an intentional or negligent action that has the potential to injure an animal or disrupt its normal behaviors to a point where such behaviors are abandoned or significantly altered. Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of an incidental take statement.

2.9.1 Amount or Extent of Take

In the biological opinion, NMFS concluded that the proposed program was likely to result in take among 18 ESA-listed species (see Section 2.4). The changes to the implementation of the NFIP in Oregon made by the RPA will allow implementation while no longer jeopardizing those ESA-listed species or destroying or adversely modifying their designated critical habitat. Avoiding jeopardy to anadromous salmon avoids prey-based effects on Southern Resident Killer Whales. While the RPA reduces the duration, magnitude, and intensity of take, it will not wholly avoid take. Consequently, under the RPA, take of 17 ESA-listed anadromous fish species that occur in the inland waters of the action area remains reasonably certain to occur. For Southern Resident Killer Whales, the proposed action would reduce their prey base and, over time, lead to jeopardy to this species as explained in our biological opinion above. Implementation of the RPA is expected to significantly reduce the death of Chinook salmon, avoiding extinction of the Chinook ESUs found in Oregon – as these are the killer whale prey at issue here, we therefore, expect the implementation of the RPA to avoid harm to Southern Resident Killer Whales. In other words, the RPA will not cause take of Southern Resident Killer Whales.
Under the RPA, NMFS concludes that incidental take would still occur:

1. Salmon and steelhead – Harm of juveniles and, to a lesser degree, adults is the primary category of take that results from floodplain development conducted under the NFIP

standards as modified by the RPA. Development in the floodplain, with the exception of habitat restoration activities, permanently and incrementally removes, degrades, or prevents the natural habitat functions (*e.g.*, off-channel habitat), including habitat processes (*e.g.*, channel migration), upon which the species depend for their successful spawning, rearing, migration, and reproduction. Thus each project that alters natural floodplain functions incrementally contributes to the adverse modification of floodplain functions and the take of ESA-listed species. Under the RPA, the significance of those effects are expected to be limited by restrictions on development in the most sensitive areas and the timely implementation of offsetting mitigation activities, such that, over time, effects will not aggregate or impact successive year classes of salmon and steelhead. Where floodplain development occurs, however, some individuals of the listed species may continue to be directly wounded or killed during flood events due to impingement (*e.g.*, screened foundation vents), or trap/capture (*e.g.*, in structures or depressions), and alteration of habitat function (e.g., reduction in water quality, increase in high flows, decrease in low flows). Furthermore, a certain degree of mapping error is unavoidable. Where mapping inadvertently excludes areas at risk of flooding and erosion, harm is likely as result of development in such areas due the permanent loss of floodplain habitat and functions.

During the 8.5 year RPA implementation period, take is likely to occur as floodplain development continues, although the measures in RPA Element 2, which require mitigation, and restrict development in the floodway and riparian buffer zone, will reduce the amount of take. Mitigation for development that occurs during the interim period is most likely to occur after the development occurs, and as such we anticipate a temporal loss of function, leading to harm. As FEMA and communities commence mapping and regulatory changes, the amount of take is expected to decline. That amount of take will decline further with increasing levels of implementation of the RPA at Federal, state, and local levels reaching the lowest level of residual take by September 2024.

2. Southern green sturgeon – Take is largely limited to harm of adult and sub-adult life stages. Floodplain development increases the level of contaminants in waterways, particularly during flood events, and in riverine substrates. Even under the RPA, this will continue to occur as flood waters are displaced and flood elevations increase due to ongoing development and climate change. Exposure would occur seasonally during summer and early fall when individuals occupy estuaries and lower reaches of coastal river systems in the action area, predominately the Columbia River. As such, individuals are not likely directly exposed to flood-sourced contaminates during periods of high flow. However, indirect effects of flood-sourced contaminants include contact with contaminated substrate and through the consumption of contaminated prey. Background levels of some contaminants are high in some reaches occupied by Southern green sturgeon and some individuals are likely repeatedly exposed over the course of their lives. Consequently, it is reasonably certain that some individuals will experience harmful health effects as a result of periodic exposure to contaminants.

3. Southern eulachon – Harm of eggs and larvae is the primary category of take that results from floodplain development conducted under the NFIP standards. Floodplain

development increases the level of contaminants in waterways, particularly during flood events, and the riverine substrates. The seasonal presence of eulachon in late winter through early summer coincides with the high flow period. Consequently, Southern eulachon are directly exposed to flood-sourced contaminates in the water column and sediments, including adults, eggs, and larval life stages. Considering the high surface to body mass ratio of these life stages and the developmental sensitivity of early life stages, it is reasonably certain that some individuals will experience detrimental health effects as a result of periodic exposure to contaminants. In addition, increases in flow volume and velocity that result from floodplain development are likely displace individuals or eggs, bury eggs, accelerate their departure from the river system, and likely cause injury or death to some individuals. Other physical habitat changes are likely to adversely modify preferred habitats (*e.g.*, simplified channel forms, altered substrate composition) and adversely affect their run timing, spawning success, and migration pathways.

Table 2.9-1. The species and the expected forms of associated take incidental to implementing the NFIP in Oregon.

	Take Category									
	Harass	Harm	Pursue	Hunt	Shoot	Wound	Kill	Trap	Capture	Collect
Salmon and Steelhead										
Willamette-Lower Columbia Domain										
LCR Chinook		X				X	X	X		
LCR coho		X				X	X	X		
LCR steelhead		X				X	X	X		
CR chum		X				X	X	X		
UWR steelhead		X				X	X	X		
UWR Chinook		X				X	X	X		
Interior Columbia Domain										
UCR sp Chinook		X				X	X	X		
UCR steelhead		X				X	X	X		
SR sp/su Chinook		X				X	X	X		
SR fall Chinook		X				X	X	X		
SR sockeye		X				X	X	X		
SR steelhead		X				X	X	X		
MCR steelhead		X				X	X	X		
Oregon Coast Domain										
OC coho		X				X	X	X		
Oregon & Northern California Coasts Domain										
SONCC coho		X				X	X	X		
Other Anadromous Fishes										
So. Green Sturgeon		X				X				
So. Eulachon		X				X	X			

Under the proposed action, as modified by the RPA, take in the form of harm is still likely to occur, but in fewer locations, less often, and with less duration.

One circumstance in which NMFS anticipates additional take is the period prior to full RPA implementation (September 2024). During this period we expect that even with the implemented measures of RPA Element 2, some take will initially occur in the form of harm at roughly the same rate as exists under the baseline conditions of the unmodified NFIP. The rate would decline as RPA as required mitigation is put in place under Element 2, and would further decline as additional components of the remaining RPA Elements are implemented by FEMA and local governments

A second circumstance in which NMFS expects take to occur is after the RPA is fully implemented, when floodplain development activities occur for which mitigation (1) is after the fact, (2) has delayed efficacy, or (3) fails to meet performance expectations. NMFS recognizes that certain types of mitigation can themselves have temporary detrimental effects that are harmful to fish (*e.g*., noise, habitat disturbance, sediment) and therefore includes mitigation specifically in the extent of take.

Per RPA Element 2, NMFS anticipates that FEMA and NFIP communities will begin to implement the interim protective measures within 6 months of the date of this opinion. Accordingly, take in the form of harm from floodplain developments that is not otherwise exempted from ESA section 9 (*e.g.*, through a separate section 7 consultation or incidental take permit) and occurs prior to 2024 is <u>not</u> exempt from the section 9 prohibition on take, unless the jurisdiction in which the development is occurring demonstrates to FEMA and NMFS that it has complied with RPA Element 2 within 2 years of the date of this opinion, and, in the years thereafter, with the other RPA elements per the associated timelines.

In addition, take is expected to occur at declining levels throughout the 8.5 years NMFS projects to achieve full implementation, and even when all elements of the RPA are being carried out, some residual take will occur. This ITS addresses expected take under all of these scenarios. Individual activities that proceed under separate section 7 consultations will be considered by NMFS individually for their effects, and take will be identified appropriately under those reviews. NMFS assumes that irrespective of a Federal nexus, the location of future development in the floodplain will be subject to local government permitting and that the standards for avoiding habitat degradation identified in this RPA will apply. This program-level consultation and the RPA allow floodplain development activities to proceed so long as they are in compliance with the floodplain management criteria as revised by the RPA. Because take under the RPA will occur primarily in the form of habitat degradation as the cause of harm, and because the numbers of fish within the various cohorts and populations is not a static number, varying over time and influenced by a variety of environmental conditions, NMFS is unable to articulate a number of fish that may be injured or killed. Therefore, NMFS has described in this ITS expected levels of floodplain development as the source of harm, measured in acres, by county. When a jurisdiction approaches the extent described, additional development may proceed if an ESA section 10(a)(1)(B) Habitat Conservation Plan is developed that both avoids jeopardy/adverse modification of designated critical habitat, and furthers the conservation needs of the listed species.

In the context of this incidental take statement, development that would result in take includes removal of vegetation, installation of structures that occupy space or reduce the flood water storage capacity of a floodplain, grading of land, creation of impervious surfaces, installation of structures capable of trapping or impinging fish during a flood (*e.g.*, open foundation with screened openings), placement of fill, and other disturbance activities that detrimentally alter the existing value of the floodplain habitat to ESA-listed anadromous fish.[181] These activities will harm, injure, or kill ESA-listed anadromous fish.

While NMFS is certain that some floodplain developments that are carried out under the proposed program as modified by the RPA will harm, injure, and kill some individuals of the 17 ESA-listed anadromous fish species that occur in the action area, and that some of these developments would not require a separate section 7 consultation, there is insufficient information available about those future developments to identify a specific amount of take. For instance, because FEMA does not have information regarding the amount of fill placed in the floodplain or the area of floodplain impacted by development, there is no way to predict the number, location, type, design, or duration of any given future development activities and their associated specific effects. Consequently, NMFS chooses to identify the extent of take at the program scale as a surrogate to an amount of take enumerating individual fish.

The extent of take corresponds to a proportion of the currently delineated SFHA acreages, as of the date of this opinion, by county (inclusive of the incorporated jurisdictions within those counties), that may be temporarily and/or permanently disturbed due to floodplain development activities. Take may be exempted for development actions occurring in the floodplain through separate section 7 consultation, and for floodplain development actions that occur after full RPA implementation, but would which not require a separate section 7 consultations (*e.g.*, in the floodplain but not in wetlands, and not relying on Federal funding).

NMFS estimates, by county, and including the incorporated jurisdictions within the county, the total acres of floodplain expected to be developed following full implementation of the RPA, as an appropriate surrogate measure of take, because the amount of disturbance in the floodplain is associated with diminishment in the habitat conditions that are necessary for juvenile refuge, rearing, feeding, growth, development, maturation and survival. Moreover, development activities typically involve vegetation or ground disturbance; these impair habitat features such as cover, shade, woody debris, and water quality, each of which bears on the success of juvenile to adult survival among listed fish species. The extent of take that NMFS estimates is measured by county and includes the communities therein:

- from mitigated development – equivalent to 1.25 % of the total SFHA,
- from the mitigation activities – 1.875% of the total SFHA (measured as the 1.25% rate of the development with an expected mitigation ratio of 1.5 to one),
- from restoration activities – 1.25% of the total SFHA, but the acreage “limit” on restoration will renew every 2 years, as we anticipate that these activities will continue at

[181] In this context, development does not include routine maintenance of existing structures, the installation of sign posts, or other activities that do not alter the existing value of the floodplain habitat to ESA-listed anadromous fish.

current levels, whereas NMFS expects other types of floodplain development activities to decline as the RPA is implemented.

(See Table 2.9-2). The estimated extent of take represents a minor portion of the existing remnant floodplain habitat in which we expect development will occur, and which is directly associated with activities that harm ESA-listed anadromous species, and which NMFS expects to occur with a loss of function (further described below).

The take surrogate was chosen because:

1. Floodplain development typically affects floodplain functions in a manner that harms anadromous fish and is likely to continue to do so, although to a lesser degree, even when the RPA and its associated mitigation requirements are fully implemented. Additionally, some development is likely to occur in the HHA because it is an allowed use (*e.g.*, water dependent, opens space, etc.), therefore a small amount of take is likely to occur with some of those development actions. Most floodplain development causing take would not require an individual section 7 consultation.
2. Mitigation consistent with the RPA may not immediately replace functions and features impaired by the development, therefore, some take can be expected as the impact of the development necessitating the mitigation 'catches up with' the benefcial impacts of the mitigation. For this reason, take associated with the amount of landscape modified for mitigation purposes is separately identified.
3. The amount of habitat loss due to floodplain to development, including fill, is measureable, and if undertaken in compliance with this RPA, is expected to occur at a scale that would not result in diminishment of habitat conditions to such a degree as to reduce viability parameters of any identified population of any listed species.

Consequently, our expectation is the majority of floodplain development proceeding in compliance with the NFIP as modified by this RPA will proceed under the jurisdiction of local governments, but the larger portion of these are unlikely to have other federal section seven obligations (*e.g.*, due to probable location in floodplain areas which are, for example upland from Corps jurisdiction, development likely would not require an individual section 7 consultation). NMFS also anticipates that remaining development would either avoid take by avoiding impacts by design when located in the HHA, or by mitigating impacts when in the remainder of the floodplain. The amount of floodplain development that NMFS anticipates will occur under this incidental take authorization is specifically identified in Table 2.9-2. Thresholds for re-initiation are based on a combination of these thresholds being exceeded.

Table 2.9-2 describes separate aspects of the extent of take anticipated for (1) development activities, (2) mitigation activities implemented to offset adverse effects associated with development activities, and (3) floodplain restoration actions. This is appropriate because, while such activities by design result in a beneficial outcome, they typically involve vegetation or ground disturbance that causes limited-duration harm to the listed species.

The compensatory mitigation and restoration aspects of the extent of take were chosen because:

1. While largely beneficial to listed species, such activities typically affect floodplain functions in a manner that harms anadromous fish but these effects are of limited scale, duration, intensity, and severity.
2. NMFS assumes that most floodplain restoration activities that occur outside of the active channel would not include a Federal nexus, or would be exempt from pre-development review
3. NMFS assumes the RPA limits the amount of future floodplain development, and therefore the amount of development that would occur with corollary required mitigation will be employing the 1:1.5 ratio.

