UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
PORTLAND, OREGON 97232-1274

Refer to NMFS No: WCRO-2021-02662

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November 8, 2022

Todd Tillinger
Chief, Regulatory Branch
U.S. Army Corps of Engineers, Seattle District
P.O. Box 3755
Seattle, WA 98124-3755

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the BNSF 0047-0072.8 Replacement Project, White Salmon River Crossing (HUC 17070105), Underwood, Washington.

Dear Mr. Tillinger:

Thank you for your October 12, 2021 letter requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the BNSF Railway Bridge 0047-0072.8 Replacement Project, White Salmon River Crossing. The U.S. Army Corps of Engineers (Corps) proposes to permit the project under section 404 of the Clean Water Act. The project may also require authorization under Section 14 of the Rivers and Harbors Act of 1899, as codified at 33 U.S.C. Section 408 (Section 408).

Thank you also for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson–Stevens Fishery Conservation and Management Act [16 U.S.C. 1855(b)] for this action.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019 Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. As a result, the 2019 regulations are once again in effect, and we are applying the 2019 regulations here. For purposes of this consultation, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

After reviewing the current status of the species, the environmental baseline, the effects of the proposed action, and the cumulative effects, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of ESA-listed Upper Columbia River (UCR) spring-run Chinook salmon (*Oncorhynchus tshawytscha*), UCR steelhead (*O. mykiss*), Middle Columbia River steelhead, Snake River Basin steelhead, Snake River (SR) spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon (*O. nerka*), Lower Columbia River (LCR) Chinook salmon, LCR coho salmon (*O. kisutch*), LCR steelhead, or Columbia River chum salmon (*O. keta*). NMFS also determined the action will not destroy or adversely modify designated critical habitats for these species. In this biological opinion (opinion) we also determined that the proposed action in not likely to adversely affect the southern distinct population segment of eulachon (*Thaleichthys pacificus*) or Southern Resident killer whales (*Orcinus orca*). We provide rationale for our conclusions in the attached opinion. The enclosed opinion is based on information provided in your biological evaluation, requested additional information provided by Scott Swarts (Jacobs Environmental Group), and other sources of information cited in the opinion.

As required by section 7 of the ESA, NMFS provided an incidental take statement (ITS) with the opinion. The ITS includes reasonable and prudent measures (RPMs) that NMFS considers necessary or appropriate to minimize incidental take associated with the proposed action. The take statement sets forth terms and conditions, including reporting requirements that the Corps and any person who performs the action must comply with to carry out the RPMs. Incidental take from the proposed action that meets these terms and conditions will be exempt from the ESA take prohibition.

Please contact Colleen Fagan, Interior Columbia Basin Office, La Grande, Oregon, 541-962-8512 or colleen.fagan@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Nancy L Munn

Nancy L. Munn
Acting Assistant Regional Administrator
Interior Columbia Basin Office

Enclosure

cc: [*File*]
Alan Bloomquist, BNSF Railway
David Moore, Corps
Scott Swarts, Jacobs
Bill Sharp, Yakama Indian Nation
Matthew Gardner, WDFW

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

BNSF Railway Bridge 0047-0072.8 Replacement Project, White Salmon River Crossing

NMFS Consultation Number: WCRO-2021-02662

Action Agency: U.S. Army Corp of Engineers, Seattle District

Affected Species and NMFS' Determinations:

ESA-Listed Species	**Status**	**Is Action Likely to Adversely Affect Species?**	**Is Action Likely to Jeopardize the Species?**	**Is Action Likely to Adversely Affect Critical Habitat?**	**Is Action Likely to Destroy or Adversely Modify Critical Habitat?**
Upper Columbia River spring-run Chinook salmon (*O. tshawytscha*)	Endangered	Yes	No	Yes	No
Upper Columbia River steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
Snake River spring/summer-run Chinook salmon (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
Snake River fall-run Chinook salmon (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
Snake River sockeye salmon (*O. nerka*)	Endangered	Yes	No	Yes	No
Snake River Basin steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
Middle Columbia River steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
Lower Columbia River Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened	Yes	No	Yes	No
Lower Columbia River steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
Lower Columbia River coho salmon (*O. kisutch*)	Threatened	Yes	No	No	No
Columbia River chum salmon (*O. keta*)	Threatened	Yes	No	Yes	No

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
Eulachon (*Thaleichthys pacificus*)	Threatened	No	No	No	No
Southern Resident Killer Whale (*Orcinus orca*)	Endangered	No	No	No	No

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

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By: Nancy L Munn

Nancy L. Munn
Acting Assistant Regional Administrator
Interior Columbia Basin Office

Date: November 8, 2022

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Acronym Glossary

BE	Biological Evaluation
BMP	Best Management Practice
cfs	Cubic Feet per Second
CHART	Critical Habitat Analytical Review Team
Corps	U.S. Army Corps of Engineers
CR	Columbia River
dB	Decibels
DIP	Demographically Independent Population
DPS	Distinct Population Segment
DQA	Data Quality Act
EFH	Essential Fish Habitat
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FHWG	Fisheries Hydroacoustic Working Group
FR	Federal Register
HUC5	Fifth-Field Hydrologic Unit Code
ICRD	Interior Columbia Recovery Domain
ICTRT	Interior Columbia Basin Technical Recovery Team
IMM	Impact Minimization Measures
ITS	Incidental Take Statement
Jacobs	Jacobs Engineering Group
LCR	Lower Columbia River
MCR	Middle Columbia River
MPG	Major Population Group
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NMFS	National Marine Fisheries Service
NWFSC	Northwest Fisheries Science Center
OHWM	Ordinary High Water Mark
opinion	Biological Opinion
PAH	Polycyclic Aromatic Hydrocarbon
PBF	Physical or Biological Feature
PCE	Primary Constituent Element
RM	River Mile
RMS	Root Mean Square
RPM	Reasonable and Prudent Measure
SEL	Sound Exposure Level
SPL	Sound Pressure Level
SR	Snake River

SRB	Snake River Basin
SRKW	Southern Resident Killer Whale
TDG	Total Dissolved Gas
TSS	Total Suspended Solids
UCR	Upper Columbia River
VSP	Viable Salmonid Population
WLCRD	Willamette-Lower Columbia Recovery Domain

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

National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) 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.), as amended, and implementing regulations at 50 CFR part 402. 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 part 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 (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within 2 weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at NMFS' La Grande, Oregon office.

1.2. Consultation History

NMFS received the U.S. Army Corps of Engineers' (Corps) request for formal consultation for the BNSF Railway Bridge 0047-0072.8 Replacement Project, White Salmon River Crossing, on October 12, 2021. The request included a biological evaluation (BE) prepared by Jacobs Engineering Group (Jacobs).

The Corps concluded that the proposed action is "likely to adversely affect" Upper Columbia River (UCR) spring-run Chinook salmon (*Oncorhynchus tshawytscha*), UCR steelhead (*O. mykiss*), Middle Columbia River (MCR) steelhead, Snake River Basin (SRB) steelhead, Snake River (SR) spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon (*O. nerka*), Lower Columbia River (LCR) Chinook salmon, LCR coho salmon, LCR steelhead, Columbia River (CR) chum salmon, and designated critical habitats for these 11 species; and is not likely to adversely affect the southern distinct population segment of eulachon (*Thaleichthys pacificus*) or Southern Resident killer whales (*Orcinus orca*). The Corps also concluded that EFH for Chinook salmon and coho salmon, as designated by Section 305 of the Magnuson–Stevens Fishery Conservation and Management Act, is likely to be adversely affected.

NMFS sent a letter on November 15, 2021, requesting additional information on bridge design alternatives, sediment transport, hydraulic modeling, fish passage, turbidity, vegetation, and bank armoring. The requested information was received from Scott Swarts, (Jacobs), on December 29, 2021. Consultation was initiated on December 29, 2021.

NMFS discussed the proposed project and potential effects to ESA-listed species in the White Salmon River with Bill Sharp (Yakama Nation) on March 28, 2022. NMFS requested and received MCR steelhead spawning ground survey information from Bill Sharp and Joe Zendt (Yakama Nation) on March 30, 2022. NMFS also requested and received LCR Chinook salmon and LCR coho salmon spawning ground survey information from Kari Dammerman and Matthew Gardner (Washington Department of Fish and Wildlife) on April 11, 2022.

Information on barge use for project construction was not included in the submitted BE. Scott Swarts (Jacobs) indicated in April 2022 that construction contractors would like the option of using barges for project construction. Therefore, NMFS requested additional information on barge use on April 25 and May 10, which was provided by Mr. Swarts on April 27, 2022 and during a meeting on May 13, 2022. Mr. Swarts also indicated that the size of steel piles for the permanent piers was reduced from 30-inch to 24-inch.

On April 27, 2022, NMFS requested a 30-day extension for consultation to review and analyze the new information. The request was approved by the Corps on April 28, 2022.

As part of the consultation process, from July 12 to September 23, 2022, NMFS, the Corps, and BNSF discussed and agreed on measures to offset project impacts to ESA-listed species and their critical habitat. During this timeframe, we also conferred with the Yakama Nation, WDFW, and the Underwood Conservation District on potential measures to offset project effects. The proposed project was revised to include removal of an estimated 44 derelict in-water piles in the Columbia River, approximately 0.27 miles downstream of the White Salmon River. In addition, 150 willow cuttings will be installed and monitored for 3 years.

1.3. Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (see 50 CFR 402.02). Under the MSA, "Federal action" means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal agency (see 50 CFR 600.910). The Corps proposes to permit BNSF to replace a 206-foot long railroad bridge (Bridge 72.8) with a 266-foot long bridge at the White Salmon River's confluence with the Columbia River. The Corps proposes to permit the project under section 404 of the Clean Water Act. The project may also require authorization under Section 14 of the Rivers and Harbors Act of 1899, as codified at 33 U.S.C. Section 408 (Section 408).

1.3.1. Project Overview

The BNSF proposes to replace Bridge 72.8, constructed in 1907-1908, because it is nearing its structural life expectancy. The bridge crosses the White Salmon River at its confluence with the Columbia River at river mile (RM) 168.4, in Underwood, Washington (Figure 1). The existing bridge is approximately 206.1 feet long and consists of two spans supported by three concrete piers in the uplands. The proposed bridge will be approximately 266.0 feet long and consist of three spans supported by four piers. Piers 1 and 4 are abutments and located in the uplands. Piers 2 and 3 will be constructed below the ordinary high-water mark (OHWM) within the White

Salmon River. All four proposed piers include a concrete cap supported by steel piles. The proposed bridge will be built on-line, generally within the footprint of the existing bridge, except that the new piers are offset from the original alignment (Figure 2).

Project construction will occur using causeways and work trestles or using four barges. A general description of project construction activities is included in this opinion. For a detailed description of project construction using causeways and work trestles, refer to Section 3.0, Project Description, in the BE submitted by Jacobs (2021). Information on use of barges for project construction was not included in the BE, but was submitted separately by Jacobs.

Figure 1. Location of the proposed BNSF Railway Bridge 0047-0072.8 Replacement Project, White Salmon River Crossing.

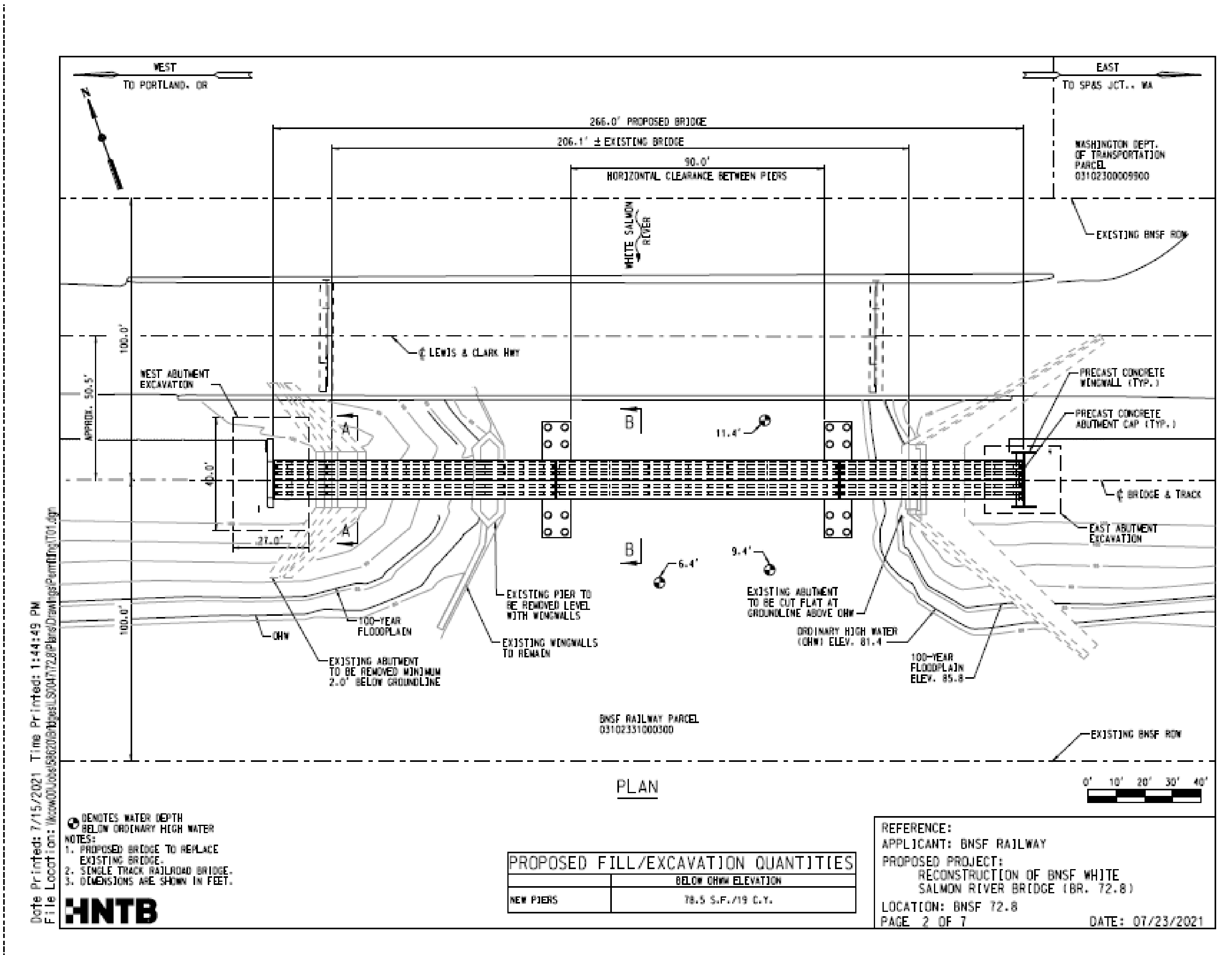

Figure 2. Existing and proposed BNSF Railway Bridges, White Salmon River crossing.

1.3.2. Construction Process

Site Preparation

Site preparation includes preparing the primary staging area for use by the construction contractor, installing erosion and sediment control best management practices (BMP), and improving site access.

Staging Area and Work Site Access

The primary staging area will be located approximately 1,200 feet west of Bridge 72.8 within an existing storage/staging area and highway pull off area located between State Route 14 and the rail line. Site access will be from State Route 14.

Temporary Work Trestles and Construction Causeways

Two temporary work trestles may be used for project construction. The north work trestle will be located between Bridge 72.8 and State Route 14, while the south work trestle will be along the edge of the Columbia River. The north work trestle will be approximately 20 feet wide by 400 feet long and supported by 20 36-inch-diameter steel pipe piles. The south work trestle will be approximately 35 feet wide by 375 feet long and supported by 30 36-inch-diameter steel pipe piles. Work trestle decking will be composed of steel H piles. Temporary work trestles will be in place for about 12 months.

Two causeways may be constructed on the south side of the tracks for equipment to access the southern work trestle. One causeway will be immediately southwest of the bridge and the other will be immediately southeast of the bridge, both between the railroad line and mainstem Columbia River. Each causeway will be constructed along the edge of the existing railroad tracks atop the existing railroad prism. Temporary shoring will be driven into the southern slope of the railroad prism with a vibratory driver, which will then be filled with crushed rock (3-inch minus embankment fill). Shoring will be installed immediately below the OHWM and fill will be placed on the existing railroad prism, resulting in 101 cubic yards of temporary fill covering a 19.2-square-foot area. Approximately 155 linear feet of shoring will be required for the southwest causeway and 135 linear feet of shoring for the southeast causeway (290 linear feet total, approximately 145 sections of 24-inch AZ Sheet Pile). Excavators will be used to place the fill between the shoring and railroad tracks. A loader and grader will then add additional layers of crushed rock that will intermittently be compacted with a roller. Fill material, sheet piles, and shoring associated with both causeways will be removed once the replacement bridge is operational.

Two temporary railroad track crossings will be used to connect the access roads to the construction causeways. One track crossing will be to the west of the bridge and the other will be to the east of the bridge.

Temporary Slide Beam Systems

Two slide beam systems, approximately 24-inches wide by 40-feet long, will be installed on each side of the White Salmon River between the south work trestle and bridge. Slide beams will be used to slide existing bridge spans off their piers and to slide the new spans onto new piers. Eight 36-inch-diameter steel pipe piles will support each slide beam system. Slide beam systems will be in place for about 12 months and removed after project construction.

Vegetation Removal

Trees that become established on the railroad prism must be removed once they become a potential hazard to rail traffic and are not allowed to become established near bridges. Seven trees (ponderosa pine and bigleaf maple) located in the railroad prism will be removed during construction of the causeways and will be left in the Columbia River along the edge of the railroad prism.

Use of Barges

Barges may be used for project construction instead of causeways and temporary work trestles. If barges are used, the contractor will use up to four barges, including: (1) one 80 x 120/200-foot long derrick barge (9,600-16,000 square feet) that will have a crane on it used to install and remove piles, move heavy bridge components, and for general hook support and falsework operations; and (2) three 40 x 120/150-foot long material barges (4,800-6,000 square feet each; 14,400-18,000 square feet total) that will be used to store fabrication materials, pile driving equipment, baker tanks, rebar, and general construction equipment and supplies. Due to sediment build-up on the west side of the bridge and downstream within the Columbia River, barge use will be limited to the Columbia River immediately to the south of the bridge and slightly upstream (east) within the Columbia River.

Material barges will be moored to temporary dolphins installed along the east bank of the Columbia River immediately upstream from the mouth of the White Salmon River. Dolphins will be 3-pile clusters of 24 inch-diameter steel piles. One pile will be installed vertically with the other two piles angled to approximately 30 feet away. Each dolphin will have a frame or steel connection. The dolphins will be spaced 100 feet apart. Dolphins will be removed by a vibratory pile driver following project construction.

The derrick barge will be deployed in the Columbia River perpendicular to the bridge. A tug boat, approximately 22 feet by 60 feet (1,320 square feet), will be used to move the barges. The tug will move material barges from dolphins to the derrick barge as needed. The derrick barge, one material barge, and the tug boat will be on site for the duration of the 16-month project.

Pier Construction

Piers 1 and 4 (bridge abutments) will be constructed in the uplands atop the existing railroad prism and each will consist of pre-cast concrete caps on four H-piles (eight H-piles total). Piers 2 and 3 will be installed in-water and each will consist of cast-in-place concrete caps on eight 24-

inch diameter steel pipe piles,16 24-inch piles total. The sixteen permanent piles will be filled with approximately 88 cubic yards of concrete. The in-water piers will cover approximately 51 square feet of substrate, which is currently dominated by sand/silt released from behind Condit Dam when it was demolished.

Pile Summary

The Project includes installation of 16 permanent and 25 to 51 temporary piles below the OHWM, depending on if barges or work trestles will be used for project construction (Table 1). Project piles will be driven to refusal with a vibratory driver and then proofed with an impact hammer.