Because our expectation is that harm associated with mitigation and restoration activities will be of short duration, and because mitigation will offset and limit the magnitude and duration of the take associated with floodplain development, we have identified an extent of take for mitigation that exceeds the extent of take for development. Because habitat restoration is encouraged and expected to continue at least at current levels under the RPA, NMFS identifies take resulting from restoration on a rolling calculation renewed every 2 years to the maximum total, on the assumption that the benefits to habitat carrying capacity promptly establish positive conditions for increasing population productivity and abundance. The amount of take anticipated with restoration therefore renews every 2 years from the date of this opinion.

The extent of take includes all forms of development activities that may occur in flood-prone areas within FEMAs jurisdiction, *i.e.*, development as previously defined herein, mitigation activities, and habitat restoration activities.

Table 2.9-2. The habitat surrogate is used to estimate incidental take associated with implementing the NFIP in Oregon for development activities that do not require additional ESA section 7 consultation. The total development estimate is based on an area equivalent to .01 % of the existing SFHA. In this context, development means fill, removal of vegetation, installation of structures other than fill that occupy space or reduce the flood water storage capacity of a floodplain, grading of land, creation of impervious surfaces, installation of structures capable of trapping or impinging fish during a flood (*e.g.*, open foundation with screened openings), and other activities that detrimentally alter the existing value of the floodplain habitat to ESA-listed anadromous fish. The compensatory mitigation estimates exceed the development estimate anticipating that mitigation will have to occur at greater than a 1:1 ratio. The restoration estimate is commensurate with the development estimate, but would reset every 2 years, as we expect these activities to continue at current levels. These take estimates are meaningful and appropriate because the estimates directly correspond with the magnitude and duration of harm associated with floodplain development and the impairment of natural floodplain functions. Shading denotes counties outside of the action area. SFHA total area source: DLCD, May 11, 2012.

		Extent of Take Amount		
County	SFHA Total Area† (acres)	Development** Area Estimate (acres)	Mitigation Take Estimate (acres)	Restoration Take Estimate (acres)
Baker	59,072			
Benton	58,752	734	1,102	734
Clackamas	23,040	288	432	288
Clatsop	31,936	399	599	399
Columbia	56,576	707	1,061	707
Coos	73,792	922	1,384	922
Crook	23,680	296	444	296
Curry	38,976	487	731	487
Deschutes	11,776	147	221	147
Douglas	59,072	738	1,108	738
Gilliam	26,880	336	504	336
Grant	11,520	144	216	144
Harney	351,423			
Hood River	9,984	125	187	125
Jackson	39,232	490	736	490
Jefferson	14,592	182	274	182
Josephine	22,720	284	426	284
Klamath	297,023			
Lake	211,967			
Lane	137,855	1,723	2,585	1,723
Lincoln	38,016	475	713	475
Linn	113,216	1,415	2,123	1,415
Malheur	58,240			
Marion	54,848	686	1,028	686
Morrow	26,752	334	502	334
Multnomah	24,640	308	462	308
Polk	40,064	501	751	501
Sherman	10,560	132	198	132
Tillamook	39,616	495	743	495

County	SFHA Total Area† (acres)	Extent of Take Amount: Development** Area Estimate (acres)	Extent of Take Amount: Mitigation Take Estimate (acres)	Extent of Take Amount: Restoration Take Estimate (acres)
Umatilla	20,480	256	384	256
Union	40,448	506	758	506
Wallowa	11,328	142	212	142
Wasco	15,360	192	288	192
Washington	41,472	518	778	518
Wheeler	16,768	210	314	210
Yamhill	42,368	530	794	530
State Totals	2,154,039	14,704	22,056	14,704
ESA Total	1,176,314	14,704	22,056	14,704
Non-ESA Total	977,725			

** Development does not include redevelopment within an existing footprint that does not further encroach the floodplain. See RPA Element 3.D and Glossary.
†SFHA at the time of development of this opinion. SFHA may change as a result of new mapping, However, the extent exempted by this incidental take statement is not intened to increase if the SFHA increases due to new mapping.

Given that the amount of take includes an acreage total of 14,704 for the action area, NMFS believes that if exceedances by county occur concentrated with geographic region, then the extent of take is exceeded, and the risk of jeopardy will be elevated to the degree that re-initiation may be required. Specifically, the five biological domains are located within three geographical regions, and most counties are located wholly within a region, which means that if development levels are exceeded in multiple counties within a region, the amount of take in the form of harm will likely be borne by multiple populations within the same species, increasing risk in viability parameters for those species. Where counties cross the geographic boundary, if that county exceeds the acreage limit, then effects will be counted as occurring in both geographic regions. Using this method for calculating the anticipated extent of take, when three counties within any geographic region have exceeded the expected amount of development, then re-initiation may be needed in order to determine what additional measures are required to revise the NFIP to avoid jeopardy.

Counties sorted by dominant recovery domain for the purpose of use in the ITS and its re-initiation trigger:

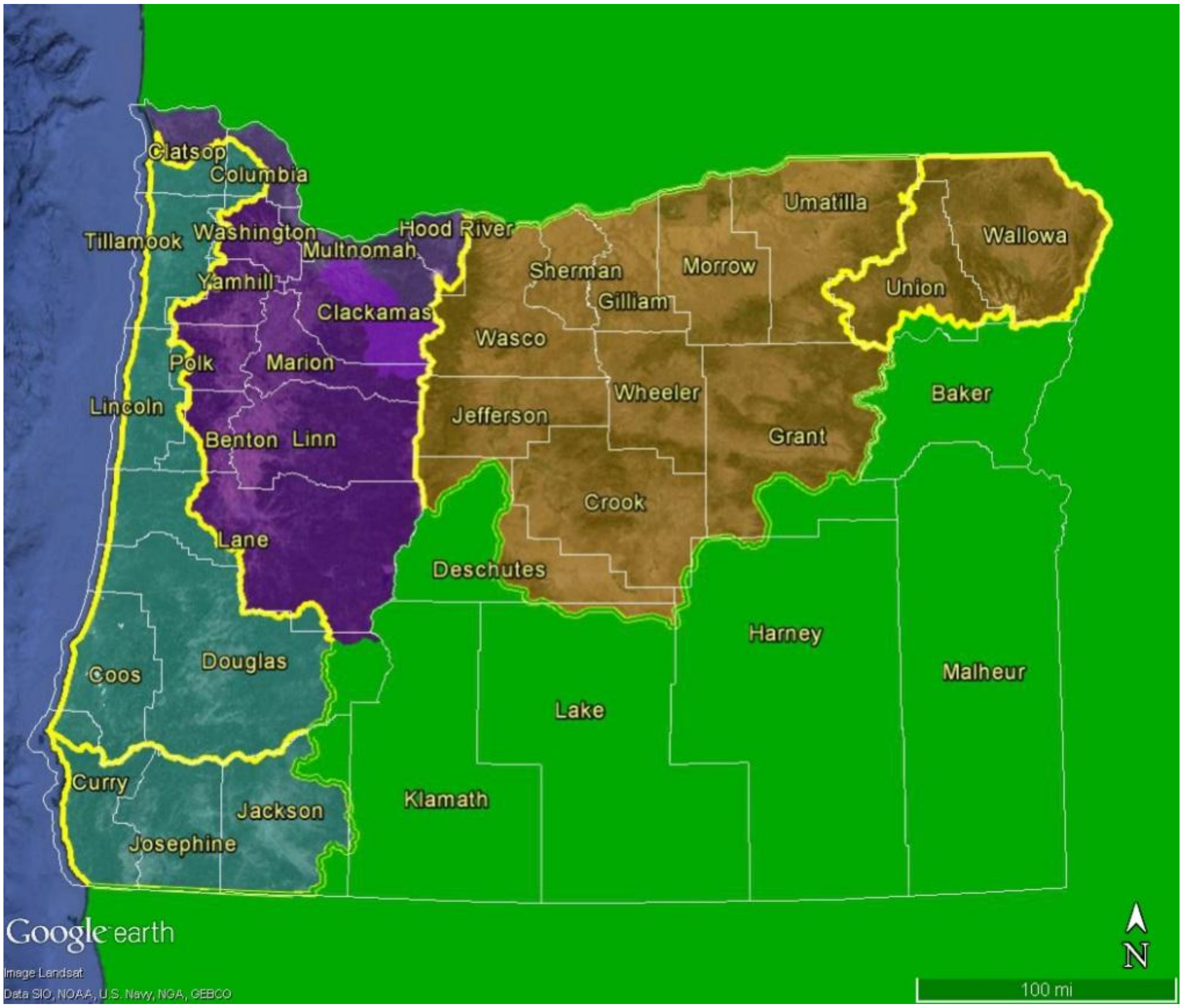

Figure 2.9-1. Geographic regions for determining if the extent of take is exceeded. Blue-Oregon Coast, purple- Lower Columbia/Willamette, brown-Eastern Oregon.

A second method for determining when the extent of take is exceeded is not based on geographic region, but is based on a pattern of exceedance across all 31 counties covered by this RPA. If six counties exceed the acreage of development, irrespective of their location, then NMFS believes that take is exceeded systemically to the point that jeopardy is not being avoided, and re-initiation may be appropriate.

2.9.2 Effect of the Take

In Section 2.8.4, the RPA Findings, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, as modified by the RPA, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat when the reasonable and prudent alternative is implemented.

2.9.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are non discretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

1. FEMA shall monitor and report on floodplain development as described in RPA Elements 2 and 5, summed by county, to ensure participating communities are minimizing modification of habitat functions that result in take of listed species addressed by this opinion.

2. Although the RPA significantly reduces NFIP impacts, we still expect implementation of the program as modified by the RPA to result in take of listed species. Thus FEMA shall report on its implementation of RPA elements 2, 3, and 4 in order to document that necessary progress is made toward reducing programmatic source of take.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and FEMA must comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). FEMA has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

<u>To implement RPM number 1</u>:

a. When reporting reveals that a jurisdiction's development affects more than 1.25 percent of the mapped SHFA within their jurisdictional boundaries, FEMA shall conduct an audit of that jurisdiction with participation by NMFS to ensure that county-wide extent of take identified in Table 2.9-1 will not be exceeded. The objective of this Term and Condition is to ensure that county-wide development patterns are distributed in a way that is not likely to concentrate take in the form of harm in any one geographic location and disproportionately impact specific populations of listed fish.

b. FEMA shall conduct community assistance visits, and theses shall be prioritized for communities in the Willamette Valley, the Grande Ronde, and any individual community that meets or exceeds 1% new development with their jurisdictional floodplain. The Grande Ronde basin and Willamette Valley were selected because they host populations of anadromous salmonids at the highest risk (*e.g.*, Upper Grande Ronde Chinook salmon, North Santiam River Chinook salmon, etc.).

To implement RPA number 2:

FEMA shall detail its efforts and the status of any necessary rulemaking efforts to revise the criteria for mapping floodways and flood-related erosion zones and the NFIP eligibility criteria for participating jurisdictions, per RPA Elements 3 and 4. The objective of this Term and Condition is to ensure that, given the anticipated time-frames for full implementation of this RPA, timely progress is made. This will ensure that amount of take in the form of harm declines to such a level as to avoid further risk of jeopardy within 8.5 years.

2.10 Conservation Recommendations

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

Conservation Recommendation #1 – Strengthen Regulatory Foundations for ESA Compliance

This biological opinion concludes that, in order for FEMA's implementation of the NFIP in Oregon to avoid jeopardy to Oregon listed species and adverse modification of their critical habitats, FEMA must strengthen the minimum eligibility requirements for community participation in the NFIP. More specifically, the RPA articulates specific development standards and mitigation requirements to protect the natural floodplain functions that provide habitat values needed to support listed species. This approach is consistent with the Unified National Program for Floodplain Management, which endorses protection of natural floodplain functions as a means to both protect natural resources and reduce local reliance on taxpayer-funded flood-disaster relief. It is also consistent with one of the goals of the National Flood Insurance Act – to "provide flexibility in the [NFIP] so that [] flood insurance may be based on workable methods of pooling risks, minimizing costs, and distributing burdens equitably among those who will be protected by flood insurance and the general public." 42 U.S.C. 4001(d)(2). Protecting listed species benefits both NFIP participants and the general public by preserving natural resources, healthy ecosystems, and recreational opportunities. See Federal Interagency Floodplain Management Task Force, "A Unitied National Program for Floodplain Management," p. 37 (1994) ("Mitigating flood hazards, protecting natural resources, and promoting wise use of the Nation's floodplains will not only have economic and environmental benefits, but will also enhance the quality of life for millions of Americans.").[182]

[182] See also, Presidential Memorandum for Executive Departments and Agencies, Incorporating Ecosystem Services into Federal Decision Making (Oct. 7, 2015) ("Ecosystem services provide vital contributions to economic and social well-being. These include, but are not limited to, provisioning food and materials, improving the quality and moderating the quantity of water, providing wildlife habitat and spawning and nursery habitats for fisheries, enhancing climate resilience, mitigating storms and floods, buffering pollutants, providing greater resilience for communities and ecosystems, and supporting a wide array of cultural benefits, recreational opportunities, and aesthetic values.").

FEMA's Federal Register notice of May 16, 2012 (77 FR 28891) indicates that FEMA is preparing an EIS on the NFIP and states that FEMA intends to "[m]odify the NFIP based upon changes identified through the evaluation process to enhance floodplain management standards including provisions to address endangered species and habitat concerns." NMFS understands that FEMA proposes to establish new minimum floodplain management requirements, revise the current minimum floodplain management criteria, and clarify existing map revision requirements as substantial steps toward ensuring its compliance with the Endangered Species Act of 1973 (ESA). As described by FEMA, FEMA is proposing changes to the aspects of its program implementation that have been highlighted by the courts as the areas of the NFIP in which the NFIP has the discretion to act for the benefit of the species – floodplain management, flood hazard mapping, and the Community Rating System.

By incorporating an ESA performance standard into the minimum floodplain management criteria that communities must adopt, FEMA can help ensure that the NFIP does not facilitate floodplain development that jeopardizes the continued survival of ESA-listed species or adversely modifies designated critical habitat. Also, by clarifying that compliance with the minimum floodplain management criteria, including the ESA performance standard, is a requirement for new development, FEMA would help ensure that these actions are ESA-compliant, since the underlying floodplain development would not adversely impact ESA-listed species or designated critical habitat. FEMA may then implement these ESA performance criteria through the use of additional species-specific technical guidance and technical assistance to participating communities that may be tailored to local or regional species' needs.

NMFS believes that FEMA's proposed rule changes will, if properly implemented, strengthen the ability of FEMA to implement its ESA responsibilities generally and in the context of these RPA recommendations in particular. Therefore, NMFS seeks through this conservation recommendation to target specific recommendations to FEMA on its national rulemaking to further these outcomes. NMFS recognizes that there remain differences between NMFS and FEMA in the manner in which FEMA frames the locus of its ESA responsibility. These differences find their expression both in the national rulemaking and in the manner in which FEMA has proposed to modify NFIP implementation in Oregon. Nevertheless, NMFS remains optimistic that these specific regulatory changes can enhance success in altering the NFIP consistent with the ESA's mandates.

The eligibility requirements for NFIP participation are found in FEMA's regulations at 44 CFR 60.3 and in associated guidance and technical bulletins. NMFS recommends that FEMA strengthen the regulatory NFIP eligibility requirements to incorporate development and mitigation standards needed to protect natural floodplain functions, and, consequently, ESA-listed species. Further, NMFS recommends that FEMA develop associated technical bulletins as needed to supplement these regulatory revisions and will assist FEMA as needed in developing such guidance. Accordingly, NMFS recommends that FEMA revise its regulations at 44 CFR Parts 59 and 60 as follows:

A. Incorporate into Part 59 definitions of "ESA-listed species," "designated critical habitat," "channel migration zone," "natural floodplain functions," "wise use(s)," "habitat restoration activities," "water-dependent," "open-space," "light recreational," and "substantial improvement."[183]

B. Amend the 44 CFR 60.3 eligibility criteria to include avoidance, minimization, and mitigation requirements regionally as needed to protect ESA-listed species and their designated critical habitats. Specifically, the regulations should:

   i. incorporate a wise-use (avoidance) standard for development within floodways and channel migration/erosion zones so that development within such areas is limited to uses compatible with the maintenance and preservation of natural floodplain functions (i.e., habitat restoration activities, open-space uses, light recreational uses, water-dependent uses, and agriculture/silviculture with appropriate buffers/best management practices);

   ii. require that the adverse impacts of development in all flood-prone areas (including floodways and channel migration/erosion zones) are minimized, *e.g.*, by limiting density/new impervious surfaces; and

   iii. require compensatory mitigation for development activities within all flood-prone areas (including floodways and channel migration/erosion zones) that involve any of the following: the placement of fill, new or substantially improved structures, new impervious surface, grading, vegetation removal, bank armoring, and new levees, dikes, or other flood control structures.

C. Specify that compliance with such technical guidance as is needed to support the ESA performance standard is required as condition of NFIP eligibility.

Conservation Recommendation #2 – Improve Levee Habitat Quality

To ensure communities are knowledgeable about the requirements associated with levee accreditation, including requirements associated with vegetation management, prior to accrediting a levee and removing areas landward of the structure from the floodplain, or recognizing flood protection provided by non-accredited levees under the new levee policy (FEMA 2013b), FEMA should:

A. Provide written notice to levee owners that U.S. Army Corps of Engineers certification is not required under the NFIP for FEMA to accredit or recognize a levee. Levee certification can be performed by a professional engineer (44 CFR 65.10(e)).

B. Provide written notice to levee owners that adequate levee maintenance plans required by 44 CFR 65.10(d) may conform to both FEMA and U.S. Army Corps of Engineers standards by pursuing a variance from the vegetation removal requirements (ETL 1110-2-583) as provided by the U.S. Army Corps of Engineers under 77 FR 9637.

[183] For "substantial improvement," see definition per RPA Element 4.G.

Conservation Recommendation #3 – CRS Modifications to Protect Natural Floodplain Functions

To improve incentives for NFIP participating communities to reduce risk from flood-related hazards while better protecting natural and beneficial functions of the floodplain, FEMA should implement the following measures related to the Community Rating System (FEMA 2013) under the NFIP:

A. FEMA Assistance Funds. Provide credits to communities that limit use of FEMA assistance funds (*e.g*., Hazard Mitigation Assistance) for acquisition (and removal) or relocation of structures from the special hazard areas.

B. Tree Retention along Levees. Provide credits to communities that have levee maintenance plans that allow for the retention of trees along the waterside toe of levees or provide waterside planting berms as provided by the U.S. Army Corps of Engineers under 77 FR 9637 and ETL 1110-2-583. Credits should be scaled to the portion of total levee length within a community that accommodates tree retention.

C. Prerequisite Credits. Implement the following changes regarding prerequisite credits to ensure that all participating CRS communities that are receiving a premium reduction are implementing measures that protect natural and beneficial floodplain functions:

    i. Require prerequisite credits for protecting natural floodplain function in order to obtain a class 9 and class 6 rating. Minimum prerequisite credits should equal 10% of the total minimum required class points (*i.e*., 50 and 200 natural floodplain function points for class 9 and class 6 rating, respectively).

    ii. Increase existing natural floodplain function prerequisite credits for obtaining a class 4 or class 1 rating to a minimum of 15% of total class points (i.e., 450 and 675 natural floodplain function points for class 4 and class 1 rating, respectively).

D. Habitat Replacement. Currently, credits are available for requiring replacement flood storage capacity where fill is used. Providing credits for lost flood storage capacity does not necessarily compensate for the spatial loss of floodplain habitat used by ESA-listed species and other species that use floodplains. To be meaningful, compensation needs to provide both spatial and volumetric replacement, and replacement habitat needs to be of equal or better functional value. In order to receive credits associated with replacement functions for fill placement, require that lost or degraded floodplain habitat area and quality be replaced in addition to meeting any compensatory storage requirement.

Conservation Recommendation # 4 – Establish Minimum Lot Size for Flood Hazard Areas.

In order to limit encroachment of development into open floodplain areas, and reduce loss of natural and beneficial floodplain functions, FEMA should allow no division of parcels that would create lots smaller than 5 acres within special hazard areas. This restriction on the size of lots limits the total number of lots and thus prevents densification of floodplain development, thereby restricting the number of future structures likely to be exposed to flood related hazards, and maintaining land to accommodate flood functions and processes. This is consistent with a similar restrictive measure in Puget Sound RPA Element 3, Appendix 4, and is supported by FEMA's inclusion of large lot size as a measure that reduces flood risk, identified as CRS Activty 420 on open space preservation, element g. (See 2013 CRS Manual pp 420-2 through 420-27).

2.11 Reinitiation of Consultation

This concludes formal consultation for FEMA's implementation of the NFIP in Oregon.

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

2.12 "Not Likely to Adversely Affect" Determinations

In this biological opinion, we conclude that the proposed action is not likely to adversely affect humpback whales, blue whales, fin whales, Sei whales, sperm whales, North Pacific Right whales, loggerhead sea turtles, green sea turtles, leatherback sea turtles, or Olive Ridley sea turtles that occur in the action area. The proposed action is also not likely to adversely affect critical habitat designated in the action for leatherback turtles. This conclusion is based on the following considerations.

2.12.1 Marine Species

The above identified marine mammal and sea turtle species are distributed in coastal areas and may be exposed to effects associated with floodplain development. Similar to Southern Resident killer whales, effects would be indirect and would include reduced prey quality and reduced prey availability.

2.12.1.1 Prey Quality

Anadromous prey species (*i.e.*, salmonids, green sturgeon, and eulachon) would be exposed to a variety of contaminants as a result of stormwater runoff from and floodwater inundation of agricultural and urban developed floodplains. Depending on the contaminants they are exposed to, the concentration of the contaminants, and the duration and frequency of the exposure, some exposed individuals would experience reduced fitness and an increase in their body burden of some contaminants. These individuals provide a reduced caloric value to predators and an exposure vector for certain contaminants.

The occurrence of the subject ESA-listed large whales and sea turtles would be rare, infrequent, and transitory in the action area. For example, the blue whale and Sei whale are likely to have limited exposure to contaminant sources associated with floodplain development as their migratory patterns are circumglobal with definite seasonal movements to offshore areas outside the likely extent of effects. In the event that the turtles and large whales are present, they would be unlikely to accumulate a significant amount of persistent pollutants because they primarily consume lower trophic-level prey. Thus, sea turtles and large whales are unlikely to accumulate significant levels of contaminants in the action area that would be a cause for concern.

2.12.1.2 Prey Quantity

We concluded in this biological opinion that the proposed action would jeopardize the continued existence of numerous anadromous fish species (*i.e.,* salmonids, eulachon) in Oregon. These species are prey species for several ESA-listed species of marine mammals. Therefore, the proposed action would indirectly reduce prey availability for these marine mammals.

As mentioned above, the occurrence of the subject ESA-listed large whales and sea turtles in the action area is rare, infrequent, and transitory. In the event that the turtles and large whales are present, the reduction in available anadromous prey species is likely insignificant because they primarily consume lower trophic-level prey (*i.e.*, not salmon or eulachon).

The proposed action may reduce the quantity of prey available for some species, due to the mortality of salmon and eulachon. We anticipate similar effects on non-listed salmon species that may be prey items for the subject ESA-listed species. Any reduction in the available amount of salmonid prey would result in an insignificant reduction in prey resources for marine mammals that may intercept these species within their range because their prey base includes other species and they are not dependent on salmonid and eulachon prey.

2.12.1.3 Species Determinations

We find that all effects of the proposed action are likely to be discountable or insignificant, and therefore conclude that the proposed action is not likely to adversely affect humpback whales, blue whales, fin whales, Sei whales, sperm whales, North Pacific Right whales, loggerhead sea turtles, green sea turtles, leatherback sea turtles, or Olive Ridley sea turtles.

2.12.2 Critical Habitat

The action area includes critical habitat designated for leatherback sea turtles.

2.12.2.1 Leatherback Turtles

Within the action area, designated critical habitat for leatherback sea turtles includes a 24,500 square-mile marine area stretching from Cape Flattery, Washington, to Cape Blanco, Oregon (January 26, 2012; 77 FR 4170). We identified a single primary constituent element as essential for the conservation of leatherback sea turtles in marine waters off the U.S. West Coast: The occurrence of jellyfish prey species[184] of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks (77FR4170).

2.12.2.2 Critical Habitat Determinations

Based on the best scientific and commercial data available, as discussed previously, we do not expect that the proposed action would adversely affect the quantity, quality, or availability of any of the constituent elements of critical habitat, or the physical, chemical, or biotic phenomena that give the designated area value for the conservation of the species when no constituent elements were identified in the designation. Although NMFS would expect critical habitat for leatherback sea turtles to be exposed to toxic contaminants due to the proposed action, the concentrations would be sufficiently low and the exposure duration sufficiently brief that the effects would be insignificant.

We find that all effects of the associated floodplain development are likely to be insignificant, and therefore conclude that the proposed action is not likely to adversely affect designated critical habitat for leatherback turtles.

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

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

This analysis is based, in part, on the EFH assessment provided by the FEMA and descriptions of EFH for Pacific coast groundfish (PFMC 2005), coastal pelagic species (PFMC 1998), Pacific coast salmon (PFMC 1999), and highly migratory species (PFMC (2007) contained in the fishery management plans developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

[184] Primarily scyphomedusae of the order Semaeostomeae (*e.g.*, *Chrysaora, Aurelia, Phacellophora*, and *Cyanea*).

3.1 Essential Fish Habitat Affected by the Proposed Action

The Pacific Fishery Management Council (PFMC) described and identified EFH for coastal pelagic species (PFMC 1998), Pacific Coast salmon (PFMC 1999), highly migratory species (PFMC 2003), and groundfish (PFMC 2005). The proposed action and action area for this consultation are described in the Introduction to this document. The action area includes areas designated as EFH for various life-history stages of coastal pelagic species, Pacific Coast salmon, highly migratory species, and Pacific Coast groundfish. In addition, the action area includes areas designated as Habitat Areas of Particular Concern (HAPC). Of these, estuary and seagrass areas are the HAPCs most likely adversely affected by the proposed action.

3.2 Adverse Effects on Essential Fish Habitat

See section 2.4 of the biological opinion for a description of the adverse effects on anadromous species habitat for Pacific salmon, and on estuarine and marine habitats potentially occupied by marine groundfish, coastal pelagic species, and highly migratory species.

NMFS concludes that the proposed action will have adverse effects on EFH designated for Pacific Coast salmon in freshwater where development will occur. Pacific salmon, coastal pelagic species, highly migratory species, and groundfish will also be adversely affected in nearshore areas and estuaries, including estuarine and seagrass areas designated as HAPCs in the Lower Columbia River and at other river mouths, bays, estuaries, and coastal waters where projects will occur.

3.3 Essential Fish Habitat Conservation Recommendations

1. To avoid and minimize the adverse effects of floodplain development on remaining habitat functions and processes, and to ensure adequate compensation for any adverse effects, FEMA should implement specific changes in program standards as provided in the ESA consultation of this opinion (*i.e*., Element 4 of the RPA).

2. To reduce flood risk and loss of natural and beneficial floodplain functions that serve to support essential fish habitat, FEMA should require that the floodplain management criteria as revised in this RPA apply to areas reasonably likely to be inundated based on future condition flood hazard modeling as soon as practicable.

3. To reduce the likelihood of inadvertently modifying floodplain habitat (and risk of unanticipated flood losses of functions and features of floodplains that support essential fish habitat), FEMA should modify floodplain mapping criteria to map in additional areas of known flood risk, and increase the accuracy of flood maps.