Table 1. The number and location of permanent and temporary pipe piles and sheet pile installed for replacement of the BNSF railway bridge at White River Crossing.

Activity	Pile Size and Type	Duration	Upland	Below OHWM	Total
Without Use of Barges for Project Construction					
New Abutments	HP14x117	Permanent	8	0	8
New Bridge Piers	24-inch pipe piles	Permanent	0	16	16
Permanent Pile Subtotals		Permanent	**8**	**16**	**24**
North Work Trestle	36-inch pipe piles	Temporary	10	10	20
South Work Trestle	36-inch pipe piles	Temporary	5	25	30
Slide Beams	36-inch pipe piles	Temporary	0	8	8
Contingency	36-inch pipe piles	Temporary	2	8	10
Temporary Pile Subtotals		Temporary	**17**	**51**	**68**
AZ Sheet Pile	24-inch	Temporary		**290 feet**	**290 feet**
Using Barges for Project Construction					
New Abutments	HP14x117	Permanent	8	0	8
New Bridge Piers	24-inch pipe piles	Permanent	0	16	16
Permanent Pile Subtotals		Permanent	**8**	**16**	**24**
Slide Beams	36-inch pipe piles	Temporary	0	8	8
Contingency	36-inch pipe piles	Temporary	2	8	10
3 Moorage Dolphins[1]	24-inch pipe piles	Temporary	0	9	9
Temporary Pile Subtotals		Temporary	**2**	**25**	**27**

Bridge Replacement

The existing bridge spans will be cut or unbolted at each span joint and at the top of the piers and abutments, cranes will be used to slide the long truss span off the existing piers and onto the south work trestle or a barge, and then spans will be moved to the staging area for temporary storage. The new spans will be assembled at the primary staging area and then moved onto the new piers with cranes located on the southern work trestle or derrick barge. The construction crew will then bolt and weld the new spans to the pier caps and abutments.

Bridge and Work Trestle Demolition

The existing concrete piers will be sawcut or wire cut. Holes will be drilled in the piers above the cut line, steel rings inserted, and a crane used to lift the cut section of concrete pier onto the work trestle or a barge for transport to the staging area.

The piles supporting the work trestles will be removed via vibratory extraction. The temporary causeways will be removed in their entirety and all final earthwork will be graded and stabilized. Temporary piles will be removed with a vibratory extractor and crane. If the contractor is unable to remove a pile, it will be cut off level with the river bottom. Contours along the railroad prism will be returned to preconstruction conditions. The temporary fill material will be removed and transported out of the project area.

Site Rehabilitation

Site rehabilitation includes final grading (around the pier and abutments); removing temporary fills associated with the work pads, causeways, and under-crossings; hydroseeding bare earth; and removing erosion control measures.

Stormwater Management

During project construction, stormwater will be managed according to Volume II, Chapter 3 (Construction Stormwater Pollution Prevention), of the "Washington State Department of Ecology 2019 Stormwater Management Manual for Eastern Washington". This will include (1) preventing sediment laden runoff from entering all existing stormwater catch basins and inlets affected by construction; (2) construction of two sediment ponds, one on each side of the bridge; (3) grading to divert uphill stormwater into ponds and to provide a temporary outlet into the White Salmon River; (4) installing drainage swales with rock check dams or coir logs every 25 feet; (5) installing a pipe from the end of the swale to the top of each sediment pond; (6) grading temporary roads to drain toward the existing trackway; and (7) installation of silt fences. No exposed, bare soils will remain unstabilized for more than 2 days October 1 to April 30 or more than 7 days May 1 to September 30. All disturbed soil surfaces will be stabilized by a suitable application of BMPs.

Following project construction, there will be no stormwater management associated with the existing railroad track and prism, or the new bridge.

Conservation Offsets

Willow Plantings. BNSF will install 150 willow cuttings between October 15 and March 15 between the OHWM and wetted edge. Willow cuttings will be installed so that at least half their length is buried in the shoreline and in contact with water or saturated substrate. Monitoring, consisting of total plant counts, will be conducted by a biologist for 3 years to assess revegetation success. Performance standards include: (1) 85 percent survival by year one, (2) 80 percent survival by year 2, (3) and 75 percent survival by year 3. Damaged or dead willow cuttings will be replaced and count towards the yearly percent survival standard. A monitoring report will be submitted to the Corps by December 31 of each year of monitoring.

Removal of in-water Piles. Activities included in the proposed action will result in the loss of rearing and migration habitat functions and values to ESA-listed species and their designated critical habitat. Therefore, project modification or conservation offsets are required for proposed activities resulting in loss of rearing and migration habitat functions and values for ESA-listed species and critical habitat. BNSF will remove approximately 44 12-inch creosote piles located 0.27 miles downstream of the White Salmon River and immediately below the project staging area (Figure 3). In-water piles will be removed per the Washington Department of Natural Resources Derelict Creosote Piling Removal Best Management Practices for Pile Removal and Disposal (2017). Piles will be removed with a vibratory extractor and crane. If the contractor is unable to remove a pile or it breaks, it will be cut off level with the river bottom. All piles will be removed prior to demobilization after bridge construction.

Figure 3. Location of creosote piling removal in the Bonneville Reservoir, to offset effects to rearing and migration habitat from construction of the BNSF White Salmon River crossing railroad bridge replacement project.

1.3.3. Construction Schedule

The in-water work window for the mainstem Columbia River is November 1 through February 28, while the in-water work window for the White Salmon River is June 15 through August 15. Since the predominance of the action area is within the Columbia River, BNSF will conduct in-water work from November 1 through February 28. The Project will take approximately 16 months to complete.

1.3.4. Impact Minimization Measures

The following impact minimization measures (IMMs) will be implemented:

- In-water work will occur November 1 through February 28, the in-water work window for the mainstem Columbia River.
- A bubble curtain will be used when in-water piles are proofed with an impact hammer in water deeper than 2 feet.
- Piles will not be installed until 1 hour after sunrise and will cease being installed 1 hour prior to sunset.
- Floating silt curtains will be installed around the perimeter of in-water piles during installation and removal, and where any other turbidity generating action will occur.
- Floating silt curtains will be installed at the base of the causeways during their installation and removal.
- Monitoring of the floating silt curtains to maintain effectiveness will be two-fold. The construction engineer who is onsite daily will be responsible for monitoring the floating silt curtains on a day-to-day basis, while a Certified Erosion and Sediment Control Lead will be responsible for weekly monitoring and reporting. Site inspections will be timed to include periods of in-water work. Monitoring will include ensuring that floating silt curtains are in place prior to construction, fully encompassing the piles or edge of the causeways when needed, and that no turbidity plume is observed. If any discrepancy is observed, construction will cease until corrective action has been undertaken and no additional leakage or plume is observed.
- Floating silt curtains will not be removed until suspended sediment settles and turbidity clears.
- A Spill Prevention, Control, and Countermeasure Plan will be developed to assist with controlling and containing pollutants and products.
- BMPs will be installed to reduce erosion from exposed upland soils.
- BMPs will be installed to reduce fugitive dust from entering waters of the United States when the existing concrete piers are leveled.
- BMPs will be installed to verify wet concrete or slurry does not escape or leak during construction and enter waters of the United States.
- Fully stocked spill kits will be kept near each abutment/work trestle during construction.
- A secondary containment basin will be used, when possible, on/under all equipment that contains fuels or other hazardous materials placed on the work trestles, causeways, or within 100 feet of the river.
- Fuel containers will not be stored on the work trestles.

- All debris accumulated on the work trestles and barges will be contained and restricted from entering waters of the United States.
- BNSF will assign an inspector to ensure that all IMMs outlined above and stipulated by the regulatory authorities are implemented.

We considered, under the ESA, whether or not the proposed action would cause any other activities and determined that it would not. The proposed project was designed to replace the existing bridge because of its age, and not to increase rail traffic volume or loads.

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. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS, and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

The Corps determined the proposed action is not likely to adversely affect eulachon or Southern Resident killer whales. Our concurrence is documented in the "Not Likely to Adversely Affect" Determinations section (Section 2.11).

2.1. Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "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). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion also relies on the regulatory definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02).

The designations of critical habitat for the 11 salmon and steelhead species in this opinion use the term primary constituent element (PCE) or essential features. The 2016 final rule (81 FR 7414; February 11, 2016) that revised the critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features.

In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The ESA Section 7 implementing regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the final rule revising the definition and adding this term (84 FR 44976, 44977; August 27, 2019), that revision does not change the scope of our analysis, and in this opinion, we use the terms "effects" and "consequences" interchangeably.

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

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species and critical habitat.
- Evaluate the effects of the proposed action on species and their critical habitat using an exposure–response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly 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; or (2) directly or indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2. Rangewide Status of the Species and Critical Habitat

In this opinion we examine the status of each species that is likely to be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" for the jeopardy analysis. We also examine the condition of critical habitat throughout the designated area, evaluate the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discuss the function of the PBFs that are essential for the conservation of the species.

2.2.1. Status of the Species

For Pacific salmon and steelhead, we commonly use 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.

"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.

"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).

"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).

"Productivity", as applied to viability factors, refers to the entire life cycle (i.e., the number of naturally-spawning adults produced per parent). When progeny replace or exceed the number of parents, a population is stable or increasing. When progeny fail to replace the number of parents, the population is declining. McElhany et al. (2000) use the terms "population growth rate" and "productivity" interchangeably when referring to production over the entire life cycle. They also refer to "trend in abundance", which is the manifestation of long-term population growth rate.

For species with multiple populations, once the biological status of a species' populations has been determined, we assess 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).

In the summary that follows, we describe the status of UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, LCR Chinook salmon, SR sockeye salmon, LCR coho salmon, CR chum salmon, UCR steelhead, SRB steelhead, MCR steelhead, LCR steelhead, and their designated critical habitat that occurs 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 resource, and their biology and ecology, are in the listing regulations and critical habitat designations published in the Federal Register (Table 2), applicable recovery plans (NMFS 2009; NMFS 2013; NMFS 2015a; NMFS 2017a; NMFS 2017b; UCSRB 2007), and the viability analysis prepared by the Northwest Fisheries Science Center (NWFSC) for the status reviews (Ford 2022). These additional documents are incorporated by reference and are available on the NMFS West Coast Region website (https://www.westcoast.fisheries.noaa.gov).

Table 2. 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.

Species	Listing Status	Critical Habitat	Protective Regulations
Chinook salmon *(Oncorhynchus tshawytscha)*			
Upper Columbia River spring-run	Endangered 3/24/1999; 64 FR 14308 Reaffirmed 5/26/2016; 81 FR 33468	9/02/05; 70 FR 52630	ESA section 9 applies
Snake River spring/summer-run	Threatened 6/3/1992; 57 FR 23458 Reaffirmed 5/26/2016; 81 FR 33468	10/25/99; 64 FR 57399	6/28/05; 70 FR 37160
Snake River fall-run	Threatened 4/22/1992; 57 FR 14653 Reaffirmed 5/26/2016; 81 FR 33468	12/28/93; 58 FR 68543	6/28/05; 70 FR 37160
Lower Columbia River	Threatened 3/24/1999; 64 FR 14308 Reaffirmed 5/26/2016; 81 FR 33468	9/2/05; 70 FR 52630	6/28/2005; 70 FR 37159
Sockeye salmon *(O. nerka)*			
Snake River	Endangered 11/20/1991; 56 FR 58619 Reaffirmed 5/26/2016; 81 FR 33468	12/28/93; 58 FR 68543	ESA section 9 applies
Coho salmon (*O. kisutch*)			
Lower Columbia River	Threatened 6/28/2005; 70 FR 37160 Reaffirmed 5/26/2016; 81 FR 33468	2/24/2016; 81 FR 9251	6/28/2005; 70 FR 37159
Chum salmon (O. *keta*)			
Columbia River	Threatened 3/25/1999; 64 FR 14508 Reaffirmed 5/26/2016; 81 FR 33468	9/2/2005; 70 FR 52630	6/28/2005; 70 FR 37159
Steelhead (*O. mykiss*)			
Upper Columbia River	Threatened 10/17/1997; 62 FR 43937 Reaffirmed 5/26/2016; 81 FR 33468	9/02/05; 70 FR 52630	2/1/06; 71 FR 5178
Snake River Basin	Threatened 8/18/1997; 62 FR 43937 Reaffirmed 5/26/2016; 81 FR 33468	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Middle Columbia River	Threatened 3/25/1999; 64 FR 14517 Reaffirmed 5/26/2016; 81 FR 33468	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Lower Columbia River	Threatened 3/19/1998; 63 FR 13347 Reaffirmed 4/14/2014; 79 FR 20802	9/2/2005; 70 FR 52630	6/28/2005; 70 FR 37159

Upper Columbia River Spring-run Chinook Salmon Evolutionarily Significant Unit

Life history. Adult UCR spring-run Chinook salmon begin returning from the ocean in April and May, with the run into the Columbia River peaking in mid-May. They enter the upper Columbia River tributaries from April through July. After migration, they hold in freshwater tributaries until spawning occurs in the late summer, peaking in mid-to-late August. Juvenile spring Chinook salmon spend a year in freshwater before migrating to saltwater in the spring of their second year of life. Most UCR spring-run Chinook salmon return as adults after 2 or 3 years in the ocean. Some precocious males, or jacks, return after one winter at sea. A few other males mature sexually in freshwater without migrating to the sea. The run, however, is dominated by 4- and 5-year-old fish that have spent 2 and 3 years, respectively, at sea (UCSRB 2007).

Spatial structure and diversity. This species includes all naturally-spawned populations of spring-run 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. Historically, UCR spring-run Chinook salmon likely included three major population groups (MPGs). Two of these MPGs were eliminated by the completion of Grand Coulee and Chief Joseph Dams (UCSRB 2007). The remaining North Cascades MPG is comprised of three extant populations: the Wenatchee River, the Methow River, and the Entiat River populations. All three populations continue to be rated at low risk for spatial structure, but at high risk for diversity criteria. Large-scale supplementation efforts in the Methow and Wenatchee Rivers are ongoing, intended to counter demographic risks given current average survival levels and the associated year-to-year variability.

Abundance and productivity. During the most recent draft status review and viability analysis (Ford 2022), NMFS determined that current estimates of natural-origin spawner abundance decreased substantially relative to the levels observed in the prior review for all three extant populations. Productivities also continued to be very low, and both abundance and productivity remained well below the viable thresholds called for in the Upper Columbia Salmon Recovery Plan for all three populations. Short-term patterns in those indicators appear to be largely driven by year-to-year fluctuations in survival rates in areas outside of these watersheds, in particular, a recent run of poor ocean condition years.

Based on the information available for this review, the UCR spring-run Chinook salmon Evolutionarily Significant Unit (ESU) remains at high risk, with viability largely unchanged from the 2016 review.

Limiting factors. Limiting factors for this species are described in the recovery plan (UCSRB 2007).

Snake River Spring/Summer-run Chinook Salmon Evolutionarily Significant Unit

Life history. SR spring/summer Chinook salmon generally exhibit a stream-type life-history, residing in freshwater for a year or more before migrating toward the ocean, although some populations exhibit variations from this pattern (e.g., Salmon River basin juveniles may spend less than 1 year in freshwater) (Copeland and Venditti 2009). Juvenile outmigrants generally pass downstream of Bonneville Dam from late April through early June. Yearling outmigrants are thought to spend relatively little time in the estuary compared to sub-yearling ocean-type fish, often travelling from Bonneville Dam (RM 146) to a sampling site at RM 43 in 1 to 2 days. Adult SR spring-run Chinook salmon return to the Columbia River in early spring and pass Bonneville Dam beginning in early March through late May. Adult SR summer-run Chinook salmon return to the Columbia River from June through July. Adults from both runs hold in deep pools in the mainstem Columbia and Snake Rivers and the lower ends of the spawning tributaries until late summer, when they migrate into the higher elevation spawning reaches (NMFS 2017a).

Spatial structure and diversity. This species includes all naturally-spawned populations of spring/summer-run Chinook salmon originating from the mainstem Snake River and the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River subbasins, and from 15 artificial propagation programs (DOC 2014; USOFR 2020). The Interior Columbia Basin Technical Recovery Team (ICTRT) recognized 28 extant and three extirpated populations of SR spring/summer-run Chinook salmon, and aggregated these into five MPGs that correspond to ecological subregions (ICTRT 2003; McClure et al. 2005). Spatial structure ratings remain unchanged from prior status reviews, with low or moderate risk levels for the majority of populations in the ESU. Four populations from three MPGs (Catherine Creek, Grande Ronde River Upper Mainstem, Lemhi River, and Middle Fork Salmon River Lower Mainstem) remain at high risk for spatial structure loss. Three of the four extant MPGs in this ESU have populations that are undergoing active supplementation with local broodstock hatchery programs. In most cases, those programs evolved from mitigation efforts and include some form of sliding-scale management guidelines designed to maximize potential benefits in low-abundance years and reduce potential negative impacts at higher spawning levels. Efforts to evaluate key assumptions and impacts are underway for several programs, but it appears likely that these programs reduce risk of extinction in the short term.

Abundance and productivity. The majority of populations in the Snake River spring/summer-run Chinook salmon ESU remain at high overall risk, with three populations (Minam River, Bear Valley, and Marsh Creek) improving to an overall rating of “maintained” due to an increase in abundance/productivity when measured over a 10- to 20-year period. However, natural-origin abundance has generally decreased over the levels reported in the prior review for most populations in this ESU, in many cases sharply. Relatively low ocean survivals in recent years are likely a major factor in recent abundance patterns. All but three populations in this ESU remain at high risk for abundance and productivity (Ford 2022).

In summary, while there have been improvements in abundance/productivity in several populations relative to the time of listing, the majority of populations experienced sharp declines in abundance in the recent five-year period, primarily due to variation in ocean survival. If ocean survival rates remain low, the ESU’s viability will clearly become much more tenuous. If survivals improve in the near term, however, it is likely the populations could rebound quickly. Overall, at this time we conclude that the Snake River spring/summer-run Chinook salmon ESU continues to be at moderate-to-high risk (Ford 2022).

Limiting factors. Limiting factors for this species are described in the recovery plan (NMFS 2017a).

Snake River Fall-run Chinook Salmon Evolutionarily Significant Unit

Life history. Most SR fall Chinook salmon production historically came from large mainstem reaches that supported a subyearling, or "ocean-type," life history strategy. Adults migrated up the Columbia and Snake Rivers from July to August through November and spawned from late September to early October through November. Eggs developed rapidly in the relatively warm lower mainstem reaches of several tributary rivers, which facilitated emergence during late winter and early spring and accelerated growth such that juveniles could become smolts and migrate to the ocean in May and June (NMFS 2017b). This life history strategy allowed fall Chinook salmon to avoid high summer temperatures and losses associated with over-summering and over-wintering that affect other Chinook salmon ESUs with a yearling, or "stream-type," life history strategy.

At present, the subyearling life history strategy contributes most of the natural-origin adult returns to the ESU, and the timing of adult migration and spawning plus egg incubation, fry emergence, and juvenile emigration is similar to historical patterns. However, a yearling life history strategy is also supported, mostly for juveniles from the cooler Clearwater River subbasin,[1] which overwinter in the lower Snake River reservoirs or other cool-water refuge areas and migrate downstream the following spring (NMFS 2017b).

Spatial structure and diversity. This species includes all naturally-spawned populations of fall-run Chinook salmon originating from the mainstem Snake River below Hells Canyon Dam; from the Tucannon River, Grande Ronde River, Imnaha River, Salmon River, and Clearwater River subbasins; and from four artificial propagation programs (DOC 2014). The ICTRT identified three populations of this species, although only the lower mainstem population exists at present, with spawners in the lower mainstem of the Clearwater, Imnaha, Grande Ronde, Salmon, and Tucannon rivers. The extant population of SR fall-run Chinook salmon is the only remaining population from a historical ESU that also included large mainstem populations upstream of the current location of the Hells Canyon Dam complex (ICTRT 2003; McClure et al. 2005). The extant population has a high proportion of hatchery-origin spawners. The fraction of natural-origin fish on the spawning grounds has remained relatively stable for the last ten years, with five-year means of 31 percent (2010–2014) and 33 percent (2015–2019).

Abundance and productivity. SR fall-run Chinook salmon have been above the ICTRT defined minimum abundance threshold since 2001. The geometric mean natural adult abundance for the most recent ten years (2010–19) is 9,034, higher than the ten-year geomean reported in the 2015 status review (6,418, 2005–2014). While the population has not been able to maintain the higher returns it achieved in 2010 and 2013-2015, it has maintained at or above the ICTRT defined Minimum Abundance Threshold (3,000) during climate challenges in the ocean and rivers.

[1] Cool water has been released from Dworshak Dam since the mid-1990s to reduce summer temperatures that can impair passage conditions for migrating adult salmon and steelhead. This action retards the growth and delays the migration of juveniles rearing in the Clearwater River in July and August, but maintains thermal conditions, especially in Lower Granite, Little Goose, and Lower Monumental Reservoirs that allow juvenile Chinook to survive the summer and early-fall periods, overwinter, and migrate the following spring.

Productivity has been below replacement (1:1) in recent years, and the longer-term 20-year geometric mean raw productivity is 0.63. While below-replacement returns are concerning, the long-term (15-year) abundance trend is stable and the population remains well above the minimum abundance threshold set by the ICTRT (Ford 2022).

Overall, the status of Snake River fall-run Chinook salmon has improved compared to the time of listing. The single extant population in the ESU is currently meeting the criteria for a rating of "viable" developed by the ICTRT, but the ESU as a whole is not meeting the recovery goals described in the recovery plan for the species, which require the single population to be "highly viable with high certainty" and/or will require reintroduction of a viable population above the Hells Canyon Complex (NMFS 2017b). The Snake River fall-run Chinook salmon ESU therefore is considered to be at a moderate-to-low risk of extinction, with viability largely unchanged from the prior review (Ford 2022).

Limiting factors. Limiting factors for this species are described in the recovery plan (NMFS 2017b).

Lower Columbia River Chinook Salmon Evolutionarily Significant Unit

Life history. The LCR Chinook salmon ESU exhibits three major life history types: fall run ("tules"), late fall run ("brights"), and spring run. LCR spring-run Chinook salmon populations are stream-type, while LCR early-fall and late-fall Chinook salmon populations are ocean-type. Stream-type populations have a longer freshwater residency, perform extensive offshore migrations, and are most commonly found in headwater streams of large river systems. Ocean-type populations are more commonly found in coastal streams and typically migrate to sea within the first 3 months of life. Other life-history differences among run types include the timing of spawning, incubation, emergence in freshwater, migration to the ocean, maturation, and return to freshwater. This life-history diversity allows different runs of Chinook salmon to use streams as small as 10 feet wide and rivers as large as the mainstem Columbia (NMFS 2013). Stream characteristics determine the distribution of run types among LCR streams. Depending on run type, juvenile LCR Chinook salmon may rear for a few months to a year or more in freshwater streams, rivers, or the estuary before migrating to the ocean in spring, summer, or fall. This diversity is an important characteristic of the ESU.

LCR spring-run Chinook salmon spawn primarily in upstream, higher elevation portions of large subbasins. Adults enter the lower Columbia River from February through June, well in advance of spawning in August and September. LCR fall-run Chinook salmon, commonly referred to as "tules," spawn in moderate-sized streams and large river mainstems, including most tributaries of the lower Columbia River. Most LCR fall-run Chinook salmon enter freshwater from August to September and spawn within a few weeks from late September to November, with peak spawning activity in mid-October. Late-fall Chinook salmon, commonly referred to as "brights," generally return later than tule fall Chinook salmon, are less mature when they enter the Columbia River, and spawn later in the year. Late-fall Chinook salmon enter the Columbia River from August to October and spawn from November to January, with peak spawning in mid-November (NMFS 2013). Both LCR spring-run and tule fall-run Chinook salmon spawn and rear in the White Salmon River.

Spatial structure and diversity. The LCR Chinook salmon ESU includes all naturally spawned populations from the mouth of the Columbia River upstream to and including the White Salmon River in Washington and the Hood River in Oregon. This ESU also includes the Willamette River upstream to Willamette Falls (exclusive of spring-run Chinook salmon in the Clackamas River), and 15 artificial propagation programs. The ESU spans three distinct ecological regions (Coast, Cascade, and Gorge) and includes three distinct life-history types (spring-run, fall-run, and late-fall-run). Major population groups are defined by the combinations of ecological region and life-history type that existed historically: Cascade spring, Gorge spring, Coast fall, Cascade fall, Gorge fall, and Cascade late-fall.

This ESU is comprised of 32 demographically independent populations (DIP). The White Salmon River spring-run Chinook salmon population is part of the Gorge spring MPG and the White Salmon river fall-run Chinook salmon population is part of the Gorge fall MPG.

Abundance and productivity. Of the 32 DIPs in this ESU, seven are at or near the recovery viability goals set in the recovery plan (Dornbusch 2013). The seven DIPs include one spring-run, five fall-run, and one late fall-run. Ten DIPs exist at very low abundances. Most of the spring-run Chinook salmon populations in this ESU are at a "high" or "very high" risk due to low abundances and the high proportion of hatchery-origin fish spawning naturally. The White Salmon River spring-run Chinook salmon population is at very high risk (Table 3). All of the fall-run Coastal and all but one the fall-run Gorge MPG populations, including the White Salmon River fall-run Chinook salmon, also fall within the "high" to "very high" risk categories. Overall, there was little change since the last status review in 2015 in the biological status of this ESU, although there are some positive trends. Increases in abundance were noted in about 70 percent of the fall-run populations, and decreases in hatchery contributions were noted for several populations. Relative to baseline VSP levels identified in the recovery plan, there has been an overall improvement in the status of a number of fall-run populations since the last status review, although most are still far from the recovery plan goals (Ford 2022). This ESU remains at moderate risk of extinction.

Limiting factors. Limiting factors for this species are described in the recovery plan (NMFS 2013).

Table 3. Five-year geometric mean of raw natural spawner counts of salmon and steelhead populations from the White Salmon River and percent change between the two most recent 5-year periods. The 5-year geometric mean of raw total spawner counts is in parentheses. The overall extinction risk rating for each population is also included.

ESU/DPS	Major Population Group	Population	Target	Natural Spawner Counts			Overall Risk Rating
				2010-2014	2015-2019	Percent Change	
Lower Columbia River Chinook Salmon	Gorge Spring	White Salmon River Spring-Run	500	18(138)	8(50)	-56(-64)	Very High

ESU/DPS	Major Population Group	Population	Target	Natural Spawner Counts			Overall Risk Rating
				2010-2014	2015-2019	Percent Change	
Lower Columbia River Chinook Salmon	Gorge Fall	White Salmon River Tule Fall-Run	500	759(962)	283(502)	-63(-48)	High
Lower Columbia River Coho	Gorge	Washington Upper Gorge Tributaries/White Salmon River	1,200	39(53)	45(60)	15(13)	Very High
Middle Columbia River Steelhead	Cascade Eastern Slope Tributaries	White Salmon River	500	-	-	-	Extirpated (recolonizing)

Snake River Sockeye Salmon Evolutionarily Significant Unit

Life history. Historically, adult SR sockeye salmon entered the Columbia River in June and July, migrated upstream through the Snake and Salmon Rivers, and arrived at the Sawtooth Valley lakes in August and September (Bjornn et al. 1968). Spawning in lakeshore gravels peaked in October. Fry emerged in late April and May and moved immediately to the open waters of the lake, where they fed on plankton for 1 to 3 years before migrating to the ocean. Juvenile sockeye salmon generally left the Sawtooth Valley lakes from late April through May and migrated nearly 900 miles to the Pacific Ocean. While pre-dam reports indicate that sockeye salmon smolts passed through the lower Snake River in May and June, PIT-tagged smolts from Redfish Lake pass Lower Granite Dam from mid-May to mid-July. SR sockeye salmon enter the estuary at a large size as a result of the long time they spend in the natal lakes before emigrating as juveniles to the ocean. They generally return as 4-year-old or older fish to their natal Sawtooth Valley Lake to spawn (NMFS 2015a).

Spatial structure and diversity. This species includes all naturally-spawned anadromous and residual sockeye salmon originating from the Snake River Basin, Idaho, and artificially-propagated sockeye salmon from the Redfish Lake Captive Broodstock Program and the SR Sockeye Hatchery Program (DOC 2014; USOFR 2020). The ICTRT defined Sawtooth Valley sockeye salmon as the single MPG within the SR sockeye salmon ESU. The MPG contains one extant population (Redfish Lake) and two to four historical populations (Alturas, Petit, Stanley, and Yellowbelly lakes) (NMFS 2015a). At the time of listing in 1991, the only confirmed extant population included in this ESU was the beach-spawning population of sockeye salmon from Redfish Lake, with about 10 fish returning per year (NMFS 2015a).

At present, anadromous returns are dominated by production from the captive spawning component. The ongoing reintroduction program is still in the phase of building sufficient returns to allow for large-scale reintroduction into Redfish Lake, the initial target for restoring natural production (NMFS 2015a). Initial releases of adult returns directly into Redfish Lake have been observed spawning in multiple locations along the lake shore, as well as in Fishhook Creek

(NMFS 2015a). There is some evidence of very low levels of early timed returns in some recent years from outmigrating, naturally produced Alturas Lake smolts. At this stage of the recovery efforts with limited distribution across the Sawtooth Valley lakes, the ESU remains rated at high risk for both spatial structure and diversity (Ford 2022).

Abundance and productivity. Adult returns of sockeye salmon to the Sawtooth Basin crashed in 2015, and natural returns have remained low. With low sockeye salmon returns to the Stanley Basin, the hatchery program remains in its initial phase with a priority on genetic conservation and building sufficient returns to support sustained outplanting (NMFS 2015a). Because of the low returns, no natural anadromous fish have been released since 2014, as they are required to be spawned in the captive broodstock program under NMFS Section 10 Permit 1454. Captive adult releases have continued to support spawning in Redfish Lake. Smolt-to-adult return rates suggest that volitional spawning within Redfish Lake appears to be important to the success of the Snake River sockeye salmon captive broodstock-based hatchery program (Kozfkay et al. 2019).

In terms of natural production, the SR sockeye salmon ESU remains at "extremely high risk," although there has been substantial progress on the first phase of the proposed recovery approach—developing a hatchery-based program to amplify and conserve the stock to facilitate reintroductions. Current climate change modeling supports the "extremely high risk" rating with the potential for extirpation in the near future (Crozier et al. 2020). The viability of the SR sockeye salmon ESU therefore has likely declined since the time of the 2016 review, and the extinction risk category remains "high" (Ford 2022).

Limiting factors. Limiting factors for this species are described in the recovery plan (NMFS 2015a).

Lower Columbia River Coho Evolutionarily Significant Unit

Life history. LCR coho salmon are typically categorized as either early- or late-returning stocks. Early-returning adult coho salmon enter the Columbia River in mid-August and begin entering tributaries in early September, with peak spawning from mid-October to early November. Late-returning coho salmon pass through the lower Columbia from late September through December and enter tributaries from October through January. White Salmon River coho are considered late-returning. Most spawning occurs from November to January (LCFRB 2010). Coho salmon generally spawn in intermediate positions in tributaries, typically further upstream than chum or fall-run Chinook, but often downstream of steelhead or spring-run Chinook (ODFW 2010). On their return, adult fish often mill near river mouths or in lower river pools until the first fall freshets occur (LCFRB 2010). Juveniles typically rear in freshwater for more than a year. After emergence, coho salmon fry move to shallow, low-velocity rearing areas, primarily along stream edges and inside channels. Juvenile coho salmon favor pool habitat and often congregate in quiet backwaters, side channels, and small creeks with riparian cover and woody debris. Side-channel rearing areas are particularly critical for overwinter survival, which is a key regulator of freshwater productivity (LCFRB 2010).

Spatial structure and diversity. The LCR coho salmon ESU includes naturally spawned coho salmon originating from the Columbia River and its tributaries downstream from the White

Salmon and Hood Rivers (inclusive) and any such fish originating from the Willamette River and its tributaries below Willamette Falls. The ESU also includes coho salmon from 21 artificial propagation programs (USOFR 2020). The ESU contains 24 DIPs in three ecological regions (Coast, Cascade, and Gorge); each of these three ecological regions is considered an MPG. The Washington Upper Gorge Tributaries/White Salmon River coho salmon population is part of the Gorge MPG. Many of the populations in the ESU contain a substantial number of hatchery-origin spawners. Hatchery releases have remained relatively steady at 10–17 million since 2005, with approximately 14 million coho salmon juveniles released in 2019. Since the 2016 status review, there have been slight improvements in spatial structure and diversity. Fish passage at culverts has improved, with 79 miles of stream habitat opened up in Washington State since 2015 (LCFRB 2020), but a large number of small-scale fish barriers still remain to be upgraded or removed. These slight improvements in spatial structure have been overshadowed by declines in abundance and productivity (Ford 2022).

Abundance and productivity. Overall abundance trends for the LCR coho salmon ESU are generally negative. Natural spawner and total abundances have decreased in almost all DIPs, and Coastal and Gorge MPG populations are all at low levels, with significant numbers of hatchery-origin coho salmon on the spawning grounds. In light of the poor ocean and freshwater conditions that occurred during much of this recent review period, it should be noted that some of the populations exhibited resilience and remained stable (Mill/Abernathy/Germany), increased (Kalama River) or only experienced relatively small declines in abundance (North Fork Lewis River and Salmon Creek). Some populations were exhibiting positive productivity trends during the last year of review, representing the return of the progeny from the 2016 adult return. For individual populations, the risk of extinction spans the full range, from “low” to “very high.” Natural-origin abundances in the Gorge MPG, which includes the White Salmon River, are low. The two populations (Hood River and Washington Upper Gorge Tributaries/White Salmon River) both had geomeans of less than 50 (Table 3). The trend was strongly negative in the Hood River and slightly positive in the White Salmon River. Hatchery-origin fish contribute a large proportion of the total number of spawners, most notably in the Hood River. Overall, the LCR coho salmon ESU remains at “moderate” risk, and viability is largely unchanged from the prior status review (Ford 2022).

Limiting factors. Limiting factors for this species are described in the recovery plan (NMFS 2013).

Columbia River Chum Salmon Evolutionarily Significant Unit

Life history. Chum salmon spawn in the Columbia River mainstem and in low-gradient, low-elevation reaches and side channels (LCFRB 2010; ODFW 2010). They enter freshwater close to the time of spawning, and their spawning sites are typically associated with areas of upwelling water. Adult chum salmon are virtually all fall-run fish, entering freshwater from mid-October through November and spawning from early November to late December (LCFRB 2010). There is evidence that a summer-run chum salmon population returned historically to the Cowlitz River, and fish displaying this life history are occasionally observed there (Myers et al. 2006; Ford 2011).

Chum salmon fry are capable of adapting to seawater soon after emergence from gravel (LCFRB 2010) and usually spend weeks or months in estuaries (NMFS 2013). Their small size at emigration is thought to make them susceptible to predation from both birds and fish during this life stage, and shallow, protected habitats such as salt marshes, tidal creeks, and intertidal flats serve as significant rearing areas for juvenile chum salmon during estuarine residency. Access to these habitats has been impaired by agricultural and residential land use, particularly modification via dikes, levees, bank stabilization, and tide gates, but also by flow alterations caused by mainstem dams (LCFRB 2010).

Spatial structure and diversity. The CR chum salmon ESU includes all naturally spawned populations of chum salmon in the Columbia River and its tributaries in Oregon and Washington. The ESU consists of 17 DIPs in three distinct ecological regions: Coast, Cascade, and Gorge. Each of these three ecological regions is considered an MPG. The ESU also includes two artificial propagation programs (70 FR 37160). The Upper Gorge population spawns above Bonneville Dam.

Abundance and productivity. Three of 17 populations exceed the recovery goals established in the recovery plan (Dornbusch 2013). During the most recent review period, the three populations (Grays River, Washougal, and Lower Gorge DIPS) improved markedly in abundance. Improvements in productivity were observed in almost every year during the 2015–2019 interval. This is somewhat surprising, given that the majority of chum salmon emigrate to the ocean as subyearlings after only a few weeks, and one would expect the poor ocean conditions to have a strong negative influence on the survival of juveniles (as with many of the other ESUs in this region). In contrast to the three DIPs, the remaining populations in this ESU have not exhibited any detectable improvement in status. Abundances for these populations are assumed to be at or near zero, and straying from nearby healthy populations does not seem sufficient to reestablish self-sustaining populations. Even with the improvements observed during the last five years, the majority of DIPs in this ESU remain at a “very high” risk level. With so many primary DIPs at near-zero abundance, none of the MPGs are considered viable. Therefore, the CR chum salmon ESU remains at "moderate" risk of extinction, and the viability is largely unchanged from the prior review (Ford 2022).

Limiting factors. Limiting factors for this species are described in the recovery plan (NMFS 2013).

Upper Columbia River Steelhead Distinct Population Segment

Life history. UCR steelhead exhibit a stream-type life history strategy (NMFS 2016). Adults return to the Columbia River in the late summer and early fall. Unlike spring-run Chinook salmon, most steelhead do not move upstream quickly to tributary spawning streams. A portion of the returning run overwinters in the mainstem Columbia River reservoirs, passing into tributaries to spawn in April and May of the following year. Spawning occurs in the late spring of the year following entry into the Columbia River. Juvenile steelhead generally spend 1 to 3 years rearing in freshwater before migrating to the ocean but have been documented spending as many as 7 years in freshwater before migrating. Most adult steelhead return to the upper

Columbia River basin after 1 or 2 years at sea. Steelhead are iteroparous, or capable of spawning more than once before death.

Spatial structure and diversity. The UCR steelhead DPS is composed of a single MPG which includes four naturally-spawned anadromous steelhead populations below natural and artificial impassable barriers in streams within the Columbia River Basin, upstream from the Yakima River, Washington, to the United States–Canada border, as well as six artificial propagation programs. Historically, there were likely three MPGs. Two additional steelhead MPGs likely spawned above Grand Coulee and Chief Joseph Dams, but these MPGs are extirpated, and reintroduction is not required for ESA recovery (UCSRB 2007). NMFS has defined the UCR steelhead DPS to include only the anadromous members of this species (70 FR 67130).

All extant natural populations are considered to be at high risk of extinction for spatial structure and diversity. With the exception of the Okanogan population, the UCR steelhead populations are rated as low risk for spatial structure. Each population is at high risk for diversity, 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 (Ford 2022).

Abundance and productivity. The most recent estimates (five-year geometric mean) of total and natural-origin spawner abundance have declined since the 2016 status review, largely erasing gains observed over the past two decades for all four populations. Recent declines are persistent and large enough to result in small, but negative 15-year trends in abundance for all four populations. The abundance and productivity viability rating for the Wenatchee River exceeds the minimum threshold for 5 percent extinction risk (Ford 2022).

Annual brood-year recruit-per-spawner estimates have been well below replacement in recent years for all four populations. All populations are consistently exhibiting natural production rates well below replacement, and natural production has also declined consistently, resulting in an increasing fraction of hatchery fish on the spawning grounds each year. The Wenatchee River population has somewhat higher productivity than the remaining populations in the DPS, but still falls into a high-risk category due to the recent downward trend in both abundance and productivity.