4. In order to limit encroachment of development into open floodplain areas, and to reduce loss of natural and beneficial floodplain functions that serve to support essential fish habitat, FEMA should allow no division of parcels that would create lots smaller than 5 acres within special hazard areas. This restriction on the size of lots limits the total number of lots and thus prevents densification of floodplain development, thereby

restricting the number of future structures likely to be exposed to flood related hazards, and maintaining land to accommodate flood functions and processes. This is consistent with a similar restrictive measure in Puget Sound RPA Element 3, Appendix 4, and is supported by FEMA's inclusion of large lot size as a measure that reduces flood risk, identified as CRS Activty 420 on open space preservation, element g. (See 2013 CRS Manual pp 420-2 through 420-27).

5. To ensure communities are knowledgeable about the requirements associated with levee accreditation, including requirements associated with vegetation management, prior to accrediting a levee and removing areas landward of the structure from the floodplain, or recognizing flood protection provided by non-accredited levees under the new levee policy (FEMA 2013b), FEMA should:
    a. Provide written notice to levee owners that U.S. Army Corps of Engineers certification is not required under the NFIP for FEMA to accredit or recognize a levee. Levee certification can be performed by a professional engineer (44 CFR 65.10(e)).
    b. Provide written notice to levee owners that adequate levee maintenance plans required by 44 CFR 65.10(d) may conform to both FEMA and U.S. Army Corps of Engineers standards by pursuing a variance from the vegetation removal requirements (ETL 1110-2-583) as provided by the U.S. Army Corps of Engineers under 77 FR 9637.

6. To improve incentives for NFIP participating communities to reduce risk from flood-related hazards while better protecting natural and beneficial functions of the floodplain, FEMA should implement the following measures related to the Community Rating System (FEMA 2013) under the NFIP:
    a. FEMA Assistance Funds. Provide credits to communities that limit use of FEMA assistance funds (*e.g*., Hazard Mitigation Assistance) for acquisition (and removal) or relocation of structures from the special hazard areas.
    b. Tree Retention along Levees. Provide credits to communities that have levee maintenance plans that allow for the retention of trees along the waterside toe of levees or provide waterside planting berms as provided by the U.S. Army Corps of Engineers under 77 FR 9637 and ETL 1110-2-583. Credits should be scaled to the portion of total levee length within a community that accommodates tree retention.
    c. Prerequisite Credits. Implement the following changes regarding prerequisite credits to ensure that all participating CRS communities that are receiving a premium reduction are implementing measures that protect natural and beneficial floodplain functions:
        i. Require prerequisite credits for protecting natural floodplain function in order to obtain a class 9 and class 6 rating. Minimum prerequisite credits should equal 10% of the total minimum required class points (*i.e*., 50 and 200 natural floodplain function points for class 9 and class 6 rating, respectively).
        ii. Increase existing natural floodplain function prerequisite credits for obtaining a class 4 or class 1 rating to a minimum of 15% of total class

points (*i.e.*, 450 and 675 natural floodplain function points for class 4 and class 1 rating, respectively).

d. Habitat Replacement. Currently, credits are available for requiring replacement flood storage capacity where fill is used. Providing credits for lost flood storage capacity does not necessarily compensate for the spatial loss of floodplain habitat used by ESA-listed species and other species that use floodplains. To be meaningful, compensation needs to provide both spatial and volumetric replacement, and replacement habitat needs to be of equal or better functional value. In order to receive credits associated with replacement functions for fill placement, require that lost or degraded floodplain habitat area and quality be replaced in addition to meeting any compensatory storage requirement

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in Section 3.2, above, approximately 1,176,315 acres of designated EFH for Pacific coast salmon.

3.4 Statutory Response Requirement

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

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

3.5 Supplemental Consultation

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

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are FEMA. Other interested users could include the State of Oregon, participating NFIP communities, local development permit applicants, citizens of affected areas, others interested in the conservation of the affected species, state and local emergency management providers, and parties interested in commercial and recreational fishing. Individual copies of this opinion were provided to FEMA. The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and 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 West Coast Region ESA quality control and assurance processes.

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6. APPENDICES

APPENDIX 1.3-A
List of CRS communities in Oregon as of May 2014

CID	Community Name	Class Rating (May 2014)	Entry Date	Current Effective Date	Discount for SFHA (%)	Discount for Non-SFHA (%)	Status
410137	ALBANY, CITY OF	6	10/1/1991	5/1/2012	20	10	Current
410090	ASHLAND, CITY OF	7	10/1/1991	10/1/2007	15	5	Current
410043	BANDON, CITY OF	10	5/1/2005	5/1/2010	0	0	**Rescinded**
410240	BEAVERTON,CITY OF	10	10/1/1991	10/1/1994	0	0	**Rescinded**
410008	BENTON COUNTY *	6	10/1/2002	10/1/2007	20	10	Current
410029	CANNON BEACH, CITY	7	10/1/1994	10/1/1999	15	5	Current
410092	CENTRAL POINT, CITY	6	10/1/1992	5/1/2012	20	10	Current
415588	CLACKAMAS CO*	6	10/1/2004	10/1/2012	20	10	Current
410009	CORVALLIS, CITY OF	6	10/1/1991	5/1/2012	20	10	Current
410059	DOUGLAS COUNTY *	8	10/1/2000	10/1/2000	10	5	Current
410122	EUGENE, CITY OF	7	10/1/1991	10/1/2001	15	5	Current
410108	GRANTS PASS, CITY	9	10/1/1992	5/1/2012	5	5	Current
410175	HEPPNER, CITY OF	8	5/1/2006	5/1/2006	10	5	Current
415589	JACKSON COUNTY *	7	10/1/1991	5/1/2002	15	5	Current
415591	LANE COUNTY*	7	5/1/2009	5/1/2009	15	5	Current
410154	MARION COUNTY*	6	4/1/2001	5/1/2007	20	10	Current
410096	MEDFORD, CITY OF	8	10/1/1994	5/1/2009	10	5	Current
410064	MYRTLE CREEK, CITY	10	5/1/2003	5/1/2008	0	0	**Rescinded**
410200	NEHALEM, CITY OF	7	10/1/2003	5/1/2008	15	5	Current
410021	OREGON CITY, CITY	7	10/1/2003	5/1/2008	15	5	Current
410186	POLK COUNTY*	8	10/1/1991	10/1/2001	10	5	Current
410183	PORTLAND, CITY OF	5	10/1/2001	10/1/2007	25	10	Current
410201	ROCKAWAY, CITY OF	10	10/1/2004	10/1/2013	0	0	**Rescinded**
410098	ROGUE RIVER, CITY	7	10/1/1992	5/1/2002	15	5	Current
410067	ROSEBURG, CITY OF	8	10/1/1994	10/1/1999	10	5	Current
410167	SALEM, CITY OF	6	5/1/2008	10/1/2012	20	10	Current
410039	SCAPPOOSE, CITY OF	7	10/1/1993	5/1/2008	15	5	Current
410144	SCIO, CITY OF	10	5/1/2004	5/1/2014	0	0	**Rescinded**
410257	SHERIDAN, CITY OF	8	10/1/2001	10/1/2001	10	5	Current
410213	STANFIELD, CITY OF	8	10/1/1991	10/1/2003	10	5	Current
410100	TALENT, CITY OF	9	10/1/2000	5/1/2006	5	5	Current
410202	TILLAMOOK, CITY OF	7	10/1/2006	5/1/2011	15	5	Current
410196	TILLAMOOK CO *	10	4/1/2001	10/1/2013	0	0	**Rescinded**
410184	TROUTDALE, CITY OF	7	5/1/2008	5/1/2013	15	5	Current

APPENDIX 1.3-B
Areas designated under Oregon Administrative Code 660-022-0010 as an "Urban Unincorporated Community"

Oregon Administrative Code 660-022-0010 [185] defines an 'Urban Unincorporated Community' as "an unincorporated community which has the following characteristics:
(a) Include at least 150 permanent residential dwellings units;
(b) Contains a mixture of land uses, including three or more public, commercial or industrial land uses;
(c) Includes areas served by a community sewer system; and
(d) Includes areas served by a community water system."

[This list only includes urban unincorporated communities located outside of urban grown boundaries. A list of urban unincorporated communities inside of urban grown boundaries was not provided to NMFS.]

[185] See *http://arcweb.sos.state.or.us/pages/rules/oars_600/oar_660/660_022.html*.

Department of Land Conservation and Development

Survey of Oregon Unincorporated Communities

January 30, 1997

In 1993, the Department of Land Conservation and Development (DLCD) conducted a statewide survey of unincorporated communities (these areas were called "rural communities" at that time). The purpose of the survey was to gather information about such areas in order to assist in writing land use planning rules for such communities. The survey included a list of community names for each county, and also provided information about land uses and public facilities in these areas.

The Land Conservation and Development Commission (LCDC) adopted administrative rules for unincorporated communities in 1994 (OAR 660, Division 22). Because the survey had been conducted prior to the drafting of the related rules, counties had listed some areas in the survey that do not meet the formal definition of "unincorporated community." As such, not all the areas listed in the survey are subject to LCDC's rural communities rules.

In 1997, LCDC revised the unincorporated communities rules. The revised rules refer to the survey of unincorporated communities. During the public review process for these amendments several counties requested that LCDC add certain communities to the DLCD survey. These communities had not been listed in the original (1993) survey, but are similar to the other community areas listed on that survey. LCDC agreed to amend the survey so as to include these additional areas.

The attached survey is on file at DLCD as the official document referenced by the amended unincorporated communities rules. This document is a list of the communities named by each county. As with the 1993 survey, not all the areas listed in this, the amended (1997) survey, will qualify as an “unincorporated community” using the definition in Division 22. The 1993 survey, which is also available from DLCD, includes additional land use and public facilities information for each of the communities surveyed at that time.

Community	County
Bourne	Baker
Bridgeport	Baker
Carson	Baker
Cornucopia	Baker
Durkee	Baker
Hereford	Baker
Homestead	Baker
Keating	Baker
Langrell	Baker
McEwen	Baker
New Bridge	Baker
Oxbow	Baker
Pine	Baker
Pleasant Valley	Baker
Alpine	Benton
Alsea	Benton
Bellfountain	Benton
Blodgett	Benton
Bruce	Benton
Greenberry	Benton
Hoskins	Benton
Kings Valley	Benton
Summit	Benton
Wren	Benton
Beavercreek	Clackamas
Boring	Clackamas
Brightwood	Clackamas
Colton	Clackamas
Damascus	Clackamas
Government Camp	Clackamas
Mulino	Clackamas
Redland	Clackamas
Rhododendron	Clackamas
Welches/Wemme	Clackamas
Zig Zag	Clackamas
Arch Cape	Clatsop
Burnside	Clatsop
Cannon Beach Jct.	Clatsop
Elderberry	Clatsop
Elsie	Clatsop
Fish Hawk	Clatsop
Highway 26	Clatsop
Jewel	Clatsop
Knappa	Clatsop

Community	County
Miles xing/Jeffers	Clatsop
Necanicum/Hwy 53	Clatsop
Old Naval Hosp.	Clatsop
Olney	Clatsop
Smith Lake	Clatsop
Svensen	Clatsop
Sunset Beach	Clatsop
Westport	Clatsop
Alston Corner	Columbia
Birkenfeld	Columbia
Deer Island	Columbia
Goble	Columbia
Mist	Columbia
Warren	Columbia
Quincy	Columbia
Allegany	Coos
Arago	Coos
Bridge	Coos
Bandon Dunes	Coos
Broadbent	Coos
Bunker Hill/Mill	Coos
Charleston/Barview	Coos
Cooston	Coos
Dew Valley	Coos
Dora	Coos
Fairview	Coos
Glasgow	Coos
Greenacres	Coos
Hauser	Coos
Hollow Stump	Coos
Laurel Grove	Coos
Lower Lee Valley	Coos
Norway	Coos
Riverton	Coos
Sumner	Coos
Sunnyhill	Coos
Paulina	Crook
Post	Crook
Powell Butte	Crook
Powell Butte West	Crook
Agness	Curry
Langlois	Curry
Nesika Beach	Curry
Ophir	Curry

Community	County
Alfalfa	Deschutes
Black Butte	Deschutes
Brothers	Deschutes
Desch. R. Woods	Deschutes
Hampton	Deschutes
Inn of 7th Mtn	Deschutes
LaPine	Deschutes
Millican	Deschutes
Spring River	Deschutes
Sunriver	Deschutes
Terrebonne	Deschutes
Tumalo	Deschutes
Whistle Stop	Deschutes
Wickiup Junction	Deschutes
Wild Hunt	Deschutes
Azalea	Douglas
Camas Valley	Douglas
Clarks Branch	Douglas
Curtin	Douglas
Days Creek	Douglas
Dillard	Douglas
Dixonville	Douglas
Dry Creek	Douglas
Gardiner	Douglas
Glendale Junction	Douglas
Glide	Douglas
Green	Douglas
Jackson Creek	Douglas
Lookingglass	Douglas
Melrose	Douglas
Milo	Douglas
Nonpareil	Douglas
North Fork	Douglas
North Umpqua V.	Douglas
Oak Valley	Douglas
Quines Creek	Douglas
Rice Hill	Douglas
Riversdale	Douglas
Scottsburg/Wells	Douglas
Steamboat	Douglas
Tenmile/Portercrk	Douglas
Tiller	Douglas
Winchester Bay	Douglas
Fortune Branch	Douglas
Mayville	Gilliam
Mikkalo	Gilliam

Community	County
Olex	Gilliam
Austin	Grant
Austin Junction	Grant
Dale	Grant
Fox	Grant
Galena	Grant
Hamilton	Grant
Izee	Grant
Kimberly	Grant
Logdel	Grant
Ritter	Grant
Susanville	Grant
Andrews	Harney
Buchanan	Harney
Crane	Harney
Diamond	Harney
Drewsey	Harney
Fields	Harney
Frenchglen	Harney
Lawen	Harney
Princeton	Harney
Riley	Harney
Wagontire	Harney
Mt. Hood	Hood River
Oak Grove	Hood River
Odell	Hood River
Parkdale	Hood River
Pine Grove	Hood River
Rockford	Hood River
Windmaster Cnr	Hood River
Van Horn	Hood River
Applegate	Jackson
Brownsboro	Jackson
Lakecreek	Jackson
Lincoln/Pinehurst	Jackson
McKee Bridge	Jackson
Prespect	Jackson
Ruch	Jackson
Trail	Jackson
Union Creek	Jackson
White City	Jackson
Wimer	Jackson