The overall UCR steelhead DPS viability remains largely unchanged from the 2016 status review, and the DPS is at high risk driven by low abundance and productivity relative to viability objectives and diversity concerns.

Limiting factors. Limiting factors for this species are described in the recovery plan (UCSRB 2007).

Snake River Basin Steelhead Distinct Population Segment

Life history. SRB steelhead are generally classified as summer-run. Summer-run steelhead are sexually immature when they return to freshwater, and require several months to mature and spawn. Adult SRB steelhead generally enter the Columbia River from June to August (NMFS 2017a). The peak passage of SRB steelhead has shifted by about two weeks from late July to early August, probably in response to warming temperatures and reduced flows. SRB steelhead can delay their migration up the Columbia and Snake Rivers, and pull into cooler tributaries for temporary holding (NMFS 2017a). Most adults pass Lower Granite Dam by fall, although a small number (approximately 2.0 percent) remain below Lower Granite Dam over the winter and move upstream in the spring (April 3 through June 20). Adults generally hold in larger rivers for several months before moving upstream into smaller tributaries to spawn. Most adults disperse into tributaries from March through May, but potentially into June in higher elevations. Spawning begins shortly after fish reach spawning areas (NMFS 2017a).

Juveniles generally emerge from redds by early June in low elevation streams and by mid-July or later at higher elevations. Juveniles in the SRB typically reside in freshwater for no more than 2 years, but may stay longer, depending on temperature and growth rate (Fuller et al. 1984; Kucera and Johnson 1986; Chandler and Richardson 2006; NMFS 2017a). Smolts migrate downstream during spring runoff, which occurs from March to mid-June in the Snake River basin, depending on elevation. Juvenile outmigrating steelhead often reach Bonneville Dam by mid-May, and most travel rapidly (less than 5 days) through the estuary and into the ocean (NMFS 2017a). Iteroparity as a life-history trait remains in several tributaries of the SRB.

Fisheries managers classify SRB steelhead into two aggregate or morphological groups, A-Index and B-Index, based on length of time spent in the ocean, size at return, and migration timing. Generally, A-Index steelhead are smaller, spend 1 year in the ocean, and begin their upriver freshwater migration earlier in the year than B-Index steelhead. B-Index steelhead are larger, spend 2 years in the ocean, and begin their upriver freshwater migration later in the year. These two groups represent an important component of phenotypic and genetic diversity of the SRB steelhead DPS through the asynchronous timing of ocean residence, segregation of spawning in larger and smaller streams, and possible differences in the habitats of the fish in the ocean (NMFS 2017a). A-Index steelhead occur throughout the steelhead-bearing streams in the Snake River basin and inland Columbia River, while B-Index steelhead only occur in the Clearwater River basin and the lower and middle Salmon River basin. Some populations support both A-Index and B-Index life-history expressions.

Spatial structure and diversity. The SRB steelhead DPS includes all naturally-spawned anadromous steelhead populations below natural and manmade impassable barriers in streams in the Snake River Basin of southeastern Washington, northeastern Oregon, and Idaho, as well as several hatchery programs (USOFR 2020). Twenty-five populations (an additional three are extirpated) within five MPGs comprise the SRB steelhead DPS. Inside the geographic range of the DPS, 12 hatchery steelhead programs are currently operational. Five of these artificial programs are included in the DPS.

With one exception, the spatial structure risk ratings for all of the SRB steelhead populations are "low" or "very low risk" given the evidence for distribution of natural production within populations. The exception is Panther Creek, which was given a "high risk" rating for spatial structure based on the lack of spawning in the upper sections (Ford 2022). The diversity risk is low for 10 SRB steelhead populations and moderate for 15 populations. Based on the most recent status review, the integrated spatial structure and diversity risk for SRB steelhead populations are: 10 low, 14, moderate, and 1 high (Panther Creek).

Abundance and productivity. The five-year geometric mean abundance estimates for the populations in this DPS all showed significant declines from 2014-2019. Each of the populations decreased by roughly 50 percent in the past 5-year period, resulting in a near-zero population change in the past 15 years for the three populations with sufficiently long data time series (Asotin Creek, Joseph Creek, and Grande Ronde River Upper Mainstem). The number of natural-origin spawners in the Upper Grande Ronde Mainstem population appears to be at or above the minimum abundance threshold established by the ICTRT, while the Tucannon River and Asotin Creek populations have remained below their respective thresholds. Hatchery-origin spawner estimates for these populations continue to be low.

Based on the updated viability information, all five MPGs are not meeting the specific objectives in the draft recovery plan, and the viability of many individual populations remains uncertain (Ford 2022). The overall risk rating for SRB steelhead populations are 4 high, 14 maintained, 6 viable, and 1 highly viable. However, a great deal of uncertainty still remains regarding the relative proportion of hatchery fish in natural spawning areas near major hatchery release sites within individual populations. Overall, the SRB steelhead DPS remains at “moderate” risk of extinction, with viability largely unchanged from the 2016 status review (Ford 2022).

Limiting factors. Limiting factors for this species are described in the recovery plan (NMFS 2017a).

Middle Columbia River Steelhead Distinct Population Segment

Life history. The MCR steelhead distinct population segment (DPS) includes 16 summer-run populations and four winter-run populations. MCR summer steelhead enter the Columbia River between May and October and require several months to mature before spawning in late winter through spring. Winter steelhead enter freshwater between November and April and spawn shortly thereafter. Summer steelhead usually spawn further upstream than winter steelhead. Steelhead in the White Salmon Basin are both summer- and winter-run. Fry emergence typically occurs between May and August dependent on water temperature. Some juveniles move downstream to rear in larger tributaries and mainstem rivers. Most steelhead smolt at 2 years and adults return to the Columbia River after spending 1 to 2 years at sea (NMFS 2009).

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 and exclusive of the Wind River in Washington and the Hood River in Oregon, to and including the Yakima River in Washington, excluding steelhead originating from the Snake River Basin. The ICTRT identified 17 extant and three extirpated populations in this DPS (ICTRT 2003; McClure et al. 2005). The populations fall into four MPGs: Cascade eastern slope tributaries, the John Day River, the Walla Walla and Umatilla Rivers, and the Yakima River (ICTRT 2003; McClure et al. 2005). Steelhead in the White Salmon River are part of the White Salmon River population, which is part of the Cascade eastern slopes tributaries MPG.

This DPS includes steelhead from seven artificial propagation programs (USDOC 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 (USDOC 2013). NMFS has defined the steelhead DPSs to include only the anadromous members of this species (70 FR 67130).

Abundance and productivity. During the most recent review (Ford 2022), NMFS determined that there has been functionally no change in the viability ratings for the component populations, and the MCR steelhead DPS does not currently meet the viability criteria described in the Middle Columbia River Steelhead Recovery Plan. In addition, several of the factors cited by the 2005 Biological Review Team remain as concerns or key uncertainties. While recent (five-year) returns are declining across all populations, the declines are from relatively high returns in the previous 5- to 10-year interval, so the longer-term risk metrics that are meant to buffer against short-period changes in abundance and productivity remain unchanged.

Natural-origin spawning estimates are highly variable relative to minimum abundance thresholds across the populations in the DPS. Two of the four MPGs in this DPS include at least one population rated at “low” or “very low” risk for abundance and productivity, while the other two MPGs remain in the “moderate” to “high” risk range. Spawner abundance estimates for the most recent five years decreased relative to the prior review for all five populations in the Cascades Eastern Slopes Tributary MPG. The White Salmon River population is considered extirpated, but is recolonizing since removal of Condit Dam (Table 3).

Updated information indicates that stray levels into the John Day River populations have decreased in recent years. Out-of-basin hatchery stray proportions, although reduced, remain high in spawning reaches within the Deschutes River basin and the Umatilla, Walla Walla, and Touchet River populations. Overall, the Middle Columbia River steelhead DPS remains at “moderate” risk of extinction, with viability unchanged from the 2106 status review (Ford 2022).

Limiting factors. Limiting factors for this species are described in the recovery plan (NMFS 2009).

Lower Columbia River Steelhead Distinct Population Segment

Life history. The LCR steelhead DPS includes both summer- and fall-run steelhead. Generally, summer-run steelhead enter freshwater from May to October in a sexually immature condition, and require several months in freshwater to reach sexual maturity and spawn between late February and early April. Winter-run steelhead enter freshwater from November to April in a sexually mature condition and spawn in late April and early May. Iteroparity (repeat spawning) rates for Columbia River basin steelhead have been reported as high as 2 to 6 percent for summer steelhead and 8 to 17 percent for winter steelhead (Leider et al. 1986; Busby et al. 1996; Hulett et al. 1996). The holding period for summer steelhead allows them to take advantage of periodically favorable passage conditions, but it may also result in higher pre-spawning mortality that puts summer-run steelhead at a competitive disadvantage relative to winter-run steelhead. Young steelhead typically rear in streams for 1 to 4 years before migrating to the ocean, with most migrating after 2 years in freshwater. In the lower Columbia River, outmigration of steelhead smolts (of both summer and winter life-history types) generally occurs from March to June, with peak migration usually in April or May (NMFS 2013).

Spatial structure and diversity. The LCR steelhead DPS includes all naturally spawned anadromous *O. mykiss* originating below natural and manmade impassable barriers from rivers between the Cowlitz and Wind Rivers (inclusive) and the Willamette and Hood Rivers (inclusive), and excludes such fish originating from the upper Willamette River basin above Willamette Falls. This DPS also includes steelhead from seven artificial propagation programs (71 FR 834). The DPS consists of 23 DIPs, including six summer-run and 17 winter-run populations, which are grouped into four MPGs.

Abundance and productivity. The majority of winter-run steelhead DIPs in this DPS continue to persist at low abundance levels (hundreds of fish), with the exception of the Clackamas and Sandy River DIPs, which have abundances in the low 1,000s. Although the five-year geometric abundance means are near recovery plan goals for many populations, the recent trends are negative. Summer-run steelhead DIPs were similarly stable, but also at low abundance levels. Summer-run DIPs in the Kalama, East Fork Lewis, and Washougal River DIPs are near their recovery plan goals; however, it is unclear how hatchery-origin fish contribute to this abundance. The decline in the Wind River summer-run DIP is a source of concern, given that this population has been considered one of the healthiest of the summer runs. It is not clear whether the declines observed represent a short-term oceanic cycle, longer-term climatic change, or other systematic issues (Ford 2022).

Although a number of DIPs exhibited increases in their recent five-year geometric means, others still remain depressed, and neither the winter- nor summer-run MPGs are near viability in the Gorge. Overall, the Lower Columbia River steelhead DPS is considered to be at “moderate” risk, and the viability is largely unchanged from the 2016 status review (Ford 2022).

Limiting factors. Limiting factors for this species are described in the recovery plan (NMFS 2013).

2.2.2. Status of Critical Habitat

In this section, we examine the status of designated critical habitat by examining the condition and trends of the essential PBFs of that habitat throughout the designated areas (Tables 4 and 5). These features are essential to the conservation of the ESA-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). The proposed action affects freshwater spawning, rearing, and migration habitats.

Table 4. Physical and biological features of critical habitat designated for ESA-listed salmon and steelhead species considered in this opinion (except Snake River spring/summer-run Chinook salmon, Snake River fall-run Chinook salmon, and Snake River Sockeye salmon), and corresponding species life history events.

Physical or Biological Features		**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/parr/smolt growth and development
Freshwater Migration	Free of artificial obstruction Natural cover Water quality Water quantity	Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
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

Table 5. Physical and biological features of critical habitats designated for Snake River spring/summer-run Chinook salmon, Snake River fall-run Chinook salmon, and Snake River sockeye salmon and corresponding species life history events.

Physical or Biological Features		**Species Life History Event**
Site Type	**Site Attribute**	
Spawning and juvenile rearing areas	Access (sockeye) Cover/shelter Food (juvenile rearing) Riparian vegetation Space (Chinook) 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

For salmon and steelhead, NMFS' critical habitat analytical review teams (CHART) ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC5) in terms of the conservation value they provide to each ESA-listed species that they support (NMFS 2005). The conservation rankings are high, medium, or low. To determine the conservation value of each watershed to species viability, the CHART evaluated the quantity and quality of habitat features (e.g., spawning gravels, wood and water condition, and side channels), the relationship of the area compared to other areas within the species' range, and the significance of the population occupying that area to the species' viability criteria. Thus, even if a location had poor habitat quality, it 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 of 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).

NMFS has designated critical habitat for all 11 salmon and steelhead species that would be affected by the proposed action. Critical habitat has been designated in the Interior Columbia recovery domain (ICRD) for UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, UCR steelhead, SRB steelhead, and MCR steelhead. Critical habitat has been designated in the Willamette-Lower Columbia recovery domain (WLCRD) for LCR Chinook salmon, LCR coho salmon, CR chum salmon, and LCR steelhead.

Habitat quality in tributary streams in the ICRD varies from excellent in wilderness and roadless areas to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994;

NMFS 2009). 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 (EPA 2020; Lee et al. 1997; McIver and Starr 2001; NMFS 2009) have degraded critical habitat throughout much of the ICRD. Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems for critical habitat in developed areas.

Tributary habitat conditions throughout the WLCRD subdomain have been significantly degraded by an array of land uses, including urbanization, agriculture, forest management, transportation networks, and gravel mining. These land uses have blocked access to historically productive habitats, simplified stream and side channels, degraded floodplain connectivity and function, increased delivery of fine sediment to streams, and degraded riparian conditions, contributing to stream channel simplification, reduced bank stability, increased sediment load, and elevated water temperatures (NMFS 2013). In addition, tributary dams block access to core spawning areas for spring Chinook salmon populations, although several dams licensed by the Federal Energy Regulatory Commission (Marmot and Little Sandy Dams on the Sandy River, Condit Dam on the White Salmon River, and Powerdale Dam on the Hood River) were removed in recent years. When Bonneville Dam was completed in 1938, the reservoir behind the dam inundated considerable portions of historical spawning habitat at the mouths of tributaries for the Upper Gorge and White Salmon fall Chinook salmon populations (NMFS 2013).

Migratory habitat quality in both recovery domains has been affected by the development and operation of the Columbia River System 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 production areas in Oregon and Idaho, including the Burnt, Powder, Weiser, Payette, Malheur, Owyhee, and Boise river basins (Goode et al. 2013); 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 adults and juveniles. Physical features of dams such as turbines also kill migrating fish. In-river survival of emigrating juveniles is inversely related to the number of hydropower projects encountered. Similarly, development and operation of extensive irrigation systems and dams for water withdrawal and storage in tributaries have altered hydrological cycles.

Many stream reaches designated as critical habitat in these recovery domains are over-allocated, 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).

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 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. Common toxic contaminants found in the Columbia River system include legacy pesticides, current use pesticides, pharmaceuticals and personal care products, and trace elements (LCREP 2007). Bradford Island is part of the Bonneville Dam complex in the Columbia River operated by the Corps. Historical operations and waste disposal at the site contaminated the land and river sediments with PCBs, toxic metals, and other chemicals that pose a health threat to people, fish, and wildlife of the Columbia River Basin. On March 17, 2022, the U.S. Environmental Protection Agency officially added Bradford Island as a Superfund site on the National Priorities List, prioritizing it for cleanup.

Many stream reaches designated as critical habitat in the ICRD and WLCRD, including the Columbia River, are listed on Oregon's and Washington's Section 303(d) lists for water temperature.

Total dissolved gas (TDG) also affects mainstem water quality and habitat conditions. Specifically, water that passes over the spillway at a mainstem dam can cause downstream waters to become supersaturated with dissolved atmospheric gasses. Supersaturated TDG conditions can cause gas bubble trauma in adult and juvenile salmonids, resulting in injury and death (Weitkamp and Katz 1980). To reduce TDG supersaturation, the Corps installed spillway improvements at each mainstem dam except The Dalles Dam.

The series of dams and reservoirs have also blocked natural sediment transport. Total sediment discharge into the estuary and Columbia River plume is only one-third of nineteenth-century levels (NMFS 2008a). Similarly, Bottom et al. (2005) estimated that the delivery of suspended sediment to the lower river and estuary has been reduced by about 60 percent (as measured at Vancouver, Washington). This reduction has altered the development of habitat along the margins of the river. It also reduces turbidity in the lower river, especially during spring, which is likely to make juvenile outmigrants more vulnerable to visual predators like piscivorous birds and fishes.

Piscivorous colonial waterbirds, especially terns, cormorants, and gulls, are having a significant impact on the survival of juvenile salmonids in the Columbia River. Native pikeminnow and nonnative smallmouth bass and walleye are significant predators of juvenile salmonids in the Columbia River basin (reviewed in Friesen and Ward 1999; ISAB 2011, 2015). California and Steller sea lions aggregate each spring at the base of Bonneville Dam (and below Willamette Falls on the lower Willamette River), where they feed on adult salmon and steelhead.

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 2013). Since 1878, the Corps has dredged 100 miles of river channel within the mainstem Columbia River, its estuary, and the lower Willamette River as a navigation channel. 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 navigation channel supports many ports on both sides of the river, resulting in several thousand commercial ships traversing the river every year. The dredging, along with diking, draining, and fill material placed in wetlands and shallow habitat, disconnects the river from its floodplain, resulting in the loss of shallow-water rearing habitat and the ecosystem functions that floodplains provide (e.g., supply of prey, refuge from high flows, temperature refugia; Bottom et al. 2005).

Despite these degraded habitat conditions, the hydrologic unit codes that have been identified as critical habitat for these species are largely ranked as having high conservation value. Conservation value reflects several factors, including: (1) how important the area is for various life history stages, (2) how necessary the area is to access other vital areas of habitat, and (3) the relative importance of the populations the area supports relative to the overall viability of the ESU or DPS.

A summary of the status of critical habitats considered in this opinion is provided in Table 6.

Table 6. Critical habitat, designation date, Federal Register citation, and status summary for critical habitat for the 11 salmon and steelhead species considered in this opinion (NMFS 2005; NMFS 2015b).

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Upper Columbia River spring-run Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses four subbasins in Washington containing 15 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some, or high, potential for improvement. We rated conservation value of HUC5 watersheds as high for 10 watersheds, and medium for five watersheds. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Columbia River Systems.
Snake River spring/summer-run Chinook salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers, and all tributaries of the Snake and Salmon rivers (except the Clearwater River) presently or historically accessible to this ESU (except reaches above impassable natural falls and Hells Canyon Dam). Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Columbia River Systems.
Snake River fall-run Chinook salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers, and all tributaries of the Snake and Salmon rivers presently or historically accessible to this ESU (except reaches above impassable natural falls, and Dworshak and Hells Canyon dams). Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
		(Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Columbia River Systems.
Lower Columbia River Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 47 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005; NMFS 2013). However, most of these watersheds have some, or high, potential for improvement. We rated the conservation value of HUC5 watersheds as high for 30 watersheds, medium for 13 watersheds, and low for 4 watersheds.
Snake River sockeye salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers; Alturas Lake Creek; Valley Creek; and Stanley, Redfish, Yellow Belly, Pettit and Alturas lakes (including their inlet and outlet creeks). Water quality in all five lakes generally is adequate for juvenile sockeye salmon, although zooplankton numbers vary considerably (NMFS 2005). Some reaches of the Salmon River and tributaries exhibit temporary elevated water temperatures and sediment loads that could restrict sockeye salmon production and survival. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Columbia River Systems.
Lower Columbia River coho salmon	2/24/2016 81 FR 9251	The specific areas designated for lower Columbia River coho include approximately 2,300 miles of freshwater and estuarine habitat in Oregon and Washington. The areas designated are all occupied and contain physical and biological features essential to the conservation of the species that may require special management considerations or protection. No unoccupied areas were identified that are considered essential for the conservation of the species. There are 55 watersheds within the range of this ESU. Three watersheds received a low conservation value rating, 18 received a medium rating, and 34 received a high rating (NMFS 2015b). The lower Columbia River rearing/migration corridor downstream of the spawning range is considered to have a high conservation value.
Columba River Chum salmon	9/02/05 70 FR 52630	Critical habitat encompasses six subbasins in Oregon and Washington containing 19 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some, or high, potential for improvement. We rated conservation value of HUC5 watersheds as high for

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
		16 watersheds and medium for 3 watersheds. The Lower Columbia migration corridor is considered to have a high conservation value.
Upper Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Washington containing 31 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 20 watersheds, medium for 8 watersheds, and low for 3 watersheds. The Columbia River corridor is considered to have high conservation value.
Snake River Basin steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 25 subbasins in Oregon, Washington, and Idaho. These subbasins contain 271 occupied and 20 unoccupied watersheds. Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Columbia River Systems. We rated conservation value of HUC5 watersheds as high for 220 watersheds, medium for 44 watersheds, and low for 27 watersheds. The Lower Snake/Columbia River corridor is considered to have high conservation value (NMFS 2005).
Middle Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 15 subbasins in Oregon and Washington containing 111 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of occupied HUC5 watersheds as high for 78 watersheds, medium for 24 watersheds, and low for 9 watersheds. The Columbia River corridor is considered to have high conservation value.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Lower Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses nine subbasins in Oregon and Washington containing 41 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some, or a high, potential for improvement. We rated conservation value of HUC5 watersheds as high for 28 watersheds, medium for 11 watersheds, and low for 2 watersheds.

2.2.3. Climate Change

Climate change generally exacerbates threats and limiting factors, including those currently impairing salmon and steelhead survival and productivity. The growing frequency and magnitude of climate change related environmental downturns will increasingly imperil many ESA-listed stocks in the Columbia River basin and amplify their extinction risk (Crozier et al. 2019, 2020, 2021). This climate change context means that opportunities to rebuild these stocks will likely diminish over time. As such, management actions that increase resilience and adaptation to these changes should be prioritized and expedited. For example, the importance of improving the condition of and access and survival to and from the remaining functional, high-elevation spawning and nursery habitats is accentuated because these habitats are the most likely to retain remnant snowpacks under predicted climate change (Tonina et al. 2022).

Climate change is already evident. It will continue to affect air temperatures, precipitation, and wind patterns in the Pacific Northwest (ISAB 2007, Philip et al. 2021), resulting in increased droughts and wildfires and variation in river flow patterns. These conditions differ from those under which native anadromous and resident fishes evolved and will likely increase risks posed by invasive species and altered food webs. The frequency, magnitude, and duration of elevated water temperature events have increased with climate change and are exacerbated by the Columbia River hydrosystem (EPA 2020a, 2020b; Scott 2020). Thermal gradients (i.e., rapid change to elevated water temperatures) encountered while passing dams via fish ladders can slow, reduce, or altogether stop the upstream movements of migrating salmon and steelhead (e.g., Caudill et al. 2013). Additional thermal loading occurs when mainstem reservoirs act as a heat trap due to upstream inputs and solar irradiation over their increased water surface area (EPA 2020a, 2020b, 2021). Consider the example of the adult sockeye salmon, both Upper Columbia and Snake River stocks, in 2015, when high summer water temperatures contributed to extremely high losses during passage through the mainstem Columbia and Snake River (Crozier et al. 2020), and through tributaries such as the Salmon and Okanogan rivers, below their spawning areas. Some stocks are already experiencing lethal thermal barriers during a portion of their adult migration. The effects of longer or more severe thermal barriers in the future could be catastrophic. For example, Bowerman et al. (2021) concluded that climate change will likely increase the factors contributing to prespawn mortality of Chinook salmon across the entire Columbia River basin.

Columbia River basin salmon and steelhead spend a significant portion of their life-cycle in the ocean, and as such the ocean is a critically important habitat influencing their abundance and productivity. Climate change is also altering marine environments used by Columbia River basin salmon and steelhead. This includes increased frequency and magnitude of marine heatwaves, changes to the intensity and timing of coastal upwelling, increased frequency of hypoxia (low oxygen) events, and ocean acidification. These factors are already reducing, and are expected to continue reducing, ocean productivity for salmon and steelhead. This does not mean the ocean is getting worse every year, or that there will not be periods of good ocean conditions for salmon and steelhead. In fact, near-shore conditions off the Oregon and Washington coasts were considered good in 2021 (NOAA 2022). However, the magnitude, frequency, and duration of downturns in marine conditions are expected to increase over time due to climate change. Any long-term effects of the stressors that fish experience during freshwater stages that do not manifest until the marine environment will be amplified by the less-hospitable conditions there due to climate change. Together with increased variation in freshwater conditions, these downturns will further impair the abundance, productivity, spatial structure, and diversity of the region’s native salmon and steelhead stocks (ISAB 2007, Isaak et al. 2018). As such, these climate dynamics will reduce fish survival through direct and indirect impacts at all life stages (NOAA 2022).

All habitats used by Pacific salmon and steelhead will be affected by climate dynamics. However, the impacts and certainty of the changes will likely vary by habitat type. Some changes affect salmon at all life stages in all habitats (e.g., increasing temperature), while others are habitat-specific (e.g., stream-flow variation in freshwater, sea-level rise in estuaries, upwelling in the ocean). How climate change will affect each individual salmon or steelhead stock also varies widely, depending on the extent and rate of change and the unique life-history characteristics of different natural populations (Crozier et al. 2008). The continued persistence of salmon and steelhead in the Columbia basin relies on restoration action that climate resilience (Jorgensen et al. 2021) in freshwater spawning, rearing, and migratory habitats, including access to high elevation, high quality cold-water habitats, and the reconnection of floodplain habitats across the interior Columbia River basin.

2.3. Action Area

“Action area” means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The BNSF Railway Bridge 72.8 crosses the White Salmon River at its confluence with the Columbia River at approximately RM 168.4, or approximately 23.4 miles upstream (east) of Bonneville Dam. For purposes of this consultation, the action area extends 2.13 miles upstream and downstream in the Columbia River (RM 166.17-170.53) and 0.37 miles upstream in the White Salmon River (RM 0-0.37), including across the width of both channels. It also includes an area extending 165 feet landward of the right bank of the Columbia River, beginning 300 feet upstream from the mouth of the White Salmon River at the east construction access route, and downstream 2,750 feet (0.52 miles) to the end of the staging area. The extent of the action area is based on the anticipated behavioral effects from underwater sound pressure levels generated during impact pile-driving. Because the distance underwater noise can emanate is reduced by river sinuosity, topography, and landform, a line-of-sight rule, meaning that noise may propagate into any area that is within line-of-sight of the noise source, was used to determine the extent of noise propagation in the White Salmon and Columbia Rivers (WSDOT 2020). The extent of action area, as described, also includes the area below the OHWM where temporary and permanent loss of forage and increased risk of predation is anticipated, the area where the existing bridge and abutments will be removed and new bridge and abutment construction will occur, the free-flowing river where turbidity is likely during construction activities, the adjacent staging and project access areas, and areas upstream and downstream of the in-water work area that are likely to be affected by the proposed action.

2.4. Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

The BNSF railway replacement project is located on the lower White Salmon River at its confluence with the Columbia River. The action area includes the lower White Salmon River (RM 0-0.37) and the mainstem Columbia River from RM 166.17 to 170.53. Hood River is located along the south shoreline of the Columbia River to the south of the bridge. Infrastructure is consolidated along both sides of the Columbia River, including State Route 14 and the BNSF rail line on the north side of the river and Interstate 84 and the Union Pacific rail line on the south side of the river. Existing train traffic and vehicle traffic on SR 14 affect ambient noise in the project vicinity. State Route 14 is located approximately 25 feet north of the project site. The average daily traffic volume on State Route 14 in the action area is 6,000 vehicles, which is equal to 600 per hour (WSDOT 2021). Noise associated with freight train traffic is typically 80 dBA (BE referencing Temple University 2014). More than 50 trains pass through the action area on a typical day.

The White Salmon enters the Columbia River at Underwood, Washington at RM 168.3. Peak flows in the White Salmon River generally occur between the months of December through February. Flows steadily decrease after May, with low-flow conditions in September and October. Flows generally increase again during the fall.

Condit Dam, constructed at RM 3.3 on the White Salmon River, blocked all fish passage prior to its complete removal in 2012. Now that Condit Dam has been removed, anadromous fish populations are beginning to repopulate the watershed. LCR spring and tule fall-run Chinook salmon, LCR coho, and MCR steelhead spawn and rear in the White Salmon River. CR Chum salmon historically spawned in the White Salmon River, but Bonneville Reservoir inundated available spawning habitat.

The White Salmon River spring-run and tule fall-run Chinook salmon populations are part of the spring-run Gorge and fall-run Gorge MPGs of the LCR Chinook salmon ESU. The complete removal of Condit Dam in 2012 reestablished access to both historical spring-run and fall-run Chinook salmon spawning grounds. Fall-run (tule) Chinook salmon appear to be reestablishing themselves, while spring-run recolonization has been very limited (LCFRB 2020). The spring-run population is currently at less than 10 percent of its recovery target, with a 56 percent decrease in its recent 5-year mean natural spawner count compared to the last 5-year review in 2016. The fall-run population is currently at 57 percent of its recovery target, and its recent 5-year mean natural spawner count decreased 63 percent from the last 5-year review (Ford 2022). LCR coho returning to the White Salmon River are part of the Washington Upper Gorge Tributaries population, which is part of the Gorge MPG. This population's recent 5-year mean abundance is 45 percent of its recovery target, although its recent 5-year mean natural spawner count increased 15 percent from the last 5-year review (Ford 2022). The White Salmon River steelhead population is part of the Cascade Eastern Slope Tributaries MPG of the MCR steelhead DPS and considered extirpated, but it is recolonizing.

White Salmon River salmon and steelhead populations pass one mainstem dam, Bonneville Dam, during their migration to and from the Pacific Ocean. The other eight salmon and steelhead species considered in this opinion use the White Salmon River as a cool water refuge in the summer, and also use the White Salmon and Columbia Rivers, including Bonneville Pool, as temporary overwintering habitat (High et al. 2006; Keefer et al. 2008).
Condit Dam was removed via a controlled blast resulting in the immediate release of waters and sediment within the reservoir. Removal resulted in an influx of sand and gravel to the lower White Salmon River that created sandbars. This influx of sediment has increased instream complexity and an abundance of salmon spawning habitat. Mitigation and restoration activities are ongoing and include sediment stabilization and revegetation efforts. Much of the released sediment has settled in the vicinity of Bridge 72.8. But since this river and associated new bedload is in a state of flux, the sediment bars are likely to continue to shift and migrate downstream based on seasonal flow and flood events. Additional sediment pulses are anticipated since the White Salmon River has not experienced any major flood events in recent years.

Although the hydraulics and substrate composition of the White Salmon River is evolving and supports natural spawning, Bonneville Reservoir inundates and continues to limit spawning in the lower reaches. The effects are greatest on Upper Gorge fall chum salmon, particularly since Bonneville Dam inundated 80 percent of the spawning area used by chum salmon (NPCC 2004). The stagnation of flow has also created more suitable habitat for non-native fish species such as smallmouth bass by reducing water velocity and increasing water temperature. This results in the loss of riparian, spawning, and rearing habitat and increased predation by native and non-native fish in the lower White Salmon River.

The reach from the former location of Condit Dam to the mouth is within the boundaries of the Columbia River Gorge National Scenic Area, and construction within the riparian area is largely prohibited. However, residential development is occurring with increasing frequency in the lower watershed and along State Route 141, and a Yakama Nation in-lieu fishing site is located at the mouth of the White Salmon River.

Riparian and bank conditions in the project area are degraded because of past and present human disturbance. These include construction and maintenance of the BNSF rail line and State Route 14, and associated bridges and infrastructure. Both streambanks at the mouth of the White Salmon River are steep and heavily armored with riprap, which constricts the White Salmon River and prevents channel migration. In addition, Bonneville Pool inundates up to 1 mile of the lower White Salmon River. Armored banks and inundation reduce available habitat, eliminate riffles and pools, result in greater fluctuation of stream levels, and result in a pinch point that concentrates migrating fish.

Beneath Bridge 72.8, there is minimal upland vegetative cover. Vegetation that exists consists primarily of herbaceous species and weedy plants. A few isolated trees/shrubs have become established along the southern edge of the railroad prism.

All 11 spring and fall-run Chinook salmon, coho salmon, chum salmon, sockeye salmon, and steelhead ESUs and DPSs considered in this opinion utilize the Columbia River, including Bonneville Reservoir, for rearing and migration. Current conditions within much of the mainstem Columbia River are degraded relative to historic conditions. The hydropower system has greatly modified natural flow and altered the hydrograph of the Columbia River. Water management activities have reduced flows in the Columbia River from April through July, and increased flows during winter months, as measured at Bonneville Dam.

Bonneville Dam and Bonneville Reservoir continue to substantially alter the mainstem migration corridor habitat. Bonneville Reservoir has increased the cross-sectional area of the Columbia River, reducing water velocity, altering the food web, and creating habitat for native and non-native species that are predators and competitors for food sources for migrating juvenile salmon and steelhead. Travel times of migrating smolts increase as they pass through the reservoir (compared to a free-flowing river), increasing exposure to both native and nonnative predators, and some juveniles are injured or killed as they pass through the dam (turbines, bypass system, spillway, or sluiceway) (NMFS 2019). Harnish et al. (2014) documented significant mortality of smolts and juvenile Chinook salmon in reservoirs from the large populations of piscivorous fish and bird colonies.

In addition, numerous anthropogenic features or activities near the project site and throughout the action area (e.g., docks, roads, railroads, bank stabilization, and landscaping) have become permanent fixtures on the landscape, and have displaced and altered native riparian habitat. Consequently, the potential for normal riparian processes (e.g., litterfall, channel complexity, and large wood recruitment) to occur is diminished and aquatic habitat has become simplified. Furthermore, riparian species that evolved under the environmental gradients of riverine ecosystems are not well suited to the present hydraulic setting of the action area (i.e., static, slackwater pools), and are thus often replaced by invasive, non-native species. The riparian system is fragmented, poorly connected, and provides inadequate protection of habitats and refugia for sensitive aquatic species.

Shoreline development has reduced natural vegetation, disconnected floodplains, and reduced available off-channel refugia. The Columbia River shoreline, shallow water habitat, and natural vegetation is altered with in-water structures, rock, and riprap. Shoreline developments and alterations have reduced rearing habitat suitability (e.g., less habitat complexity, reduced forage base), reduced spring water velocities (which hampers downstream migration by smolts), and created better habitat for juvenile salmonid predators (e.g., birds, and native and non-native fish). These factors further limit habitat function by reducing cover, attracting predators, and reducing foraging efficiency for juvenile salmonids.

Bonneville Reservoir in the action area is considered water quality limited by the Oregon Department of Environmental Quality and it is on the Clean Water Act section 303(d) list for dioxins, PCBs, methylmercury, water temperature, pH, and Total Dissolved Gasses (ODEQ 2020). Water temperatures in the action area are often elevated in the summer and early fall. Chemical contamination, nutrients and dissolved oxygen are also issues of water quality concern in the area. The Washington State Department of Ecology's Water Quality Atlas identifies three listings at the mouth of the White Salmon River: water temperature, pH, and dissolved oxygen.

2.5. Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action (see 50 CFR 402.02). A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered the factors set forth in 50 CFR 402.17(a) and (b).

Effects to ESA-listed salmon and steelhead and critical habitat include: (1) water quality impacts from elevated total suspended solids (TSS), increases in turbidity, and releases of small amounts of chemicals during project construction; (2) behavior modification and increased exposure to predators from temporary increases in turbidity; temporary in-water and over-water structures, and from permanent in-water structures; (3) temporary and long-term loss of benthic habitat and forage from steel piles and tree removal; (4) disturbance and displacement from increased sound levels during steel pile installation; (5) behavior modification, injury, and mortality (increased exposure to predators) from pile driving; (6) temporary alteration of fish passage and migration from sound and presence of in-water and overwater structures; (7) permanent alteration of fish migration, feeding, and rearing from permanent in-water structures; (8) and increase risks to water quality and all ESUs and DPS considered in this opinion from toxic spills.

2.5.1. Effects on Species

Presence and Exposure

Project construction is expected to take 12 to 16 months to complete. In-water work will occur during the Columbia River in-water work window, November 1 through February 28. Throughout the year, different-sized species and age classes of salmon and steelhead use the action area for spawning, rearing, holding, and migration (Table 7).

Adult Salmon and Steelhead Within the Action Area. Based on the life histories of salmon and steelhead in the Columbia Basin, we expect adults of all species covered in this opinion will migrate through the action area, and some steelhead adults will overwinter in the action area, and potentially be exposed to project effects.

We do not expect adult UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, or LCR spring-run Chinook salmon to be present during the in-water work window. Upstream migration of UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, and SR fall-run Chinook salmon typically occurs March through September (Table 7). Sockeye adults typically pass Bonneville Dam beginning in May, with 95 percent passing in June and July, and passage complete by early September. LCR spring-run Chinook salmon primarily migrate through the action area from March through October. Although adult LCR spring-run Chinook salmon, including those from the White Salmon spring-run population, begin returning to the Columbia River in February, we do not expect any will be present in the action area during the in-water work window. The recent 5-year average count of Chinook salmon at Bonneville dam in January-February is one fish. White Salmon River spring-run Chinook salmon (LCR spring-Run Chinook Salmon ESU) spawning in the White Salmon River occurs outside the action area and outside the in-water work window.

Adult LCR fall-run Chinook salmon; CR chum salmon; LCR coho salmon; and UCR, SRB, MCR, and LCR steelhead will be present in the action area during the in-water work window. Adult LCR fall-run Chinook salmon primarily migrate through the action area August through October. However, adult fall Chinook salmon pass Bonneville Dam in small numbers in November (recent 5-year average of 2,085) and December (recent 5-year average of 44).[2] Fall Chinook salmon passing Bonneville Dam are comprised of fish from ESA listed and unlisted species. Therefore, we expect a small number of adult LCR fall-run Chinook salmon in the action area in November and December. The White Salmon River fall-run Chinook salmon population (LCR fall-run Chinook Salmon) spawns from late September through October, with peak spawning activity in mid-October. However, based on spawning ground surveys conducted by WDFW in 2019 and 2020, a very small number of White Salmon River fall-run Chinook salmon spawn in the White Salmon River in early November. In addition, White Salmon River fall-run Chinook salmon spawning begins approximately 0.35 miles upstream from the mouth of the White Salmon River near the northern extent of the action area. Therefore, a very small number of spawning adult White Salmon River fall-run Chinook salmon may be present in the action area during the in-water work window.

Most CR chum salmon spawning populations are located downstream of Bonneville Dam. However, small numbers of adult chum salmon pass upstream of Bonneville Dam between October and December (recent 5-year average of 200). Therefore, a very small number of adult CR chum salmon may be present in the Columbia River in the action area during the in-water work window.

[2] Based on analysis of Fish Passage Center daily adult fish count data.

Adult LCR coho salmon migrate through the action area August through January, with most returning to the White Salmon River and Hood River September through November. The Washington Upper Gorge Tributaries/White Salmon River late-run coho salmon population (LCR coho salmon ESU) spawns October through January in the White Salmon River in the action area. Most Washington Upper Gorge Tributaries/White Salmon River late-run coho salmon spawning in the White Salmon River occurs upstream of the action area from October through January, with peak activity in November. However, a very small number of coho salmon spawn at the northern extent of the action area in the White Salmon River. The abundance of adult Washington Upper Gorge Tributaries/White Salmon River late-run coho salmon in the White Salmon River is small, with less than 50 natural-origin spawners annually. Therefore, we expect a very small number of Washington Upper Gorge Tributaries/White Salmon River late-run population coho salmon will be present in the action area during the in-water work window.