Community	County
Ashwood	Jefferson
Camp Sherman	Jefferson
Crooked Rvr Rnch	Jefferson
Chinook Airport	Jefferson
Gateway	Jefferson
High Chapparal	Jefferson
Kerby	Josephine
Merlin	Josephine
Murphy	Josephine
North Valley	Josephine
O'Brien	Josephine
Pottsville	Josephine
Shan Creek	Josephine
Selma	Josephine
Sunny Valley	Josephine
Wilderville	Josephine
Williams	Josephine
Wolf Creek	Josephine
Wonder	Josephine
Beatty	Klamath
Beaver Marsh	Klamath
Bly	Klamath
Chemult	Klamath
Crescent	Klamath
Crescent Lake	Klamath
Dairy	Klamath
Diamond Lake Jnct	Klamath
Fort Klamath	Klamath
Gilchrist	Klamath
Henley	Klamath
Keno	Klamath
Midland	Klamath
Olene	Klamath
Rocky Point	Klamath
Sprague River	Klamath
Adel	Lake
Alkalai Lake	Lake
Christmas Valley	Lake
Five Corners	Lake
Fort Rock	Lake
New Pine Creek	Lake
Plush	Lake
Silver Lake	Lake
Summer Lake	Lake
Valley Falls	Lake

Community	County
Westside	Lake
Alvadore	Lane
Blachly	Lane
Blue River	Lane
Cheshire	Lane
Crow	Lane
Culp Creek	Lane
Cushman	Lane
Deadwood	Lane
Dexter	Lane
Dorena	Lane
Elmira	Lane
Fall Creek	Lane
Franklin	Lane
Glenada	Lane
Goshen	Lane
Greenleaf	Lane
Jasper	Lane
Lancaster	Lane
Leaburg	Lane
London	Lane
Lorane	Lane
Mapleton	Lane
Marcola	Lane
McKenzie Bridge	Lane
Nimrod	Lane
Noti	Lane
Pleasant Hill	Lane
Rainbow	Lane
Saginaw	Lane
Swisshome	Lane
Trent	Lane
Triangle Lake	Lane
Vida	Lane
Walterville	Lane
Walton	Lane
Beverly Beach	Lincoln
Burnt Woods	Lincoln
Eddyville	Lincoln
Elk City	Lincoln
Harlan	Lincoln
Kernville	Lincoln
Lincoln-Gleneden	Lincoln
Logsden	Lincoln
Nashville	Lincoln
Otis Junction	Lincoln

Community	County
Otter Rock	Lincoln
Rose Lodge	Lincoln
San Marine	Lincoln
Seal Rock	Lincoln
Star Creek	Lincoln
Tidewater	Lincoln
Cascadia	Linn
Crabtree	Linn
Crawfordsville	Linn
Holley	Linn
Lacomb	Linn
Peoria	Linn
Shedd	Linn
West Scio	Linn
Annex	Malheur
Arock	Malheur
Brogan	Mahleur
Burns Junction	Mahleur
Cairo Junction	Mahleur
Farewell Bend	Mahleur
Harper	Mahleur
Ironside	Mahleur
Jamieson	Mahleur
Johnson Brothers	Mahleur
Juntura	Mahleur
McDermitt	Mahleur
Oregon Slope	Mahleur
Owyhee Corner	Mahleur
Rome	Mahleur
Weiser Junction	Mahleur
Willowcreek	Mahleur
Brooks	Marion
Brooks Intchnge	Marion
Butteville	Marion
Central Howell	Marion
Drakes Crossing	Marion
Fargo Interchange	Marion
Hopmere	Marion
Labish Village	Marion
Lone Pine	Marion
Macleay	Marion
Marion	Marion
Mehama	Marion
Monitor	Marion
North Howell	Marion

Community	County
North Santiam	Marion
Norton's Corner	Marion
Pratum	Marion
Quinaby	Marion
Shaw	Marion
St. Louis	Marion
Talbot	Marion
Waconda	Marion
West Stayton	Marion
Hardman	Morrow
Ruggs	Morrow
Bridal Veil	Multnomah
Burlington	Multnomah
Corbett (NSA)	Multnomah
Dodson (NSA)	Multnomah
Orient	Multnomah
Springdale	Multnomah
Warrendale (NSA)	Multnomah
Airlie	Polk
Ballston	Polk
Buell	Polk
Buena Vista	Polk
Derry	Polk
Eola	Polk
Fort Hill	Polk
Grand Rond	Polk
Lincoln	Polk
McCoy	Polk
Pedee	Polk
Perrydale	Polk
Rickreall	Polk
Suver	Polk
Suver Jct	Polk
Valley Jct	Polk
Biggs Jct	Sherman
Kent	Sherman
Barview	Tillamook
Beaver	Tillamook
Cape Meares	Tillamook
Cloverdale	Tillamook
Falcon Cove	Tillamook
Hebo	Tillamook
Idaville	Tillamook

Community	County	Community	County
Mohler	Tillamook	Meacham	Umatilla
Neahkahnie	Tillamook	Rieth	Umatilla
Neskowin	Tillamook	Umapine	Umatilla
Oceanside	Tillamook		
Netarts	Tillamook	Alice	Union
Pacific City/Woods	Tillamook	Anthony Lakes	Union
Syskeyville	Tillamook	Camp Elkanah	Union
Tierra Del Mar	Tillamook	Hotlake	Union
Twin Rocks	Tillamook	Medical Springs	Union
		Perry	Union
Flora	Wallowa	Spout Springs	Union
Imnaha	Wallowa	Starkey	Union
Minam	Wallowa	Telocaset	Union
Troy	Wallowa		
Wallowa Lake	Wallowa	Clarno	Wheeler
		Kinzua	Wheeler
Pine Grove	Wasco	Service Creek	Wheeler
Pine Hollow	Wasco	Twickenham	Wheeler
Tygh Valley	Wasco		
Walter's Corner	Wasco	Bellevue	Yamhill
Wamic	Wasco	Cove Orchard	Yamhill
		Grand Isl Jct	Yamhill
Buxton	Washington	Grande Ronde Agny	Yamhill
Cherry Grove	Washington	Hopewell	Yamhill
Laurelwood	Washington	Unionvale	Yamhill
Manning	Washington	Whiteson	Yamhill
Timber	Washington		
Verboort	Washington	Total = 403	

APPENDIX 2.4-A
Comparison of Reasonable and Prudent Alternatives for the NFIP for the Puget Sound Region and for Oregon

Introduction

In September 2008, NMFS issued a biological opinion on FEMA's implementation of the National Flood Insurance Program (NFIP) in the Puget Sound region of Washington state. The 2008 opinion concluded that the NFIP was likely to result in jeopardy to several listed salmon species and adverse modification of their designated critical habitat and was also likely to jeopardize southern resident killer whales. NMFS' 2008 biological opinion included an RPA specifying changes to FEMA's administration of the NFIP in the Puget Sound area to avoid jeopardy/adverse modification.

Per FEMA's request, the 2008 Puget Sound RPA requirements were framed as program objectives rather than regulatory revisions, deferring to FEMA to determine implementation methods. FEMA subsequently devised a "3 Door" approach to implementation, providing the Puget Sound NFIP communities a choice among three compliance options: (1) adopt a model ordinance incorporating the RPA requirements ("Door 1"); (2) use a check-list developed by FEMA to demonstrate that the community's existing regulations and enforceable policies contain all requirements of the RPA ("Door 2"); (3) ensure compliance with the RPA on a permit-by-permit basis, by requiring that developers prepare a "habitat assessment" for any development likely to "adversely affect" floodplain functions and implement mitigation to offset all adverse effects ("Door 3"). Of the 122 NFIP communities subject to the RPA, 5 opted for Door 1, 12 chose Door 2, and the remaining 105, either by choice or by default, are considered Door 3.

Substantive Comparison

Substantively, the provisions in both RPAs are largely the same, with some variation in details. The most significant differences between the Washington RPA and the Oregon RPA are: (1) the Oregon RPA specifies that FEMA must revise its regulations, policies, procedures, and/or guidance as needed to ensure that the RPA requirements are mandatory for all the NFIP participating communities in Oregon, and (2) some provisions from the Puget Sound RPA have been modified so as to better align with FEMA's existing program, *e.g.*, leveraging FEMA's existing regulatory protections for floodways and erosion zones into greater conservation benefit by utilizing a more protective floodway standard and requiring E-Zone mapping rather than through the "protected area" construct of the Puget Sound RPA. The following table provides an element-by-elment comparison of the two RPAs.

PUGET SOUND	OREGON
Notice to Communities (Puget Sound Element 1 / Oregon Element 1)	
30 days to deliver	60 days to deliver
Advise of measures to avoid take.	Advise of types of development found to harm listed species.
Recommend moratorium on floodplain development.	Recommend elevation of new structures by means other than fill; recommend CLOMRs for projects including ≥50 cy fill.
Advise that compliance with development provisions of RPA confers take coverage	N/A
N/A	Advise of interim measures.
N/A	Advise of pending reporting requirements.
N/A	Request that communities provide any available data on locally-identified flood hazards to FEMA
Interim Measures (Puget Sound Element 6 / Oregon RPA Element 2)	
FEMA to ensure that mitigation occurs for any loss of habitat functions during implementation period.	Require mitigation for lost flood storage, vegetation removal, and placement of new impervious surface per specified ratios & methods. Alternative mitigation standards allowed if approved by FEMA and NMFS.
N/A	Limit development in RBZ per FEMA's proposed action.
N/A	Deny or decline to process LOMR-Fs unless mitigation is demonstrated.
Consult with NMFS prior to issuing LOMCs related to manmade floodplain alterations.	Review CLOMRs for ESA compliance/mitigation, coordinate with NMFS as needed.
N/A	Track and report per FEMA's reporting tool.
N/A	Recommend that State prioritize buy-outs based on listed species presence.
Mapping Revisions (Puget Sound Elements 2 & 5 / Oregon Element 3)	
FEMA to process LOMCs only when adverse effects of channel or floodplain alterations are factored and avoided or mitigated.	N/A
Prioritize mapping based on fish presence.	Same.
Use more accurate modeling / methods.	Same.
Consider future conditions, including climate change and future land use change.	Same.
Encourage identification of risk behind levees.	Map risk behind levees.
Do not accredit COE-certified levees unless no adverse effects from levee vegetation standards are shown.	N/A
Revise memoranda to reflect other levee certification methods.	N/A
N/A	Limit term of provisional accreditation.

Accredit levees only on showing that fish habitat values are preserved.	Coordiante or consult with NMFS before levee accreditation / map changes.
Identify channel migration zones (CMZs) (per RPA Element 3).	Map CMZs and identify as E Zones.
N/A	Include in mapping watersheds ≥ 160 acres; use 90% value for BFEs.
N/A	Include areas where floodwater depth ≥ 3ft. and where velocity ≥ 3ft./sec. in identifying floodways, *or* use 6" rise floodway.
N/A	Revise map adoption procedures to expedite issuance of final maps.
N/A	Develop schedule for ensuring all communities have updated maps.
Revise Floodplain Management Criteria (Puget Sound Element 3 / Oregon Element 4)	
Identify a "no-disturbance zone" (protected area) where development restrictions apply; protected area includes the greater of the floodway, CMZ+50 feet, and riparian buffer zone (150-250 feet).	Identify a "high hazard area" where development restrictions apply; high hazard area includes the greater of the floodway and E Zones.
Within the protected area, either: (1) allow no development; or (2) only allow development that demonstrably does not adversely affect natural floodplain functions.	Within the high hazard area, limit development to specified uses.
Activities compatible with the "no adverse effects" standard include: repair/remodel within an existing footprint; removal of noxious weeds; replacement of non-native vegetation with native vegetation; lawn and garden maintenance; removal of hazard trees; normal maintenance of of public utilities and facilities; and, habitat restoration consistent with federal and state standards. Activities that may not process unless they are shown to meet the "no adverse effects" standard include: new buildings, new impervious surfaces, removal of native vegetation, new clearing, grading, filling, land-disturbing activity or other development.	Uses permitted within the high hazard area include: open space, habitat restoration, low intensity recreational uses, water-dependent uses, and bioengineered bank protection; also, agriculture and forestry are allowed outside of the 10-year floodplain. Mitigation required for allowed uses.
N/A	Grandfathering applies in the high hazard area; measure substantial damage/substantial improvements cumulatively.
Outside the protected area, mitigation required for all adverse effects; balanced cut and fill required.	Outside of high hazard area, mitigation required for all adverse effects; balanced cut and fill (zero increase in rise/velocity) required.
Use LID.	Use LID/green infrastructure.
Storm water treatment for 10% or greater increase of impervious surface.	Mitigate new impervious surfaces.
No activity allowed that would limit the natural meandering pattern of CMZs.	Specified uses are allowed in the CMZ with mitigation/set-back requirements.