The majority of adult steelhead migrate through the Columbia River action area between April and October, with peak steelhead passage at Bonneville Dam occurring July through September. However, steelhead migrate through the Columbia River throughout the year, with some overwintering in the Columbia River prior to returning to natal streams to spawn. Keefer et al. (2008) estimated that 12.4 percent of fish that reached spawning areas had overwintered in the Columbia River. Therefore, we expect a small number of UCR, SRB, MCR, and LCR adult steelhead will be migrating through, and overwintering in, the action area during the in-water work window.
White Salmon River steelhead (MCR steelhead DPS) generally return to the White Salmon River between April and October, although some hold over in the Columbia River throughout the year and enter the White Salmon River as they approach spawning. White Salmon River steelhead spawn in the White Salmon River subbasin upstream from the action area February through June, with peak spawning in April. Therefore, a very small number of adult White Salmon River steelhead may be migrating through the action area in the White Salmon River during the in-water work window; but spawning White Salmon River steelhead will not be present in the action area.

Juvenile Salmon and Steelhead in the Action Area. Millions of juvenile salmonids migrate through the Columbia River and Bonneville Reservoir each year. Based on the life histories of salmon and steelhead in the Columbia Basin, we expect juveniles of all species covered in this opinion will migrate through, and possibly rear, in the action area and potentially be exposed to project effects.

The vast majority of out-migrating salmon and steelhead juveniles will pass through the action area outside the in-water work window, including White Salmon River spring- and fall-run Chinook salmon, Washington Upper Gorge Tributaries/White Salmon River late-run coho salmon, and White Salmon River steelhead which out-migrate March-June. However, some juvenile salmon and steelhead will overwinter in the action area (Table 7). Therefore, we expect juveniles from all ESUs and DPSs will be present in the action area in small numbers during the in-water work window.

Because White Salmon River fall-run Chinook salmon and Washington Upper Gorge Tributaries/White Salmon River late-run coho salmon spawn at the northern edge of the action area in the White Salmon River, a small number of eggs and fry from White Salmon River fall-run Chinook salmon and a very small number of eggs from Washington Upper Gorge Tributaries/White Salmon River late-run coho salmon will be in the action area during the in-water work window. White Salmon River fall-run Chinook salmon and Washington Upper Gorge Tributaries/White Salmon River late-run coho salmon emergence in the White Salmon subbasin begins in February and March, respectively.

Summary. Project construction is expected to take 12 to 16 months to complete. In-water work will occur during the Columbia River in-water work window, November 1 through February 28. Based on the above-described life history behaviors of the listed species, we expect adults and juveniles of all 11 ESUs and DPSs covered in this opinion will migrate through the project action area and potentially be exposed to project effects. During the in-water work window, we expect:

- Adult UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, or LCR spring-run Chinook salmon will not be present. White Salmon River spring-run Chinook salmon will not be present.
- A small number of adult UCR, SRB, MCR, and LCR steelhead will be present.
- A small number of adult LCR fall-run Chinook salmon will be present; and a very small number of LCR fall-run Chinook salmon spawners from the White Salmon River fall-run population will be present.
- A very small number of adult CR chum salmon will be present.
- A very small number of adult LCR coho salmon will be present; and a very small number of LCR fall-run coho salmon spawners from the Washington Upper Gorge Tributaries/White Salmon River population will be present.
- Spawning White Salmon River steelhead will not be present in the action area.
- Small numbers of juveniles from all ESUs and DPSs will be present in the action area.
- A small number of eggs and fry from White Salmon River fall-run Chinook salmon and a very small number of eggs from Washington Upper Gorge Tributaries/White Salmon River late-run coho salmon will be present.

Table 7. Timing of Fish Presence in the action area for the BNSF railway bridge replacement project at the White Salmon River Crossing.

Species	**Life Stage**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
		***IWWW**										***IWWW**	
Chinook Salmon													
Upper Columbia River Spring-Run	Adult												
	Juvenile						Smolts						
Lower Columbia River spring and fall runs	Adult			Spring Run Feb-Sep					Fall Run Aug-Oct				
	Spawning								Spring Aug-Sep; Fall Sep-Oct				
	Eggs												
	Juvenile					Smolts							
Snake River Fall-Run	Adult												
	Juvenile						Smolts						
Snake River Spring/Summer-Run	Adult												
	Juvenile					Smolts							
Steelhead													
Upper Columbia River	Adult												
	Juvenile					Smolts							
Snake River Basin	Adult												
	Juvenile					Smolts							

Species	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		*IWWW										*IWWW	
Lower Columbia River	Adult												
	Juvenile				Smolts								
Middle Columbia River	Adult				Return to White Salmon River Apr-Oct								
	Spawning												
	Eggs												
	Juvenile			Smolts									
Sockeye													
Snake River	Adult												
	Juvenile				Smolts								
Coho Salmon													
Lower Columbia River	Adult												
	Spawning												
	Eggs												
	Juvenile			Smolts									
Chum Salmon													
Columbia River	Adult												
	Juvenile			Smolts									

Water Quality

Sedimentation and turbidity. The proposed action will affect water quality during installation and removal of floating silt curtains, causeways which include 290 feet of sheet pile shoring, up to 67 steel piles (16 permanent and 25-51 temporary), and removal of 44 creosote piles below the OHWM; demolition of existing piers at the edge of the White Salmon River; heavy machinery and equipment working from causeways and work trestles or barges; and movement of barges by temporarily increasing sediment delivery to the waterway and turbidity in the water column, and by small releases of fuels and contaminants.

Low to moderate levels of turbidity can provide cover from predation (Gregory and Levings 1998). However, increased fine sediment can be detrimental to juvenile salmon and steelhead in several ways including avoidance of the area, abandonment of cover, stress, and reduced growth rates (Newcombe and Jensen 1996). Turbidity from increased fine sediment may disrupt steelhead feeding and territorial behavior and may displace fish from preferred feeding and resting areas. It can also delay adult migration to spawning habitat. Direct mortality can occur at very high concentrations or extended exposure to suspended solids. The severity of effect of suspended sediment increases as a function of the sediment concentration and exposure time (Bash et al. 2001; Newcombe and Jensen 1996).

Erosions control BMPs will be installed and monitored daily to minimize project construction effects. These BMPS include installing two sediment ponds, grading to divert uphill stormwater into ponds, installing drainage swales with rock check dams or coir logs, grading temporary roads to drain toward the existing trackway, stabilizing bare soil, and installation of floating silt curtains.

Floating silt curtains will be installed around turbidity generating activities in the White Salmon and Columbia Rivers, including: (1) around each in-water pile being installed or removed, encompassing approximately 20-38.5 square feet per pile (based on pile size); and (2) instream and along the streambank on both sides of the bridge, encompassing 3,125 square feet. Silt curtains will extend approximately 100 feet on both the east and west banks of the White Salmon River and 525 feet along the north bank of the Columbia River (225 feet upstream and 300 feet downstream of the of the White Salmon River mouth), and will extend approximately 5 feet offshore. Installation will disturb substrate in the project area, which consists primarily of sand and silt. Disturbance of this fine material tends to result in resuspension, and staying in suspension longer than coarser sediments. Therefore, we expect installation of floating silt curtains will mobilize sediments and elevate TSS and turbidity levels up to 300 feet downstream for a few minutes to a few hours. We expect that the pulses of turbidity generated during installation of floating silt curtains will cause short term (a few minutes to a few hours) behavioral changes to a small number of adult LCR fall-run Chinook salmon and adult UCR, SRB, MCR, and LCR steelhead; a very small number of adult CR chum salmon and LCR coho salmon; and a very small number of juveniles from all ESUs and DPSs, within 300 feet downstream. We expect adults and some juveniles will flee the area of higher turbidity, which will increase the risk of predation to juveniles (Berg and Northcote 1985). Juveniles that do not flee may exhibit reduced feeding for a few hours. This is not expected to reduce their fitness over the long-term.

Installation of temporary causeways and sheet pile shoring, and demolition of existing bridge piers, will occur out of water but close to the water's edge. Although BMPs will be installed to reduce erosion from exposed upland soils, and shoring will separate the causeways from the river, we expect delivery of sediment from these actions will intermittently increase turbidity above background levels within floating silt curtains (3,125 square feet) on both sides of the bridge for about 16 months. Turbidity levels will settle out during the day or overnight.

During pile driving and pile removal, we expect resuspension of sediments will occur within each floating silt curtain. Turbidity levels will be high within floating silt curtains and settle out during the day or overnight. Floating silt curtains will remain installed around each pile for about 24 hours.

We expect adults and most juveniles holding or rearing nearby will be disturbed by installation of floating silt curtains and flee the area. However, we do expect a few juvenile salmon and steelhead will be trapped inside floating silt curtains based on the number and size/area of floating silt curtains installed, size and life history of salmon and steelhead in the action area, and use of the White Salmon and Columbia Rivers in the action area for rearing. Adults and larger juveniles are generally better at avoiding disturbance. Since adults and larger juveniles are better able to avoid disturbance, we anticipate adult and most juvenile salmon and steelhead in the construction area will flee from the area into deeper waters or nearby areas away from the in-water work. However, a few smaller fish are less likely to avoid construction activities and may be trapped in floating silt curtains. Juveniles salmon and steelhead trapped in floating silt curtains are likely to experience physical and behavioral effects from reduced water quality, including: reduced feeding, growth, and fitness; injury; and death. We expect there will only be a very small number of fish trapped because the majority of adult and juvenile salmon and steelhead smolts will have already migrated past the action area by the time the in-water work and installation of floating silt curtains begins. We also expect the injured and dead fish to be distributed across multiple populations, ESUs, DPSs, and MPGs. Therefore, we expect a very small number of juvenile fish from all ESUs and DPSs covered in this opinion may experience reduced feeding, growth, and fitness; injury; and death from being trapped in up to 6,585 square feet of floating silt curtains (3,125 square feet along the streambank and up to 3,460 square feet around piles).

After installation, we mostly expect turbidity levels outside the floating silt curtains to be slightly above background levels, and we do not expect juvenile or adult fish to respond to the small water quality changes. However, we do expect turbidity levels will increase outside floating silt curtains along the streambanks if there is a large rain event or high river flows. Temporary shoring and 101 cubic yards of fill will be installed immediately below the OHWM, and areas of exposed soils will be present above and below the OHWM throughout the 16-months of construction. Rain and high flows will create runoff and erosion, most of which will be contained by BMPS. However, we expect heavy rain events and high flows above the OHWM will occur for a few days and increase delivery of sediment to both the White Salmon and Columbia Rivers in excess of what can be contained by BMPS, including turbidity curtains. We also expect increased turbidity, which will last for a few hours to a few days and extend as far as 300 feet downstream, will be sufficient to cause behavioral changes to a very small number of adult and juvenile salmon and steelhead from all ESUs and DPSs considered in this opinion. We expect adults and some juveniles will flee the area of higher turbidity, which will increase the risk of predation to juveniles. Therefore, we expect large rain and high flow events will cause elevated turbidity levels for a few hours to a few days, and be sufficient to cause a very small number of adults and juveniles from all ESUs and DPSs to alter their behavior within 300 feet downstream of project construction, which will increase the risk of predation to juveniles. Juveniles that do not flee may exhibit reduced feeding for a few hours. This is not expected to reduce their fitness over the long-term.

Floating silt curtains will be removed when actions are completed, but not until TSSs settle and water is clear within the curtains. However, removal of the floating silt curtains will mobilize sediments and likely elevate TSS and turbidity levels in the immediate work area. Similar to floating silt curtain installation, we expect that the pulses of turbidity generated during removal of floating silt curtains will cause short term (a few minutes to a few hours) behavioral changes to a small number of adult LCR fall-run Chinook salmon and UCR, SRB, MCR, and LCR steelhead; a very small number of CR chum salmon and LCR coho salmon; and a very small number of juveniles from all ESUs and DPSs, within 300 feet downstream. We expect adults and some juveniles will flee the area of higher turbidity, which will increase the juvenile's risk of predation. Juveniles that do not flee may exhibit reduced feeding for a few hours. This is not expected to reduce their fitness over the long-term.

If the contractor uses barges for construction, intermittent barge movements for 16 months during and outside the in-water work window will also suspend sediment and create small turbidity plumes. Barges will be moved approximately 100-200 feet from moorage dolphins to the derrick barges using a tug. Water depth will range from about 6-17 feet. We expect the pulses of elevated suspended sediment from barge movements within the Columbia River to last several minutes to a few hours and be carried 300 feet downstream. Therefore, we expect that the pulses of turbidity generated during barge movements will cause short term (several minutes to a few hours) behavioral changes to a small number of adult and juveniles from all ESUs and DPSs within 300 feet downstream. We expect adults and some juveniles will flee the area of higher turbidity, which will increase the risk of predation (Berg and Northcote 1985). Juveniles that do not flee may exhibit reduced feeding for a few hours. This is not expected to reduce their fitness over the long-term.

Summary. NMFS expects that the pulses of turbidity generated during installation and removal of floating silt curtains will cause short term (a few minutes to a few hours) behavioral changes to a small number of adult LCR fall-run Chinook salmon and adult UCR, SRB, MCR, and LCR steelhead; a very small number of adult CR chum salmon and LCR coho salmon; and a very small number of juveniles from all ESUs and DPSs, within 300 feet downstream. Pulses of turbidity generated during barge movements will also cause short-term (several minutes to a few hours) behavioral changes to a small number of adult and juveniles from all ESUs and DPSs within 300 feet downstream, for up to 16 months. Additionally, we expect large rain and high flow events will cause elevated turbidity levels for a few hours to a few days, and be sufficient to cause a small number of adults and juveniles from all ESUs and DPSs to alter their behavior within 300 feet downstream of project construction. We expect adults and some juveniles will flee the areas of higher turbidity, which will increase the risk of predation to juveniles. We also expect a very small number of juveniles from all ESUs and DPSs covered in this opinion may experience reduced feeding, growth, and fitness; injury; and death from being trapped in up to 6,585 square feet of floating silt curtains (3,125 square feet along the streambank and 2,580 square feet around piles).

Chemical Contamination. Additional impairment of water quality may result from accidental releases of fuel, oil, and other contaminants that can injure or kill aquatic organisms. Petroleum-based contaminants, such as fuel, oil, and some hydraulic fluids, contain polycyclic aromatic hydrocarbons (PAHs), which can kill salmon at high levels of exposure, and can cause sublethal, adverse effects at lower concentrations (Meador et al. 2006). Therefore, spills that make their way into the White Salmon and Columbia Rivers could harm fish. The operation of equipment and heavy machinery will occur from causeways, temporary work trestles, and potentially barges. NMFS anticipates that only very small quantities (ounces) of PAHs are likely with each accidental release or spill. In addition, conservation measures will be implemented to prevent or contain any spill that may occur (e.g., staging and fueling equipment in a protected location; emergency spill response kit available onsite, and secondary containment basins used when possible on/under all equipment that contains fuels or other hazardous materials placed on the work trestles, causeways, barges, or within 100 feet of the river). These should minimize the risk of a spill and opportunity for contaminants to enter the waterway and affect salmon and steelhead. If a spill does occur, we expect containment will occur quickly with emergency spill kits located on site, and conservation measures will minimize its dispersal, limiting exposure and related impacts of adult and juvenile salmon and steelhead. For these reasons, NMFS does not expect any fish to be injured or killed by exposure to accidental releases of fuel, oil, and other contaminants caused by this action.

Creosote Pilings. Creosote is derived from the distillation of tar from wood or coal and is used as a wood preservative. Creosote can contain thousands of chemicals, with PAHs one of the highest chemicals of concern. Polycyclic aromatic hydrocarbons can kill salmon at high levels of exposure, and can cause sublethal, adverse effects at lower concentrations (Meador et al. 2006). Creosote-treated pilings may leach chemicals into the sediments and water column throughout their lifetime. Chemicals in creosote break down in water very slowly. They tend to cling to particles of matter, and as such, sediments are considered the primary location for these contaminants to collect in aquatic environments. Many PAHs do not migrate far from the point of contamination, and accumulate at that primary location. The toxic effects of organic contaminants such as PAHs depends on several factors, including the route of exposure, duration and concentration, chemical composition, organism sensitivity, life stage affected, organism potential for detoxification/excretion, and the physical condition of a particular organism during exposure. Organisms such as fish have the potential to metabolize and excrete PAHs. However, these toxins can accumulate in tissues of mollusks and other benthic invertebrates that do not metabolize as efficiently, and which provide an important source of food for salmon and steelhead.[3] Removal of 44 creosote piles from approximately 50 square feet of the Columbia River will occur in accordance with Washington Department of Natural Resources' Derelict Creosote Pile Removal BMPs for Pile Removal and Disposal. Therefore, we expect removal of 44 creosote piles will reduce a source of toxic chemicals in a very small area of the Columbia

[3] Washington Department of Natural Resources, Science of Creosote, 2pp.

River (Bonneville Reservoir), increasing water quality and decreasing concentration of PAHs in substrate over time, permanently benefitting migrating and rearing adults and juveniles from all ESUs and DPSs covered by this opinion.

Stormwater. During project construction, stormwater will be managed according to Volume II, Chapter 3 (Construction Stormwater Pollution Prevention), of the "Washington State Department of Ecology 2019 Stormwater Management Manual for Western Washington". This will include using sediment ponds, drainage swales, sediment fences, grading, and stabilizing disturbed soil surfaces. Based on the BMPs for erosion control and stormwater management, we expect only infrequent and small amounts of stormwater will enter the White Salmon and Columbia Rivers during the 16-months of project construction. Therefore, we do not expect stormwater to degrade water quality such that it impacts salmon or steelhead during project construction.

Ambient Light/Shading and Predation

Juvenile salmon and steelhead rely heavily on light perception to orient themselves in space, capture prey, avoid predators, shoal, and migrate along the shoreline to the ocean (Ono and Simenstad 2014). The reduction of ambient light (e.g., light attenuation and shading) is one of the primary mechanisms by which over-water (barges, moored vessels) and in-water structures (piers and pilings) adversely affect salmon and steelhead. Reduced light levels can impair fitness and survival in juvenile salmonids by altering certain behaviors, such as migration, feeding success, and predator avoidance (Nightingale and Simenstad 2001; Rondorf et al. 2010). Darkly shaded areas can delay fish migration and drive juvenile salmon into deeper waters during daylight. This, in turn, increases the risk of predation by exposing young salmon to larger fish and diving birds. Predators such as smallmouth bass and northern pikeminnow select and use in-water and overwater structures (Pribyl et al. 2004; Celedonia et al. 2008), and juvenile salmonids account for high portions of northern pikeminnow diets (Poe et al. 1991; Zimmerman and Ward 1999; Harnish et. al 2014) and avian predator diets (Collis et al. 2002). Construction of overwater structures (e.g. docks and pilings) also creates habitat for predatory, perching birds such as cormorants and gulls.

Project construction will result in up to 35,320 square feet of temporary, overwater structure for 16 months; either 3,500 square feet of work trestles and slide beams in the White Salmon River or 35,320 square feet of barges and a tug boat in the Columbia River. Work trestles will be erected 20 feet over the White Salmon River, block light penetration, and create shaded areas at the mouth of the White Salmon River. Shaded areas can increase a predator's capture efficiency of prey. In general, predation on juvenile salmonids increases as light intensity decreases (Petersen and Gadomski 1994; Tabor et al. 1998). One 16,000 square foot derrick barge, one 6,000 square foot material barge, and one 1,320 square foot tug boat will be on site for the duration of the project. Two 6,000 square foot material barges will come and go depending on the phase of construction. The three material barges will be moored approximately 35 feet from the shoreline in water approximately 13 to 17 feet deep. The derrick barge will be moored perpendicular to the bridge in the Columbia River in water approximately 6-17 feet deep. A stationary barge moored in shallow water can block light and provide a haven for predatory fish such as smallmouth bass and northern pikeminnow, which prey on juvenile salmonids in the

Columbia River system (Fritts and Pearsons 2004; Tabor et al. 2004; Vigg et al. 1991; Zimmerman and Ward 1999).

Trestles and barges will be located in areas used by juvenile salmon and steelhead, from all 11 ESUs and DPSs considered in this opinion, for feeding, resting, and growth during rearing and downstream migration (Mains and Smith 1964; Dauble et al. 1989; Beeman and Maule 2006; Chapman 2007; Timko et al. 2011). Therefore, we expect up to 35,320 square feet of overwater structures will alter the behavior of several individual juvenile salmon and steelhead from all 11 ESUs and DPSs considered in this opinion, including altered migration and avoidance, which will increase the risk of predation.

Riparian Vegetation

Riparian vegetation contributes to many attributes of productive salmonid habitat including shade, cover, and food production (Spence et al. 1996). Tree removal can increase sedimentation, remove cover, reduce large wood recruitment, and increase water temperatures. The proposed action may result in removal of up to seven trees (ponderosa pine and bigleaf maple) from the southern edge of the railroad prism within the railroad right-of-way. Removal of trees will result in a minor loss of shade which we do not expect to increase water temperature because the small number of trees removed provide a minor amount of shade and protection against solar radiation, and the size/volume of the White Salmon and Columbia Rivers in the action area. Tree removal will prevent future recruitment of large wood. However, all removed trees will be placed in the Columbia River and are expected to provide a minor amount of natural cover for salmonids. Additionally, 150 willows will be planted immediately downstream of the bridge at the base of the railroad prism along the edge of the Columbia River. As the 150 willow trees grow and mature, they will provide some shade and cover. Thus, removal of up to seven trees is not expected to harm individual steelhead present in the action area because the action will not appreciably reduce instream cover or stream shade, or increase water temperature.

Forage

The proposed action will have minor short-term and long-term effects on benthic invertebrates by crushing, covering, or dislodging them during installation and removal of the floating silt curtains and steel piles; removal of creosote piles; barge movements; settling of suspended sediment below the work area; removal of up to seven trees; and the long-term presence of two in-water piers. Pile driving will temporarily displace up to 311 square feet of substrate in the White Salmon River and 29 square feet in the Columbia River, and permanently displace 51 square feet of substrate (in-water piers) in the White Salmon River. Resuspension and settling of suspended sediments will occur within floating silt curtains (3,125 square feet). An additional small area of river bottom (up to 300 feet downstream) at the mouth of the White Salmon River and within the Columbia River will be disturbed by settling of suspended sediment following installation and removal of floating silt curtains and from barge movements. In addition, removal of seven trees will affect forage by decreasing terrestrial invertebrate production and allochthonous input. However, removal of 44 creosote piles will open approximately 50 square feet of substrate for forage production.

Food availability has the potential to limit stream salmonid production (McCarthy et al. 2009; Rosenfeld et al. 2005; Wipfli and Baxter 2010), and reducing food availability generally leads to reduced growth, and ultimately survival (Spence etal. 1996). In lotic environments, salmonids primarily forage on aquatic and terrestrial invertebrates drifting in the water column (Allan et al. 2003; Dedual and Collier 1995; Elliott 1973; Nielsen 1992; Romaniszyn et al. 2007;Wipfli 1997). Invertebrate drift in both the White Salmon and Columbia Rivers will maintain a source of forage for salmon and steelhead below the project. We also expect macroinvertebrates will begin to recolonize disturbed areas via drift and migration within a few days, and fully recolonize disturbed areas within a few months after project completion (Fowler 2004; Griffith and Andrews 1981; Yount and Nemi 1990). In addition, 150 willows will be planted along the edge of the Columbia River and provide terrestrial macroinvertebrate and allochthonous inputs as they grow and mature. Given the small size of the disturbed area relative to the amount of available local habitat, and invertebrate drift maintaining a source of forage, we expect the small decrease in forage production will be too small to cause competition for forage, or a decrease in growth or survival of juvenile salmon and steelhead.

Sound Pressure Levels and Noise.

Pile driving will create short-term hydroacoustic disturbance to any juvenile or adult salmon or steelhead present in the action area. The proposed action includes installation below the OHWM of 16-25 24-inch steel piles for permanent in-water piers and moorage dolphins, installation and removal of 16-51 36-inch steel piles for slide beams and work trestles, installation and removal of up to 290 feet of 24-inch AZ sheet pile, and removal of approximately 44 12-inch creosote piles. A vibratory driver will be used to install the 24-inch AZ sheet pile below the OHWM but above the water line, and to remove all piles. Both 24- and 36-inch steel piles will be installed in water first using a vibratory hammer until the pile is advanced to refusal, at which time an impact hammer and a bubble curtain for attenuation will be used. Two to four piles will be installed daily. Pile driving will not occur between 1 hour before sunset and 1 hour after sunrise, during the in-water work period.

Pile driving increases sound pressure levels (SPL) and noise. Fishes with swim bladders (including salmonids) are sensitive to underwater impulsive sounds (i.e., sounds with a sharp sound pressure peak occurring in a short interval of time). As the pressure wave passes through a fish, the swim bladder is rapidly compressed due to the high pressure, and then rapidly expanded as the “under-pressure” component of the wave passes through the fish. Injuries resulting from compression and decompression from a sound pressure pulse are known as barotrauma (Halvorsen et al. 2012; Popper et al. 2019). Injuries from intense or continuous underwater sound pressure can include damage to the auditory system. This can result in a temporary or permanent loss of hearing known as either a “temporary threshold shift” (Carlson et al. 2007) or a long-term “permanent threshold shift” (Liberman 2016). The level of injuries can vary based on the intensity and characteristic of the high pressure, distance to the pressure source, and the size and species of the fish (CalTrans 2020; Hastings and Popper 2005). Barotrauma injuries can include external and internal damage including bulging eyes, ruptured organs and swim bladders, hemorrhaging, and death (Brown et al. 2009, 2012; Halvorsen et al. 2012). Fish respond differently to sounds produced by impact drivers than to sounds produced by vibratory drivers. Vibratory drivers produce a more rounded sound pressure wave with a slower rise time. Because the more rounded sound pressure wave produced by vibratory drivers produces a slower increase in pressure, the potential for injury and mortality is reduced.

The Fisheries Hydroacoustic Working Group (FHWG), a multi-agency work group, identified criteria to define SPLs where effects to fish are likely to occur from pile driving activities (FHWG 2008). The FHWG determined:

- Instant injury or death can occur from a single strike if peak level is at or above 206 decibels (dB).
- Injury to fish larger than 2 grams occurs at 187 dB sound exposure level (SEL), and at 183 dB SEL where fish are smaller than 2 grams, for cumulative strikes.
- "Harassment" threshold is 150 dB, where behavioral effects or potential physical injury (i.e., harm) to individual salmon or steelhead within a distance of the source may occur (FHWG 2008; Popper et al. 2006).

Vibratory pile driving. Using the NMFS vibratory calculator, information provided in the BE, and data from similar projects (CalTrans 2020), we estimate the behavioral threshold of 150 dBs will be exceeded up to 100 meters (328 feet) from 36-inch steel piles. The behavioral threshold will not be exceeded during installation of 24-inch steel piles. We expect varying levels of behavioral responses form salmon and steelhead exposed to SPLs above 150 dB. These responses range from no change, to mild awareness, to a startle response (Hastings and Popper 2005). Installation of 36-inch piles will take 13 to 26 days (two to four piles per day). Some fish will flee the immediate area for the duration of vibratory pile driving activity. These fish are expected to move short distances or seek cover. Similar habitat types exist nearby and are expected to provide forage and hiding cover similar to the areas fish are displaced from. Therefore, relocations are not expected to affect growth. Juvenile fish that flee will experience increased exposure risk to predators from avoiding elevated SPLs for up to 26 days. Risk is likely low due to the small area affected, anticipated short distance of movements, and availability of cover. However, vibratory pile driving will occur when rearing juveniles of all ESUs and DPSs could be in the project area in small numbers. Therefore, we expect a very small number of juvenile salmon and steelhead from all ESUs and DPS within 328 feet of 36-inch steel piles to alter their behavior during vibratory pile driving, increasing their risk of predation.

During vibratory pile driving, a very small number of adult LCR coho (Washington Upper Gorge Tributaries/White Salmon River population) and a small number of LCR fall-run Chinook salmon (White Salmon River fall-run population) will be returning to the White Salmon River to spawn; a very small number of CR chum salmon will be migrating in the Columbia River; and small numbers of adult UCR, SRB, MCR, and LCR steelhead could be overwintering in the project area and exposed to SPLs above 150 dB during vibratory pile driving of 36-inch steel piles. Adult LCR coho and LCR fall-run Chinook salmon may experience migration delays up to 12 hours (daylight work period) on vibratory pile drive days of 36-inch piles (up to 26 days) with migrations resuming overnight. We do not believe sound levels will delay CR chum salmon migration. We also do not expect more than a startle response from adult CR chum salmon and UCR, SRB, MCR, and LCR steelhead, which may include moving short distances away from the sound.

We do not have specific data on the number of adult or juvenile fish that will be present near each of the piles during in-water work; however, the majority of adult and juvenile salmon and steelhead smolts will have already migrated past the action area by the time the work window for pile driving begins. Therefore, NMFS expects a very small number of adult LCR coho salmon (Washington Upper Gorge Tributaries/White Salmon River population) and a small number of adult LCR fall-run Chinook salmon (White Salmon River fall-run population) will delay their migration for up to 12 hours; a very small number of adult CR chum salmon, and a small number of adult UCR, SRB, MCR, and LCR steelhead will move short distances away from the sound; and a small number of juveniles from all ESUs and DPSs considered in this opinion will alter their behavior in response to vibratory pile driving of 36-inch steel piles for 13-26 days, which will increase their risk of predation. We do not believe that vibratory driving will result in immediate direct injury or death to juvenile or adult salmon or steelhead.

Impact pile driving. We used the NMFS hydroacoustic calculator, information provided in the BE, and data from similar projects (CalTrans 2020) to determine distances individual fish may encounter effects from impact pile driving. Expected sound pressure levels based on information submitted in the BE and in CalTrans (2020) are included in Table 8; these data assume measurement occurs at 10 meters (33 feet), a default transmission loss constant of 15 meters (49 feet), and a minimum of a 5-dB reduction in underwater sound levels at 10 meters (33 feet) from the pile being installed from use of a bubble curtain.

Instantaneous injury. NMFS estimates the single strike peak pressure will range between 199 and 205 dB, the single strike SEL will be 164-178 dB, and the single strike root mean square pressure will be 168-188 dBs (Table 8). NMFS assumes a high likelihood of injury to salmonids from instantaneous pulses of SPLs above 206 dB, which is greater than the estimated SPLs. Therefore, the proposed action is not expected to result in instantaneous injury to salmon or steelhead.

Table 8. Estimated distance to onset of behavioral changes or physical injury for salmon and steelhead greater than 2 grams and less than 2 grams (in parentheses if different from fish greater than 2 grams), near the BNSF railway bridge replacement project at the mouth of the White Salmon River. Estimated distance is based on steel pile size, maximum number of piles driven per day, maximum number of pile strikes per day, and use of a bubble curtain for noise attenuation. Peak single strike sound exposure level (SEL) and root mean square (RMS) decibels (dB) are from CalTrans (2020). Distance to threshold was estimated using the National Marine Fisheries Service's hydroacoustic calculator.

Pile Size	**Number of Piles Per Day**	**Maximum Strikes per Day**	**Peak (dB)**	**Single Strike SEL (dB)**	**RMS (dB)**	**Cumulative SEL at 32.8 feet**	**Distance (feet) to Threshold**		
							Onset of Physical Injury		**Behavior**
							Peak	**Cumulative SEL**	
36-inch	2-4	7,200	205	178	188	217	30	2,415	11,205
24-inch	2-4	3,200	199	164	168	199	10	210 (282)	519

Cumulative strike effects. Installation of all in-water piles is expected to take 20-39 days, depending on whether work trestles or barges will be used for project construction, and the minimum and maximum number of piles that will be installed per day. The model used by NMFS assumes that cumulative effects “reset” overnight based on assumed fish movement, so only strikes in a single day count toward cumulative impacts. Based on the proposed action, including use of a bubble curtain, the project may result in cumulative SPLs of 199-217 dBs (Table 8).

Injury to salmonids from cumulative strikes is possible above 187 dB for salmonids weighing greater than 2 grams and above 183 dB for salmonids weighing 2 grams or less. Fork length data of juvenile salmonids passing through the Columbia River presented by Cooney (2002), and the length curves presented by MacFarlane and Norton (2002) and Duffy (2003), indicates most juvenile salmonids in the action area will be heavier than 2 grams. However, eggs and fry weighing less than 2 grams of LCR fall-run Chinook salmon (White Salmon River fall-run population) and eggs of LCR coho salmon (Washington Upper Gorge Tributaries/White Salmon River population) may also be present in the action area. LCR fall-run Chinook salmon and LCR coho salmon spawning occurs at the northern extent of the action area, approximately 0.3 miles (1,584 feet) upstream of Bridge 72.8, where the backwater effect from the Bonneville Pool ends and riffle habitat begins. In 2021, six coho redds and six LCR fall-run Chinook salmon redds were located within 0.37 miles of Bridge 72.8.[4] LCR fall-run Chinook salmon spawning is usually completed in early November with eggs in the gravel through May, and emergence and fry colonization occurring February through May. LCR Coho spawning occurs October through January with eggs in the gravel through May, and fry emergence and colonization occurring March through May.

Based on the NMFS hydraulic calculator, cumulative SELs will attenuate to below 187 dB within 210-2,415 feet (0.46 miles) of piles being proofed with an impact hammer (Table 8). Cumulative SELs will attenuate to below 183 dB within 282-2,415 feet (0.46 miles). Because the distance underwater noise can emanate is reduced by river sinuosity, topography, and landform, and using the line-of-sight rule (WSDOT 2020), we expect the extent of noise propagation in the White Salmon River will be 1,954 feet (0.37 miles).

Vibratory pile driving will occur prior to proofing piles with an impact hammer. We expect that use of the vibratory hammer to start each pile will cause adult salmon and steelhead and most juvenile salmon and steelhead greater than 2 grams to move short distances away from the sound without physical injury. We then expect adults and most juveniles will flee the action area once impact pile driving begins, and not be injured or killed by the cumulative effects of repeated pile strikes. Juvenile salmon and steelhead that do not flee and remain within 210 feet of 24-inch piles in the Columbia River, within 2,415 feet of 36-inch steel piles in the Columbia River, and within 1,954 feet of 36-inch piles in the White Salmon River will be injured or killed by the cumulative effects of repeated pile strikes.

Spawning and emergence occurs beginning approximately 1,584 feet upstream from pile driving. Injury to fish less than 2 grams from the cumulative effects of pile driving extends 1,954 feet. Therefore, we expect LCR fall-run Chinook salmon fry and eggs (White Salmon River fall-run population) and LCR coho salmon eggs (Washington Upper Gorge Tributaries/White Salmon

[4] 2015-2021 redd GPS data provided by Kari Dammerman with WDFW.

River population) in 370 linear feet of the White Salmon River will experience SPLs that will injure or kill them from the cumulative pile strikes of 36-inch piles. Injuries to juvenile salmon and steelhead will include non-auditory tissues as well as temporary threshold shifts in hearing sensitivity; which can lead to reductions in survival, growth, and reproduction of the affected fish by increasing the risk of predation and reducing foraging or spawning success (Stadler and Woodbury 2009).

Behavioral effects. Behavioral modifications of adult and juvenile salmon and steelhead are expected to occur for 7 to 13 days within 519 feet of 24-inch piles, 13 to 26 days within 11,205 feet of 36-inch piles in the Columbia River, and 13 to 26 days within 1,954 feet of 36-inch piles in the White Salmon River being proofed with an impact hammer. We expect varying levels of behavioral responses from adult and juvenile salmon and steelhead exposed to SPLs above 150 dBs. These responses range from no change, to mild awareness, to a startle response (Hastings and Popper 2005). We expect a small number of adult LCR fall-run Chinook salmon and UCR, SRB, MCR, and LCR steelhead; a very small number of adult LCR coho salmon and CR chum; and a small number of juveniles from all 11 ESUs and DPSs considered in this opinion will flee the immediate area for the duration of impact pile driving activity. These fish are expected to move short and long distances or seek cover. Similar habitat types exist throughout the action area and are expected to provide forage and hiding cover similar to the areas fish are displaced from. Therefore, relocations are not expected to effect growth. However, we do expect a very small number of juveniles from all 11 ESUs and DPSs considered in this opinion will experience increased risk of predation (larger fish and birds) from avoiding elevated SPLs for up to 39 days. Risk increases as the duration of pile driving increases, and as the distance moved increases.

All pile driving will occur during daylight. Therefore, adult LCR coho (Washington Upper Gorge Tributaries/White Salmon River population) and LCR fall-run Chinook salmon (White Salmon River fall-run population) may experience migration delays up to 12 hours (daylight work period) on pile drive days (up to 39) with migrations resuming overnight.

It is difficult to determine the exact number of fish that will be injured or killed from impact pile driving for several reasons. First, the number of adult and juvenile fish likely to be in the action area is unknown, but expected to be above zero; and the majority of adult and juvenile salmon and steelhead smolts will have already migrated past the action area by the time the work window for pile driving begins. Second, it is unknown how far from the construction area fish will move in response to disturbance from general construction activities and vibratory pile driving. Third, the number of eggs and fry in the action area is unknown, but expected to be above zero; and we would expect many of the eggs and fry within the action area to not survive to smolt, with or without the proposed action; Fourth, it is unknown what proportion of fish will move away from pile driving, reducing the cumulative impacts they absorb.

Neither vibratory or impact pile driving is expected to result in instantaneous injury to salmon or steelhead. We expect adults and most juvenile salmon and steelhead over 2 grams will flee the action area once impact pile driving begins, and not be subject to the repeated concussive impacts required to cause injury. We also expect juveniles less than 2 grams will be unable to flee the action area. Although most fish will flee once any construction or sound pressure disturbance begins, we still expect a very small number of juvenile salmon and steelhead will be exposed to the effects of cumulative pile strikes. Therefore, we expect a very small number of juvenile salmon and steelhead within 210 feet of 24-inch piles in the Columbia River, 2,415 feet of 36-inch piles in the Columbia River, and 1,954 feet of 36-inch piles in the White Salmon River, will be injured or killed by the cumulative effects of repeated pile strikes for 20-39 days. The juvenile fish injured or killed will likely be distributed among the populations of each ESU and DPS that could be present. We also expect a very small number of White Salmon River fall-run Chinook salmon eggs and fry and a very small number of Washington Upper Gorge Tributaries/White Salmon River coho salmon eggs will be injured or killed in 370 linear feet of the White Salmon River by the cumulative effects of repeated pile strikes of 36-inch piles for 20-39 days.