Mitigation required for disturbance to wetlands.	N/A
Retain 5 acre minimum lot size.	Retain 5 acre minimum lot size; alternate compliance allowed within UGBs in effect on Jan. 1, 2019.
Require that new structures be located outside the mapped floodplain if possible; site structures to have the least possible impact on habitat functions.	Restrict division of parcels that would create new lots wholly within the floodplain; restrict division of parcels that would render the lot unbuildable without a variance from local requirements.
Set back all structures at least 15 feet from the RBZ and as close to the 100-year floodplain boundary as possible.	N/A
N/A	Limit footprint of new structures to 10% or less of total lot size.
Removal of native vegetation must leave 65% of the surface area of the lot undeveloped.	Mitigate for vegetation removal.
No new stream crossings.	N/A
Proposed development must be designed and located so that it will not require new structural flood protection.	N/A
During permit process, notify applicants if the property is within the RBZ or 100-year floodplain and require that a Notice on Title be recorded before the permit may issue.	Require assurances that mitigation will function in perpetuity.
Apprise permit applicants of 10-yr and 50-yr flood elevations when 100-year elevation is provided.	N/A
N/A	Alternative compliance for special circumstances (3 methods available).
Data Collection and Reporting (Puget Sound Element 7 / Oregon Element 5)	
Communities must anually report all permitted development to FEMA: include direct and indirect effects to fish habitat, amount of mitigation provided, and effectiveness of mitigation. All permits must be reported until full implementation. Report must include storm water, riparian vegetation removal, bank armoring, modified large wood or gravel recruitment, and changes to CMZ.	Communities must report to FEMA quarterly: each permit issued for development flood hazard areas. Include amount lost flood storage, impervious surface, clearing/grading, disconnected floodplain, and all associated mitigation for these effects.
FEMA to report annually to NMFS.	Same.
If reporting reveals mitigation does not equal habitat protection, FEMA and Community must provide additional mitigation (RPA Element 7).	Community probation/suspension from NFIP for non-compliance by 2024.
3 years to full compliance.	8.5 years to full compliance.
Community Compliance schedule tied to Species Priority.	Community Compliance schedule tied to FEMA's implementation of program revisions.
Community Rating System (Puget Sound Element 4, Oregon Element 6)	
Increase points/credits for fish-friendly measures, e.g., open space preservation, use of LID, retaining riparian vegetation, levee setbacks, buy outs.	Increase points/credits for early implementation of RPA elements.
Decrease points/credits for fish impacting measures *e.g.*, flood control structures (levees berms dikes, piping streams).	N/A

One difference between the Puget Sound and Oregon RPAs is that the time-frame for Oregon implementation has been expanded to account for state-wide implementation and the potential need for FEMA rulemaking. A second important distinction is that NMFS anticipates a more active role in developing implementation strategies with FEMA and Oregon DLCD than was originally considered for Puget Sound. Finally, the Oregon RPA is designed to reduce the largest points of difficulty and confusion for implementation among state and local partners by providing more specific performance measures and mitigation standards.

Rationale for Oregon Modifications

Three main factors drove the decision to structure aspects of the Oregon RPA differently from the Puget Sound RPA: (1) uncertainty as to FEMA's capacity to enforce the proposed conservation measures; (2) experience gained, suggesting inconsistent implementation among Puget Sound communities and the need for greater clarity in identifying development impacts and effective mitigation strategies; and (3) FEMA is currently in the process of revising its regulations with the intent of meeting ESA requirements.

Legal Uncertainty

Lawrence Letter **–** Molly Lawrence, an attorney with the law firm of Gordon Derr, provided a letter to multiple NFIP participating communities affected by the Puget Sound RPA providing her legal analysis of local level obligations arising from the RPA. "Put simply, each jurisdictions' obligation is to comply with NFIP regulation 44 CR6 0.3(a)(2), which provides that you must require applicants for floodplain development permits to obtain all other necessary federal or state permits. This is different – and significantly less onerous – than any of the options that FEMA is currently articulating…It is extremely important, however that local governments understand that their obligations under the NFIP are not the same as FEMA's obligations resulting from the biop. …FEMA cannot require [a jurisdiction] to take any of these [door] three actions under the existing NFIP regulations…FEMA is attempting to transfer its obligation under the biop onto local jurisdictions without adequate legal authority."

Martinez Decision **–** While FEMA points to the Decision of the Federal District Court for the Western District of Washington as validation of the 3-Door approach, a careful reading reveals that the court concluded that the RPA in Washington was drafted with such flexibility as to implementation, that FEMA's implementation approach was not arbitrary and capricious. No review as to substantive outcomes was reached, as no inquiry as to on-the-ground outcomes was made. However, NMFS has significant concerns about Puget Sound compliance meeting the protective outcomes that were intended by the Puget Sound RPA. Judge Martinez noted in his opinion: "Importantly, the RPA does not identify a specific compliance program for FEMA to implement. It is silent on how FEMA should ensure that communities meet the 'no adverse effects' standard for all development going forward…. Element 3's lack of clarity… shows that the development standards were not tailored to help communities understand their NFIP and ESA compliance obligations." The RPA for Oregon is crafted to avoid both of these failings by specifying implementation through appropriate regulatory revisions where needed, and by removing the subjectivity and confusion related to identifying and avoiding "adverse effects," requiring instead clear mitigation requirements to address specified types of impacts.

FEMA's Proposed Action – FEMA's proposed action for the Oregon NFIP consultation carried forward and modified certain elements of the Puget Sound RPA for proposed implelmentaiton in Oregon. However, based on the information provided by FEMA, NMFS was unable to conclude that the proposed ESA conservation measures would be mandatory for Oregon NFIP communities and enforceable by FEMA. Therefore, to meet ESA requriements, NMFS devised the Oregon RPA to provide greater implementation certainty and enforceability.

Puget Sound RPA Implementation Issues

Of the 122 communities in the Puget Sound Region, only 5 are in Door 1, 12 are approved as Door 2 jurisdictions with local ordinances and plans identified as meeting the RPA's criteria to preserve floodplain functions. The remaining 105 communities are in "Door 3." An abiding concern is that at the time of species listing in Washington and Oregon, a finding that existing regulatory schemes were insufficient to prevent species extinction was made, and 5-year status reviews in 2005 and 2011 have not altered this finding. An equal concern goes to the capacity of local planners and permitters who have not had training in salmonid lifehistory, biology, or habitat ecology, to evaluate species and habitat effects from development.

In the spring of 2014, the Northwest Regional Floodplain Management Association sent a survey to all 122 floodplain jurisdictions subject to the RPA. This survey asked general questions with open narrative responses as to the perceived value or efficacy of the RPA as implemented, 5 years after the RPA was issued. Only 6 jurisdictions replied. Of these six, the responses were generally negative, *e.g*.: "There is no successful part to the program...time and money wasted reviewing, reporting, implementing, etc. for no measurable benefit to the environment." The most positive comments were that the RPA under FEMA's implementation "increased awareness" and created more local "opportunity to blend biological values into floodplain management" for the benefit of listed fish.

Program Scale Weaknesses of the Door 2 Approach **–** "The fundamental underpinning of the [Puget Sound] RPA is that *local land use ordinances and plans* need to be sufficient to protect current habitat functions in all stream reaches within the mapped floodplain." Stelle Letter to Murphy, Sept. 26, 2011.

- **Conflicts exist between the state regulatory programs that are the basis for "Door 2" status and the regulatory criteria of RPA element 3 –** Examples include the Shoreline Management Act's identification of Single Family Residences (SFR) as a priority use that is exempt from certain permit requirements in riverine and marine shorelines (WAC 173-26-241), an exemption for bulkheads to protect those SFRs and related appurtenances (WAC 173-27-040), and an exemption for docks designed for pleasure-craft. These actions all have adverse effects to floodplain habitat values, especially marine docks and bulkheads which are likely to be located in designated critical habitat (see Table under "Bulkheads" section below).

  Another example is the Growth Management Act, which requires all counties, and cities above a certain size, to adopt development regulations for critical areas, including both fish and wildlife habitat conservation areas, and frequently flooded areas. Cities and counties with certain projected population growth rates must also develop comprehensive growth plans with urban growth areas. While the GMA requires that best available science be used in developing regulations to protect critical areas, and that special consideration be given to measures necessary to preserve anadromous fisheries (RCW 36.70A.172), most jurisdictions have adopted the minimum criteria of the NFIP as the regulations for frequently flooded areas, the same criteria which were found to jeopardize listed species in our 2008 opinion. The following criterion has been part of Washington state law under the GMA since 1989: "If development regulations allow harm to critical areas, they must require compensatory mitigation of the harm. Development regulations may not allow a net loss of the functions and values of the ecosystem that includes the impacted or lost critical areas." The regulatory provision is similar to that goal intended with the Puget Sound RPA, but loss of floodplains to development continues incrementally despite this local mandate and the RPA.

❖ **Millie Judge Report of 2011 –** While this report was prepared to evaluate recovery plan implementation for Puget Sound salmonids, its conclusions are relevant to the efficacy of the RPA as well. At the time the Judge report was issued, the Puget Sound RPA was 3 years old, and deadlines for implementation in communities affecting high and medium priority fish populations were 1-2 years past. The Judge Report indicated that habitat was still declining, and protections for remaining habitat were insufficient. These findings despite the no loss of floodplain functions requirement of the RPA, as well as the mitigation requirements of the GMA, and the no net loss standard of the SMA, which are primary components of "Door 2" communities' programmatic demonstration of RPA compliance.

❖ **Master Program Identified Cumulative Effects –** Puget Sound jurisdictions were required with their recent (2010 and later) Shoreline Master Program updates to include a cumulative effects component. The following are excerpts from these cumulative effects sections, which suggest that the "no adverse effects" standard of the RPA, which applies within 200 feet of fish bearing water or the 100 year floodplain, whichever is larger, is unlikely to be met.

- <u>Snohomish County</u>: (Applied for Door 2, not yet approved) Cumulative Effects analysis prepared in 2010 indicates that Shoreline Master Plan will allow within 200 feet of OHWM (the "protected area" of the RPA) *2,000+ homes, 160+ acres new impervious, and 499 parcels with new bank armoring.*
- <u>City of Stanwood</u>: (Door 2) The proposed shoreline designation is High Intensity. Requirements for buffers in proposed regulations (SMP 17.150.21(4)) include a minimum *40- foot Critical Area buffer* on the Stillaguamish River with restoration to more natural river configuration with removal of fill. On Irvine Slough (Type 2 or 3 water), a minimum *35-foot Critical Area buffer* is required. Prospective development under the General Industrial zoning includes a wide range of wholesale and manufacturing uses.

❖ **Kramer Report –** In 2011, an outside consultant reviewed the RPA's implementation by five different jurisdictions, including cities and counties in both urban and rural contexts, in order to develop recommendations to improve RPA success. The consultant convened a technical team that "worked with these jurisdictions to assess how existing locally adopted regulations and programs protect floodplain functions, and evaluate how the current floodplain programs of these pilot jurisdictions compare to the requirements in FEMA's door 2." Under the local codes for these 5 communities, riparian buffers ranged in size but were all smaller than the buffer zone required by the RPA, and all allowed intrusion by development. Most of the jurisdictions had either CMZ maps, or CMZ related development restrictions, but not both; most did not require compensatory storage for fill placed in floodplains; and not all had critical areas ordinances for floodplains even though required by the Growth Management Act; most relied on stormwater detention and treatment rather than LID.

The technical team noted of the Puget Sound RPA, "some development is likely to occur [in floodplains], and that habitat functions will be better protected by anticipating this development" and allowing programmatic mitigation, and restoration actions in high value locations. The Oregon RPA has clearer protocols for mitigation and when it is required, whereas the Puget Sound RPA required mitigation for "adverse effects," which has proved to be a difficult standard. The report also stated, "[m]onitoring and enforcement will be necessary to ensure the mitigation is successful." The Oregon RPA has more carefully crafted reporting and enforcement requirements.

A second recommendation was "[w]here channel migration zones have not been mapped, local governments should use the Department of Ecology two step method ('web' guidance) to identify floodplains with the potential for migrating channels" and "FEMA should require jurisdictions to manage CMZs as a Protected Area tailored to existing floodplain conditions," i.e., cognizant of current levels of development. The Oregon RPA is consistent with this recommendation.

The Kramer Report also had a recommendation on high density floodplain development: "Allow high density floodplain development within urban growth areas while ensuring that other management strategies are implemented to protect existing functions." The Oregon RPA has specific provisions for Urban Growth Boundaries and altertnative methods to achieve protective outcomes.

Program Scale Weaknesses of the Door 3 Approach **–** "A parcel-by-parcel approach (Door 3) raises the challenge of addressing cumulative effects adequately. If any adverse effects were allowed at the site level, it would be difficult to avoid adverse effects at the reach scale. In order to avoid unaccounted for incremental impacts, NMFS anticipates that habitat assessments will be necessary for all floodplain development permits in the Door 3 Communities and all individual permits in the protected area must specify how they avoid adverse effects. Because of the difficulties of addressing cumulative effects on a parcel-by-parcel basis, NMFS encourages FEMA to promote the use of the large scale approaches contemplated by Door 2." Stelle Letter to Murphy, Sept. 26, 2011.

- **Reporting Insufficiencies –** Four years of annual reports from FEMA have produced multiple pages of project level effects statements. Virtually all local habitat statements indicated “no effect” or “not likely to adversely affect,” which may be an accurate evaluation for many, but clearly not all, described projects, which run a wide spectrum from installation of HVAC to new commercial development. Included here are samples from FEMA’s 2014 annual report.

NFIP/ESA Biological Opinion Reporting Tool

Please answer the following questions for each permit.
When completed save the spreadsheet and email your response to FEMA
Your participation is greatly appreciated.

▶**Most cells contain drop-down lists from which to choose - please respon**
▶**Use as many lines as required for info on each FloodPlain Development**

	joriburnett@cityofferndale.org
Email **Addr**	Jori Burnett
Name	FPA
Title	FERNDALE, CITY OF
Community	WHATCOM COUNTY
County	

FloodPlain Development Permit #	Brief Description of Project & Habitat Conditions	Anticipated Effects on Habitat?
13005.LDP	site preparation	No Effect
13011.LDP	parking lot	No Effect
13012.LDP	site preparation	No Effect
13013.LDP	site preparation Stormwater Ponc	No Effect
13015.LDP	Site preparation BMX bike park	No Effect
13017.LDP	Site preparation Fourplex	No Effect
13021.LDP	Site preparation Wetland Reconfi	No Effect
13022.LDP	Site preparation Boulous Library I	No Effect
13016.ENC	cable work	No Effect
13070.ENC	lighting placement	No Effect
13072.ENC	utilities for four plex	No Effect
12044.B	Residential	No Effect
11008.B	Library	No Effect
13181.B	Commercial Remodel	No Effect
13014.Si	Sign permit	No Effect
13005.Si	Sign permit	No Effect
12175.B	Tenant Improvement	No Effect
12112.B	Tenant Improvement	No Effect
12076.B	SFR buidling permit	No Effect
13006.Demo	Garage Demolition	No Effect
12175.B	Mobile Home	No Effect
13019.B	Cell tower	No Effect
12035.B	Tenant Improvement pilot	No Effect
13185.B	retaining wall	No Effect
12005.SI	Sign permit	No Effect
12082.Si	single family residence	No Effect

❖

NFIP/ESA Biological Opinion Reporting Tool

Please answer the following questions for each permit.
When completed save the spreadsheet and email your response to FEMA-R10-ESAcomments@fema.dhs.gov.
Your participation is greatly appreciated.

- **Most cells contain drop-down lists from which to choose - please respond using these standardized answers.**
- **Use as many lines as required for info on each FloodPlain Development Permit; this form contains 100 formatt**

Email Addr	william.appleton@cityoffederalway.com	**Respondent**	william appleton
Name	william appleton	**Respdnt Email**	william.appleton@cityoffederalwa
Title	surface water manager		
Community	Federal Way	**CID**	530322
County	King	**State**	wa

Data No.

FloodPlain Development Permit #	Brief Description of Project & Habitat Conditions	Anticipated Effects on Habitat?	Increase in Impervious Surfaces	Increase in Impervious Surfaces - to nearest 1/10th acre	Trees Removed	Follow On Number Small Trees	I I I T
13-102886	Construction of a detached garage for single family home	No Effect	Yes > 10% of Lot	0.04	Yes	2	(
13-103682	Garage and second story addition to single family residence	No Effect	Yes < 10% of Lot	0.01	No	0	(

CMB2012-0252, SEP2013-034	Construct one new single family residence on 0.25-acre site located within the floodplain.	May affect, NOT LIKELY to Adversely Affect (NLAA)	Yes; 4,458 square feet	40% of lot (.10 acre)	Yes; 2 trees removed.
VAR2012-095, CMB2013-0359	Construct one new single family residence on 0.34-acre site located within the floodplain.	May affect, NOT LIKELY to Adversely Affect (NLAA)	Yes; 3,983 square feet.	27% of lot (.26 acre)	

NFIP/ESA Biological Opinion Reporting Tool

Please answer the following questions for each permit.

When completed save the spreadsheet and email your response to FEMA-R10-ESAcomments@fema.dhs.gov.

Your participation is greatly appreciated.

- **Most cells contain drop-down lists from which to choose - please respond using these standardized answers.**
- **Use as many lines as required for info on each FloodPlain Development Permit; this form contains 100 formatt**

Email Addr	mfleek@ci.burlington.wa.us	**Respondent**	Margaret Fleek
Name	Margaret Fleek	**Respdnt Email**	mfleek@ci.burlington.wa.us
Title	Planning Director		
Community	City of Burlington	**CID**	**Data No.**
County	Skagit	**State**	WA

FloodPlain Development Permit #	Brief Description of Project & Habitat Conditions	Anticipated Effects on Habitat?	Increase in Impervious Surfaces	Increase in Impervious Surfaces - to nearest 1/10th acre	Trees Removed	Follow On Number Small Trees
PR2013101	Single Family Res.	No effect	Yes < 10% of Lot		No	
PR2013102	Single Family Res.	No effect	Yes < 10% of Lot		No	
PR2013047	garage	No effect	Yes < 10% of Lot		No	
PR2013022	Single Family Res.	No effect	Yes < 10% of Lot		No	
P2012070	Single Family Res.	No effect	Yes > 10% of Lot		No	
P2010031	Single Family Res.	No effect	Yes < 10% of Lot		No	
PR2013013	commercial	No effect	Yes < 10% of Lot		No	
PR2013056	commercial	No effect	Yes > 10% of Lot		No	
PR2013059	commercial	No effect	Yes < 10% of Lot		No	
PR2013029	commercial	No effect	No		no	
PR2012124	commercial	No effect	no		no	
PR2013037	commercial	No effect	Yes > 10% of Lot		no	
PR2013060	commercial	No effect	NO		no	
PR2013104	commercial	No effect	No		no	

LUA2013-0065	Shoreline Exemption, Floodplain Development and SEPA Review for construction of a concrete bulkhead.	Does not create long-term impacts to the environment or neighboring properties.

❖ **Bulkheads –** despite a "no adverse effect" standard for development in the "Protected Area," which always includes river banks and marine areas at and near the OHWM, bulkheads, which have a suite of adverse effects to habitat, continue to be constructed within the Puget Sound region, with close to a mile of new marine shoreline armoring in each 2011 and 2012.

County Name	2009	2010	2011	2012	2013	2014	**Linear feet Totals by County**
Clallam	290	0	0	538	0	255	**1083**
Island	505	110	1758	93	486	36	**2988**
Jefferson	65	0	305	340	65	0	**475**
King	0	59	0	60	0	99	**218**
Kitsap	641	665	204	849	365	20	**2744**
Mason	612	1958	481	554	502	523	**4630**
Pierce	476	183	125	1445	440	316	**2555**
San Juan	814	320	395	660	1140	110	**3439**
Skagit	375	546	1050	0	776	118	**2865**
Snohomish	70	0	100	0	0	53	**223**
Thurston	380	25	0	395	150	0	**950**
Whatcom	20	32	380		0	0	**432**
Totals by Year	**4248**	**3898**	**4798**	**4934**	**3924**	**1530**	23332

(source: Randy Carman, WDFW 2015)

❖ **Anticipated Community Development/Project-by-Project Floodplain Impacts**

- City of Monroe: (Door 3) August 2014, rezoned 43 acres of floodplain from "limited open space" to "General Commercial" development.

- City of Bainbridge Island: (Door 3) Significant shoreline residential development is anticipated throughout most of the City's shorelines. SMP provisions set standard shoreline buffer and setback regulations that are tailored to the level of existing development and impairment. The maximum potential for subdivision in the shoreline area would create *104 new lots on the shoreline* (a 5 percent increase). The overwhelming majority of these new lots would occur in areas with R-1 and R-2 zoning. Finally, the [cumulative effects] analysis indicates that *approximately 154 existing vacant lots are able to accommodate development*. Potential incremental and/or unavoidable impacts are likely to be offset by ongoing and planned restoration actions over time.

- San Juan County: (Door 3) The proposed SMP establishes building setback widths that depend on whether trees are present on the parcel. If possible, residential setbacks shall be behind the treeline and a minimum of 50 feet from OHWM. If trees are not present, *the minimum building setback is 100 feet from OHWM. A reduced setback may also be accepted* if neighboring houses are farther waterward than the established setback (*i.e.*, smaller than the RPA setback).

- Kitsap County: (Door 3) Kitsap County's marine shorelines are projected to see the most population growth and additional single-family home development (75% of total future dwellings). Most of these future dwelling units are likely to occur on shorelines designated Rural Conservancy and Shoreline Residential. (*i.e.*, will occur in protected area).

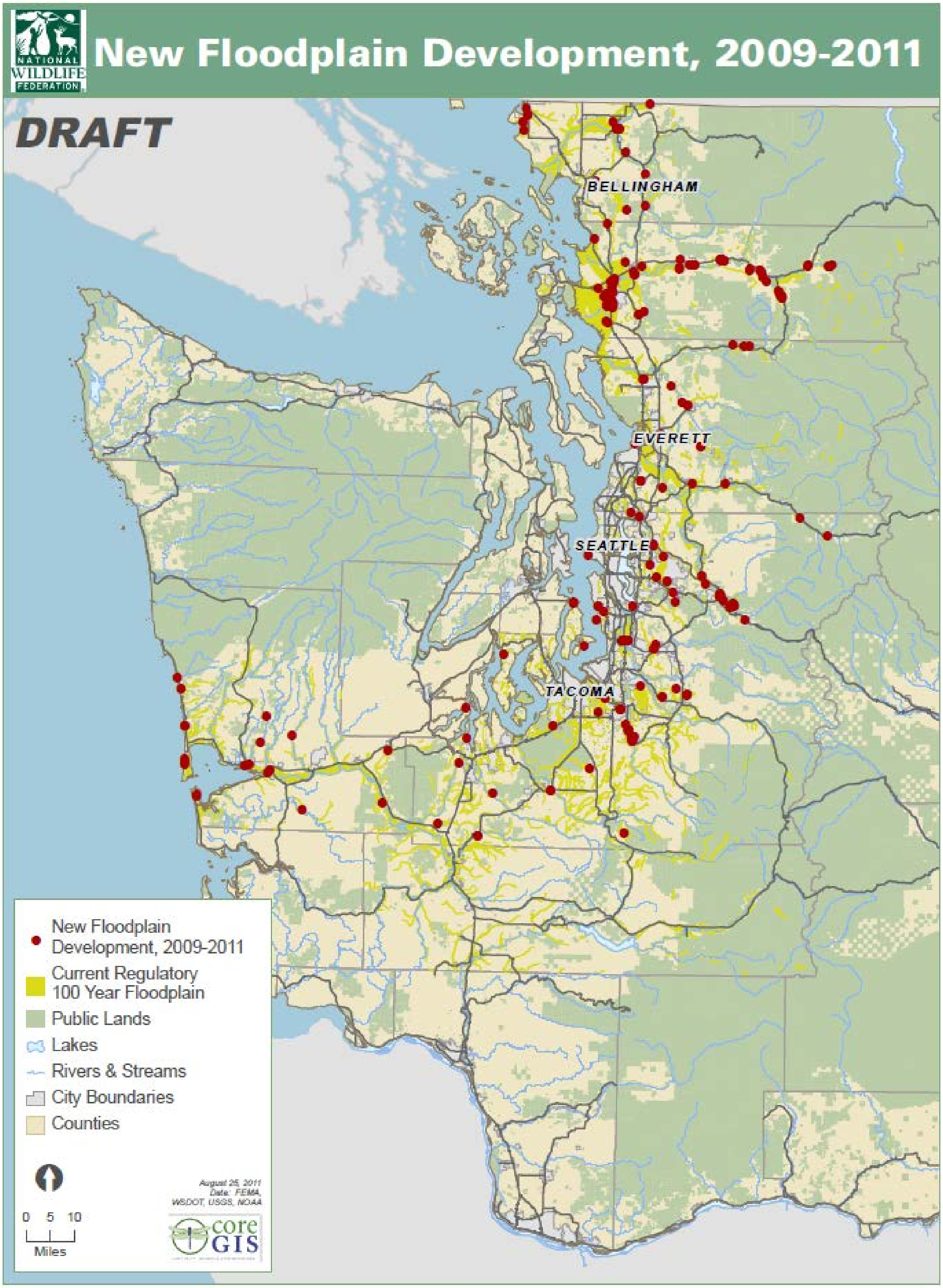
❖ **Issues Raised to NMFS by the *NWF v FEMA* Plaintiff**

- City of Burlington: in one reporting period, 24 projects added 8 football fields worth of new impervious surfaces. No habitat assessments.
- Zero implementation of LID standard throughout the Puget Sound region.
- Very difficult to tell if implementation is successful because critical information was missing from reporting, *e.g.*, new imprevious amounts.
- Habitat assessments are of poor quality, *e.g.*:

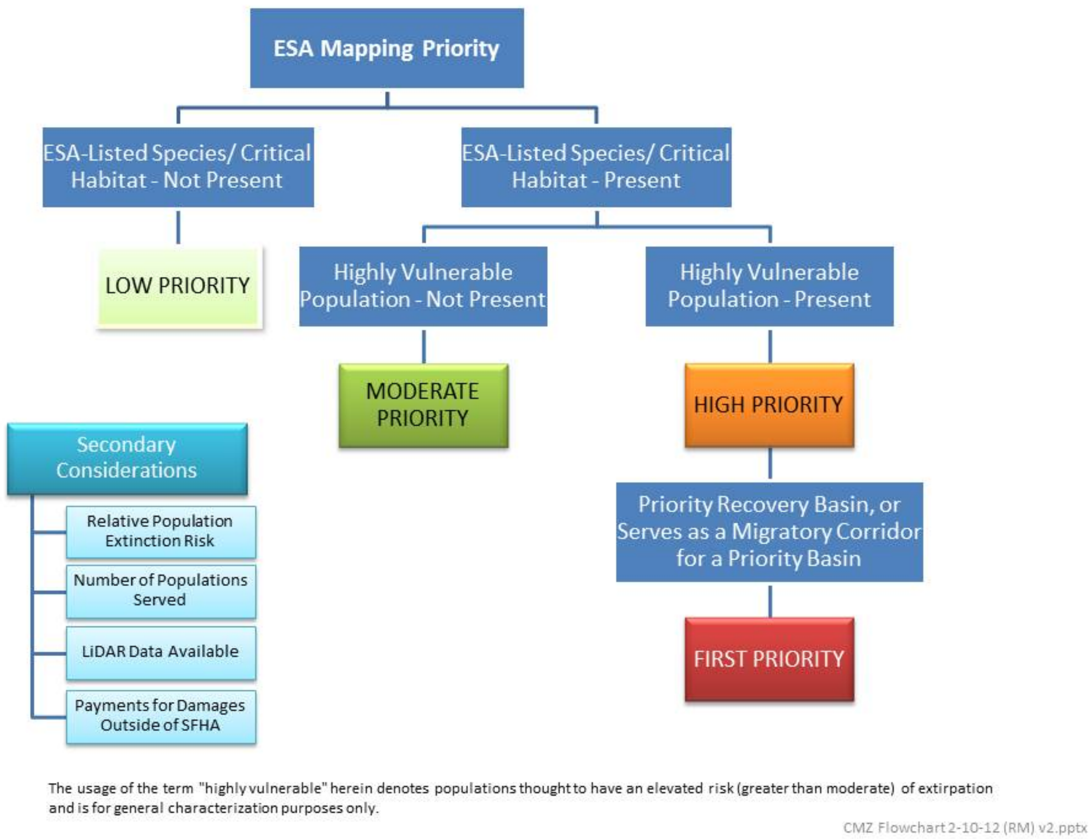
> 12) Please describe how your project has been designed to have no effect on wildlife habitat.
> The project will not have an effect on wildlife habitat.

> 12) Please describe how your project has been designed to have no effect on wildlife habitat.
> The project only expands an existing home located within an already established barn-yard area with out-buildings. There is no wildlife that lives in this area.

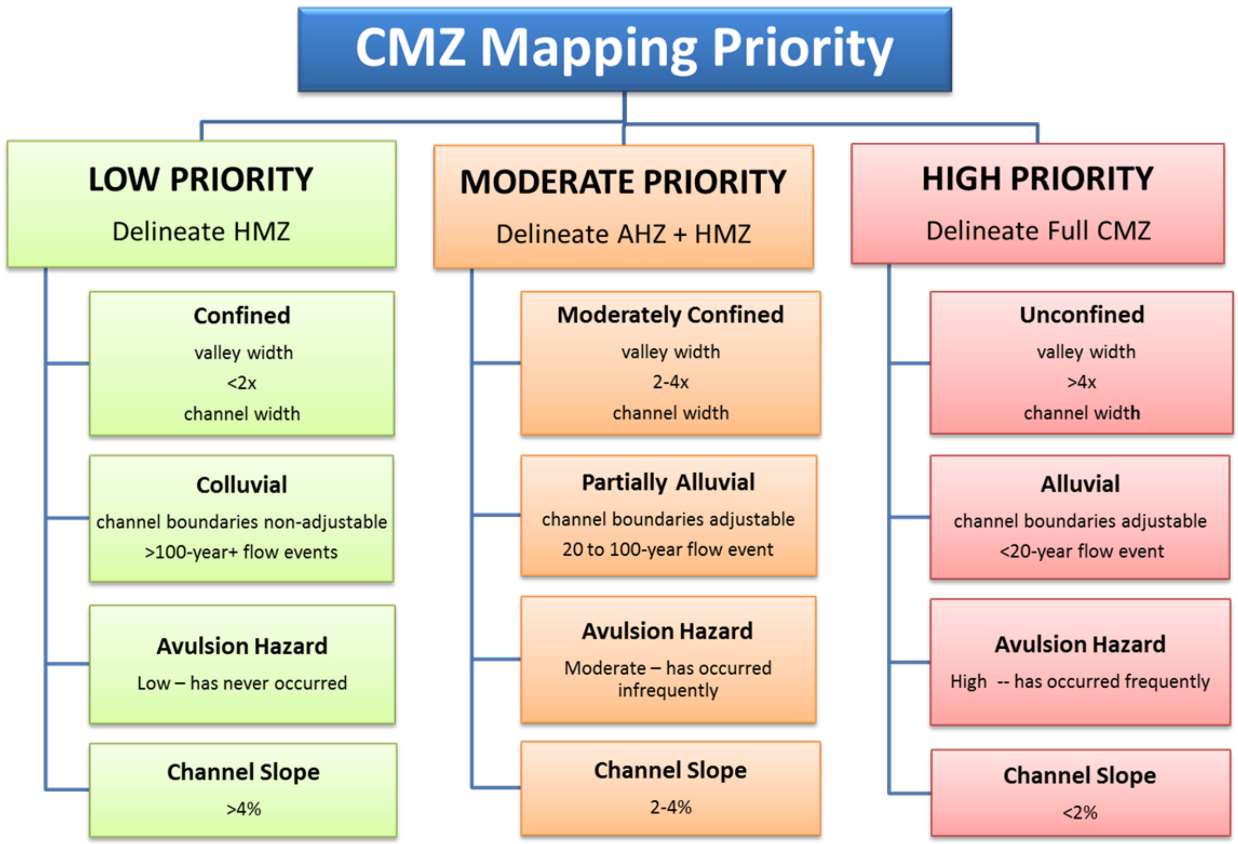
- Most communities still using unchanged development codes 7 years after BiOp issued.
- And the following graphic provided by plaintiff:


New Floodplain Development, 2009-2011
NATIONAL WILDLIFE FEDERATION
DRAFT
BELLINGHAM
EVERETT
SEATTLE
TACOMA
New Floodplain Development, 2009-2011
Current Regulatory 100 Year Floodplain
Public Lands
Lakes
Rivers & Streams
City Boundaries
Counties
0 5 10
Miles
August 25, 2011
Data: FEMA, WSDOT, USGS, NOAA
core GIS

APPENDIX 2.8-A
ESA Mapping Priority



APPENDIX 2.8-B
CMZ Mapping Priorities and Protocols



CMZ Proxy Methods

The preferred method of accurately identifying a channel migration zone is through careful analysis of historical photos and maps, combined with analytical methods to determine rates of potential erosion, deposition, an avulsion. However, this is resource intensive, so a proxy for the channel migration zone (CMZ) is often desired. Proxy values are generally chosen to be conservative and inclusive of actual values, hence a CMZ delineation should almost always result in a zone that is smaller than that determined using a proxy. A balance then must be struck between expediency and precision.

The best proxy for a CMZ analysis would be a historical record of rates of channel migration for the specific river system and reach being assessed. As this is not available for most rivers, averages calculated using a large, robust data set for a large number of rivers provide an appropriate alternative. For the United States, an archive of historical channel migration rates measured at 1,503 meander bends at 141 sites on 89 rivers in 22 States within the continental U.S.A. was compiled by Ayres Associates as part of a study to develop a practical methodology to predict the rate and extent of alluvial channel migration in proximity to bridges for the National Cooperative Highways Research Program (NCHRP) (Lagasse *et al*. 2004).

The NCHRP data base was refined in subsequent research supervised by Dr. Colin Thorne at Nottingham University, UK to support probabilistic prediction of lateral migration in meandering rivers without the need for historical information or specialist skills in GIS (Sikder 2012). The method used statistical analysis of an enhanced version of the NCHRP data base to established probability density functions for historical lateral migration rates. This allows the extent of lateral channel migration at a given future date (for example, 30 years from now) to be predicted, with the user selecting an acceptable level of risk (for example, 10%) that the predicted rate will be exceeded. Hence, if a 10% level of risk is selected, there is a 90% chance that the actual extent of lateral migration will be equal to or less than that predicted using Dr. Sikder's method.

According to Dr. Sikder's findings there is a 90% chance that the annual rate of channel migration will not equal or exceed 0.1x channel width per year at one bank. Applying this to retreat rate to both banks, and extrapolating out 100 years, results in a predicted migration zone 20x the channel width (that is 10x the channel width on each side of the current alignment). The probability that a channel might migrate further than this is somewhat less than 10% because the periods of record used in the analysis were actually shorter (30 to 40 years). This is because migration beyond the predicted migration zone would require migration a rate faster than 0.1x channel widths per year for three, consecutive 30-year periods.

References:

Lagasse, P.F., Zevenbergen, L.W., Spitz, W.J., and Thorne, C.R. 2004. *Methodology for Predicting Channel Migration*, Final Report prepared by Ayres Associates for the National Cooperative Highway Research Program, Transportation Research Board, National Research Council, NCHRP Web-Only Document 67 (Project 24-16), Washington, D.C., 162 p. plus appendices. Available for download at: *http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_w67.pdf.*

Sikder, M.A.S. 2012. *Probabilistic Analysis and Prediction of Bend Migration in Meandering Alluvial Streams*, PhD thesis, University of Nottingham, 420p.

APPENDIX 2.8-C
Mitigation

The following mitigation standards are considered adequate to ensure compensatory mitigation replaces or rectifies adverse effects associated with floodplain development and may be implemented as an interim measure pending FEMA's completion of its own comparable standards.

A. Mitigation is required for all adverse effects to natural floodplain functions that occur as a consequence of development within special hazard areas. Mitigation must be self-sustaining, meaning that the ecological processes that provide the habitat functions offered as mitigation need to be present and expected to persist in perpetuity. Floodplain functions and features requiring mitigation include:
   i. Loss of flood storage due to placement of fill, construction of levees or dikes, or new residential or commercial structures.
   ii. Loss of hyporheic function due to the addition of impervious surface.
   iii. Reduction in water quality (temperature and pollutants) due to the addition of impervious surface.
   iv. Modified hydrologic processes (hyporheic flows, volume peak and timing, stream recharge) due to the addition of impervious surface.
   v. Loss of riparian vegetation due to clearing for conversion of land.
   vi. Loss of habitat forming processes due to levees, bank armoring, or other channel simplification.

B. Mitigation is not appropriate without first taking all available measures to avoid adverse effects to floodplain functions and features. For example, effects can be avoided by siting development outside of special flood hazard areas. Where adverse effects cannot be fully avoided, those effects must be kept to a minimum, for example, by placing structures on pilings instead of fill, reducing the footprint of new structures, and limiting density. After being minimized, residual adverse effects must be mitigated by:
   i. Taking measures that replace those features and functions that were impaired, and/or providing other adequate compensatory mitigation that offset or rectify the adverse effects.
   ii. Mitigation activities must benefit the same species and populations affected by the proposed development.

C. Mitigation must be performed prior to the issuance of final development authorization, or the development proponent must demonstrate a legal right to implement the proposed mitigation activities (*e.g.*, property owner agreement) and demonstrate that financial assurances are in place for the execution of and long-term maintenance of all mitigation projects. To offset the impacts of delay in performing mitigation, a 25% increase in the required minimum area is surcharged for each year mitigation implementation is delayed.

D. Where habitat preservation (*e.g.*, conservation easement) is used to mitigate for lost habitat function:

i. The site must be at risk of loss (i.e., if not protected, the site is likely to be developed or otherwise degraded in the foreseeable future). The risk shall be documented by the community's land use planner, or comparable authority, and attached to the development permit.
ii. The preserved site must be of equal or better habitat value (determined by, e.g., the relative presence or lack of impervious surface, native riparian vegetion, flood storage, floodplain connectivity, and complex habitat) than the full potential habitat value of the affected site, not just its current value.
iii. FEMA must apply a minimum 10:1 replacement-preservation to impact area ratio (e.g., 10 acres preserved for each acre impacted).
iv. FEMA must require that the property be secured in perpetuity with a conservation easement and/or deed restriction that runs with the land.
v. FEMA must require the parcel owner provide a management plan that identifies the responsible site manager, stipulates what activities are allowed on site, and requires the posting of signage identifying the site as a mitigation area.

E. In-kind mitigation is preferred. Any out-of-kind mitigation must address a NMFS-recognized limiting factor (*e.g.*, identified in an appropriate recovery plan or other NMFS document).

F. On-site mitigation is preferred. Any off-site mitigation must occur in the same hydraulic reach as the affected area. If proposed development cannot proceed without off-site mitigation, the proponent and/or the permitting authority must present the proposed action, together with proposed off-site mitigation, to FEMA for review to ensure no net loss of function for listed species. FEMA may contact NMFS for technical support in its review. In order to consider mitigation that would occur out of the affected hydraulic reach, it must be located within the affected 5th field watershed and the required base mitigation must be increased by a multiplier of two (200%).

G. Mitigation must occur prior to or concurrent with the loss of habitat function. If proposed development cannot proceed without mitigation occurring subsequent to the development, then the required mitigation must be increased by 25% per year (*e.g.*, 1-year delay in replacing 4,000 cubic feet of flood storage mitigation requires 5,000 cubic feet of required mitigation).

H. Mitigation that has delayed realization of replacement functional value must include an increase in the required mitigation by 5% for each year the mitigation site is below the existing performance level (e.g., replace the loss of 0.1 acre of 70-year old stand of trees by replanting 0.35 acres [(0.05 x 70 years) x 0.1 acres = 0.35 acres].

I. Existing habitat value must be deducted from the mitigation value and the required mitigation increased proportionally (e.g., a stand of 20-year old trees is proposed to mitigate for the loss of 0.1 acre of 70-year old trees would need to increase the mitigation area from 0.35 acres to 0.45 acres [((0.05 x (70 years + 20 years)) x 0.1 acres = 0.45 acres].

J. All mitigation must:
   i. Prior to the issuance of any development authorization, demonstrate a legal right by the project proponent to implement the proposed mitigation activities (*e.g*., property owner agreement).
   ii. Prior to the issuance of any development authorization, demonstrate that financial assurances are in place for the long-term maintenance and monitoring of all mitigation projects.
   iii. Be secured in perpetuity with a conservation easement and/or deed restriction placed on the property.
   iv. Include a management plan that identifies the responsible site manager, stipulates what activities are allowed on site, and requires the posting of signage identifying the site as a mitigation area.

K. Any action in the special hazard area that would reduce flood storage volume or accessible floodplain habitat for fish that would be mitigated by the creation of new storage capacity and accessible habitat (*i.e*., balanced cut/fill) must comply with the following:
   i. Site selection of replacement storage capacity and accessible fish habitat must effectively offset effects of the "loss" site and preferably be located on site. However, the replacement area(s) may occur off site if located within the same hydraulic reach as the affected area.
   ii. Any replacement area created to provide replacement storage capacity must occur at or below the proposed "loss" site elevation relative to the BFE for the cut site. For example, if the loss site elevation is 2 feet below BFE, the cut site must be 2 feet or more below BFE. Mitigative storage must be constructed so as to not strand fish, and will drain as the flood recedes. All storage provided must have positive drainage and not allow standing water (ponded) to occur. Activities that occur in the SFHA may not be mitigated in the floodway.
   iii. The size (area) and volume of any replacement area must be:
      a. Increased by 25% for each year mitigation implementation is delayed;
      b. Increased by 5% for each year the functional value of the mitigation site will remain below the proposed "loss" area's existing habitat value; and
      c. Calculated so as to exclude any existing functional value that may exist at the mitigation site as stipulated above.
   iv. Any replacement area must be vegetated and managed in such a manner as to allow the site to develop to its maximum functional habitat potential.
   ix. Any replacement area must be designed to avoid fish entrapment in the site following the subsidence of flood flows.

L. Use of an NMFS-approved conservation bank or in-lieu fee program may provide an acceptable alternative approach to compensate for adverse effects of floodplain development.