Pile Driving Summary. Neither vibratory or impact pile driving is expected to result in instantaneous injury to adult or juvenile (greater than and less than 2 grams) salmon or steelhead. NMFS expects a very small number of adult LCR coho salmon (Washington Upper Gorge Tributaries/White Salmon River population) and a small number of adult LCR fall-run Chinook salmon (White Salmon River fall-run population) will delay their migration for up to 12 hours; a very small number of adult CR chum salmon, and a small number of adult UCR, SRB, MCR, and LCR steelhead will move short distances away from the sound; and a small number of juveniles from all ESUs and DPSs considered in this opinion will alter their behavior in response to vibratory pile driving of 36-inch steel piles for 13-26 days, which will increase their risk of predation.

Adults and most juveniles will flee the action area once impact pile driving begins, and not be injured or killed by the cumulative effects of repeated pile strikes. However, we expect a very small number of juvenile salmon and steelhead within 210 feet of 24-inch piles in the Columbia River, 2,415 feet of 36-inch piles in the Columbia River, and 1,954 feet of 36-inch piles in the White Salmon River, will be injured or killed by the cumulative effects of repeated pile strikes for 20 to 39 days. Injuries to juvenile salmon and steelhead will include non-auditory tissues as well as temporary threshold shifts in hearing sensitivity; which can lead to reductions in survival, growth, and reproduction of the affected fish by increasing the risk of predation and reducing foraging or spawning success. The juvenile fish injured or killed will likely be distributed among the populations of each ESU and DPS that could be present. We also expect a very small number of White Salmon River fall-run Chinook salmon eggs and fry and a very small number of Washington Upper Gorge Tributaries/White Salmon River coho salmon eggs will be injured or killed in 370 linear feet of the White Salmon River by the cumulative effects of repeated pile strikes of 36-inch piles for 20 to 39 days.

NMFS also expects a small number of adult LCR fall-run Chinook salmon and UCR, SRB, MCR, and LCR steelhead; a very small number of adult LCR coho and CR chum salmon; and a small number of juveniles from all 11 ESUs and DPSs considered in this opinion will alter their behavior in response to impact pile driving for up to 39 days. Behavioral modifications will occur for 2 to 5 days within 519 feet of 24-inch piles; 8 days within 7,067 feet of 30-inch piles; and 2 to 22 days within 11,205 feet of 36-inch piles in the Columbia River, and within 1,954 feet in the White Salmon River. These responses will range from no change, to mild awareness, to a startle response. Behavioral modifications will also include delayed migration of adult LCR coho (Washington Upper Gorge Tributaries/White Salmon River population) and fall-run Chinook salmon (White Salmon River fall-run population) up to 12 hours (daylight work period) on pile drive days (up to 39) with migrations resuming overnight, and increased risk of predation for rearing juveniles.

Vibrations and Sound from In-water Piers

Trains on bridges with in-water pilings can result in vibration of underwater substrates (Martin and Popper 2016; Reeder et al. 2020). Salmon and steelhead are able to detect low frequency particle motion and substrate vibration and sounds emanating from the substrate (Popper and Hawkins 2018). The added sounds in the aquatic environment may have a wide range of effects on fishes. The added sounds may affect their behavior, causing them to move away from their migration routes, leave favored habitats in which they feed or breed, interfere with communication using sound, or prevent the detection of other biologically important sounds. Anthropogenic vibrations may also produce stress responses (Popper and Hawkins 2019; Popper et al. 2020). As a consequence, the addition of anthropogenic sounds to the aquatic environment has the potential to harm fishes. Approximately 50 trains cross this bridge per day, but it varies significantly. We expect daily train crossings to startle some fish, which may result in altered behaviors or abandonment of cover. Therefore, we expect daily sounds and vibrations from trains crossing the bridge will result in substrate vibrations and sounds that will create a startle response in several juvenile and adult salmon and steelhead, which will increase the risk of predation for juveniles of all species considered in this opinion, based on the use of the action area by juvenile and adults for migration, rearing, and feeding.

Reduced Access and Safe Passage

The project has the potential to hinder migration of salmonids due to elevated underwater noise levels, structure and shading created by trestles and barges, and construction of two permanent in-water piers; and improve migration in the Columbia River from removal of 44 creosote piles. In-water construction will occur during the winter season when we anticipate few fish of any species will be migrating either upstream or downstream in the action area. Very small numbers of adult LCR coho salmon (Washington Upper Gorge Tributaries/White Salmon River population) and small number of adult LCR fall-run Chinook salmon (White Salmon River fall-run population) will be returning to the White Salmon River to spawn during in-water work, and may be delayed when piles are being installed. Though pile driving may affect migratory behavior, it is not expected to prevent upstream or downstream passage because pile driving will not be every day, and will not occur at night when adults can continue upstream migration.

Up to 35,320 square feet of temporary overwater structure, and 340 square feet of temporary in-water structure (311 square feet in the White Salmon River and 29 square feet in the Columbia River) will be present for 12 to 16 months. These structures will create perching habitat for predatory birds, and will create shaded areas and low velocity microhabitats that may attract predators such as smallmouth bass and northern pikeminnow (Petersen et al. 1993). Reduced light may inhibit or alter migration pathways of juvenile salmonids, including delays due to disorientation, dispersal of schools, and a change in migratory routes into deeper waters. Therefore, we expect temporary in-water (340 square feet) and overwater structure (35,320 square feet) will cause behavior modifications of several individual juvenile salmon and steelhead from all ESUs and DPSs considered in this opinion, including altered migration and avoidance, that will increase risk of predation by predatory birds and fish for 12 to 16 months.

Bridges can act as barriers to fish passage by creating a physical blockage, a hydrological barrier, a light barrier, or by forming artificial conditions that act as behavioral barriers to fish. Piers on bridges can influences flow, turbulence, and bed shear stresses in the vicinity of the piers. Bridge piers can also adversely impact native fish by restricting access to preferred habitat and food resources, and by providing predatory fish habitat thereby increasing the chance of predation. Two new, permanent in-water bridge piers (25.5 square feet each) will be constructed in migratory, rearing, and feeding habitat of White Salmon River spring- and fall-run Chinook Salmon, White Salmon River steelhead, and Washington Upper Gorge Tributaries/White Salmon River coho salmon. These structures will be located approximately 90 feet apart and 20 feet from the shoreline. The presence of bridge piers in the White Salmon River will cause constricted flow in the opening between the piers and between the piers and bridge abutments in the uplands. The riprapped and hardened banks on both sides of the White Salmon River associated with the BNSF and SR 14 bridges will also constrict flow. Bridge piers that constrict the channel can affect hydrological flows (e.g. excessive velocity and turbulence) and aquatic habitat conditions. The proposed project includes removing the existing BNSF bridge bents/abutments and laying back the slope to new bents that are set back from the existing bents. This change in channel cross section results in a larger channel opening under the bridge, so velocities reduce under the BNSF and SR 14 bridges, ranging from a decrease of 0.18 feet per second at the mouth to 5.8 feet per second immediately upstream of the railroad bridge. The backwater elevation reduces by about 0.50 feet upstream of the bridge crossing, so velocities increase slightly, 0.05 to 0.58 feet/second, up to 200 feet upstream of the bridges. NMFS does not expect these changes in hydraulics to effect fish passage.

However, local scouring will also occur at the bridge piers. When water flows around a structure located in or near an erodible sediment bed, the increased forces on the sediment particles near the structure may remove sediment from the vicinity of the structure. This erosion of sediment is referred to as structure-induced sediment scour (local scour or pier scour). Scour hole depth, or more simply scour depth, refers to the maximum depth within the scour hole. Jacobs conducted a detailed scour analysis of the bridge. For current conditions, which includes an estimated 15 to 20 feet of sediment fill from the Condit Dam removal, they calculated 27.1 feet of contraction scour and 16.0 feet of pier scour, for total scour at each pier of 43.1 feet (below a flowline of 70 feet) for the 100-year flood event. Scouring of natural substrates downstream of the piers may create a large head loss that fish are unable to negotiate upstream.

Waterborne debris (or drift) often accumulates on bridges during flood events. The accumulation of debris and drifts around a bridge pier can substantially modify the local scour pattern. Debris accumulations can obstruct, constrict, or redirect flow through bridge openings resulting in erosion of stream banks and increased scour at abutments and piers**.** The scour hole dimensions generally increase as debris accumulation increases. Pagliara and Carnacina (2010) found that the presence of debris can increase the maximum scour depth by up to three times compared to that without debris accumulation. Accumulation of floating debris around bridge piers during floods augments scour holes by increasing shear stress, turbulence, and consequently increasing the scour depth at the pier (Lagasse et al. 2010).

Debris accumulation on an individual structure depends greatly on the geometry of the structure. Apertures in the structure greatly increase the likelihood for debris accumulation (Lagasse et al., 2010). Each pier is comprised of eight piles which will provide apertures and opportunities for debris accumulation. Therefore, we expect there will be debris accumulation on both bridge piers. If accumulation on individual structures occurs, then span accumulation may be possible between the piers (Lagasse et al. 2010). Debris accumulation will provide additional habitat for predators which would increase predation on juvenile ESA listed salmon and steelhead. If span accumulation occurs, it could inhibit upstream migration of adult and juveniles. This would increase the susceptibility of juvenile salmon and steelhead to predation.

The in-water piers and reduced velocities under the bridge will also increase habitat for predators, thereby increasing the number of predators and the amount of predation on ESA listed salmon and steelhead populations returning to the White Salmon River, and other ESA listed salmon and steelhead that utilize habitat at the mouth of the White Salmon River for rest, rearing, and feeding.

Because the construction of two in-water piers near the mouth of the White Salmon River will create upstream and downstream migration obstructions by narrowing the passage corridor, debris accumulation, scour, and creating predator habitat, we expect several adult and juvenile White Salmon River spring- and fall-run Chinook salmon, White Salmon River steelhead, and Washington Upper Gorge Tributaries/White Salmon River coho salmon will experience behavior modifications annually, including altered migration and avoidance. Juveniles will be exposed to increased predation. We also expect a very small number of juveniles from all DPSs and ESUs covered in this opinion will utilize rearing and feeding habitat near the bridge piers and also be exposed to increased predation each year.

Summary. Temporary in-water (340 square feet) and overwater structure (35,320 square feet) will cause behavior modifications of several individual juvenile salmon and steelhead from all ESUs and DPSs considered in this opinion, including altered migration and avoidance, that may increase risk of predation by predatory birds and fish for 12 to 16 months.

Because the construction of two in-water piers near the mouth of the White Salmon River will create upstream and downstream migration obstructions by narrowing the passage corridor, debris accumulation, scour, and creating predator habitat, we expect several adult and juvenile White Salmon River spring- and fall-run Chinook salmon, White Salmon River steelhead, and Washington Upper Gorge Tributaries/White Salmon River coho salmon will annually experience behavior modifications, including altered migration and avoidance. Juveniles will be exposed to increased predation. We also expect a very small number of juveniles from all DPSs and ESUs covered in this opinion will utilize rearing and feeding habitat near the bridge piers and also be exposed to increased predation each year.

Removal of creosote piles will permanently improve migration and rearing habitat in approximately 1,380 square feet of the Columbia River for several adults and juveniles from all ESUs and DPSs covered in this opinion. Creosote pile removal will also permanently decrease predation and annually increase survival of several juveniles from all ESUs and DPSs covered in this opinion that migrate and rear in this location.

Extending the Functional Life of the Railroad

Railroad traffic will continue to pose risks to water quality and ESA listed salmon and steelhead after bridge construction. Extending the life of the railroad by installing a new bridge will have effects on White Salmon River spring- and fall-run Chinook salmon, White Salmon River steelhead, and Washington Upper Gorge Tributaries/White Salmon River coho salmon, and other salmon and steelhead species that use the lower White Salmon River for holding and feeding by: impacts to water quality; noise and vibration; and permanent in-water structures in migration, rearing, and feeding habitat. Extending the life of the railroad will also have effects on adult and juvenile salmon and steelhead from all species considered in this opinion through potential impacts to Columbia River water quality.

Types of impacts caused by rail transportation include water quality (Levengood et al. 2015), noise (Aasvang et al. 2007; Ali, 2005; Trombetta Zannin and Bunn 2014), vibration (Kouroussis et al. 2014; Sanayei et al. 2013) and air pollution (Dincer and Elbir 2007; Salma et al. 2009). Railroad traffic (number of trains, number of containers) will remain the same at least in the short term, but we expect it will increase as the West Coast population continues to grow and regional demands require a higher volume of freight. With future population and economic growth, and the subsequent growth in freight, experts anticipate that railroads will continue to make the necessary investments in the capacity required to move heavy and long-distance shipments[5]. With the increase in rail traffic, we anticipate increased impacts to salmon and steelhead.

Stormwater. Potential sources of contaminants associated with railways include diesel exhaust; the abrasion of brakes, wheels, and rails; dust from the transport of minerals and treated railway ties; and leaked cargo or spills (Levengood et al. 2015). Fuel combustion, track material abrasion, and leaked cargo emit particles containing metals that are deposited in the soils along rail tracks and supporting infrastructure, where they can remain for many years due to their low biodegradability (Wilkomirski et al. 2012; Zhang et al. 2012). High concentration levels of heavy metals and PAHs are often found in the vicinity of railways (Wiłkomirski et al. 2011; Mazur et al. 2013; Malawaka and Wilkomirski 2001) and in waterways bisected or bordered by railways (Levengood et al. 2015). Levengood et al. (2015) found that PAH concentrations at some sites represented a risk to aquatic life.

Movement of these pollutants from the soil and bridge to the White Salmon and Columbia Rivers after project construction could potentially result in stormwater contamination (Burkhardt et al. 2008). Runoff is a major source of water pollution. As the water runs along a surface, it picks up litter, petroleum, chemicals, fertilizers, and other toxic substances. These chemical pollutants can harm an entire ecosystem, from absorbing the pollutants directly, or by consuming contaminated organisms and increasing the level of pollutants in their own bodies and up the food chain (biomagnification). Following project construction, there will be no stormwater

[5] Information from Federal Department of Transportation Website, July 15, 2022.

management or treatment associated with the new bridge and railway. Stormwater that runs off the new bridge will not be treated prior to entering the White Salmon or Columbia Rivers.

Soil acts as a natural sponge, filtering and absorbing many harmful chemicals. The railway embankment is comprised of compacted soil and rock and devoid of vegetation, which can affect permeability and water drainage, and promote erosion (Ferrell and Lautala 2010; Chen et al. 2014). Beneath the bridge, both banks are steep and composed of riprap fill with minimal upland vegetative cover. Most stormwater associated with the railroad track will infiltrate the embankment. However, we still expect untreated stormwater that does not percolate into the embankment or hardened streambanks will run off into the White Salmon and Columbia Rivers and affect water quality. Based on the size of the bridge, most stormwater infiltrating the embankment, and rail traffic increasing over time after project completion, we expect stormwater runoff from the railroad and new bridge to slightly degrade water quality conditions further in the action area. However, we do not expect slight changes in water quality from stormwater to result in impacts to salmon or steelhead.

Spills. Potential for a fuel, or other contaminant, spill to affect a stream exists wherever railroads are near streams (Furniss et al. 1991). Petroleum-based products (e.g., fuel, oil, and some hydraulic fluids) contain PAH, which can cause lethal or chronic sublethal effects to aquatic organisms (Neff 1985). These products are moderately to highly toxic to salmonids, depending on concentrations and exposure time. Free oil and emulsions can adhere to gills and interfere with respiration, and heavy concentrations of oil can suffocate fish. Evaporation, sedimentation, microbial degradation, and hydrology act to determine the fate of fuels entering fresh water (Saha and Konar 1985).

Despite stringent safety regulations and improved technology and equipment, train accidents continue to happen. Approximately 1,704 derailments (passenger and freight trains combined) occur annually.[6] By extending use of the railroad into the future, and with increased rail traffic expected with population growth, we expect there to be increased potential for a rail accident and spill to affect water quality in the White Salmon and Columbia Rivers. We would expect a hazardous spill to result in injury and mortality of several juvenile and adult salmon and steelhead from any of the species considered in this opinion, depending on the size of spill, the timing of spill, and emergency spill containment measures implemented.

Summary on Effects on Species

Pulses of turbidity generated during installation and removal of floating silt curtains will cause short term (a few minutes to a few hours) behavioral changes including: fleeing and avoidance of turbidity plumes, and changes in feeding behavior and movement of fish within turbidity plumes, to a small number of adult LCR fall-run Chinook salmon and adult UCR, SRB, MCR, and LCR steelhead; a very small number of adult CR chum salmon and LCR coho salmon; and a very small number of juveniles from all ESUs and DPSs, within 300 feet downstream. Pulses of turbidity generated during barge movements will also cause short term (several minutes to a few hours) behavioral changes to a small number of adult and juveniles from all ESUs and DPSs

[6] Statistic from the Bureau of Transportation website.

within 300 feet downstream, for up to 16 months. Additionally, we expect large rain and high flow events will cause elevated turbidity levels for a few hours to a few days, and be sufficient to cause a small number of adults and juveniles from all ESUs and DPSs to alter their behavior within 300 feet downstream of project construction. We expect adults and some juveniles will flee the areas of higher turbidity, which will increase the risk of predation to juveniles. We also expect a very small number of juvenile fish from all ESUs and DPSs covered in this opinion may experience reduced feeding, growth, and fitness; injury; and death from being trapped in up to 5,705 square feet of floating silt curtains (3,125 square feet along the streambank and 2,580 square feet around steel piles).

Temporary in-water (340 square feet) and overwater structure (35,320 square feet) will alter the behavior of several individual juvenile salmon and steelhead from all 11 ESUs and DPSs considered in this opinion, including altered migration and avoidance, which will increase the risk of predation by predatory birds and fish for 12-16 months.

Neither vibratory or impact pile driving is expected to result in instantaneous injury to salmon or steelhead. NMFS expects a very small number of adult LCR coho salmon (Washington Upper Gorge Tributaries/White Salmon River population) and a small number of adult LCR fall-run Chinook salmon (White Salmon River fall-run population) will delay their migration for up to 12 hours; a very small number of adult CR chum salmon, and a small number of adult UCR, SRB, MCR, and LCR steelhead will move short distances away from the sound; and a small number of juveniles from all ESUs and DPSs considered in this opinion will alter their behavior in response to vibratory pile driving of 36-inch steel piles for 13-26 days, which will increase their risk of predation. We do not believe that vibratory driving will result in immediate direct injury or death to juvenile or adult salmon or steelhead.

Adults and most juveniles will flee the action area once impact pile driving begins, and not be injured or killed by the cumulative effects of repeated pile strikes. However, we expect a very small number of juvenile salmon and steelhead within 210 feet of 24-inch piles in the Columbia River, 2,415 feet of 36-inch piles in the Columbia River, and 1,954 feet of 36-inch piles in the White Salmon River, will be injured or killed by the cumulative effects of repeated pile strikes for 20-39 days. Injuries to juvenile salmon and steelhead will include non-auditory tissues as well as temporary threshold shifts in hearing sensitivity; which can lead to reductions in survival, growth, and reproduction of the affected fish by increasing the risk of predation and reducing foraging or spawning success. The juvenile fish injured or killed will likely be distributed among the populations of each ESU and DPS that could be present. We also expect a very small number of White Salmon River fall-run Chinook salmon eggs and fry and a very small number of Washington Upper Gorge Tributaries/White Salmon River coho salmon eggs will be injured or killed in 370 linear feet of the White Salmon River by the cumulative effects of repeated pile strikes of 36-inch piles for 20-39 days.

We expect a small number of adult LCR fall-run Chinook salmon and UCR, SRB, MCR, and LCR steelhead; a very small number of adult LCR coho salmon and CR chum; and a small number of juvenile fish from all 11 ESUs and DPSs considered in this opinion will alter their behavior and flee the immediate area for the duration of impact pile driving activity. Behavioral modifications of adult and juvenile salmon and steelhead are expected to occur for 7-13 days within 519 feet of 24-inch piles, 13-26 days within 11,205 feet of 36-inch piles in the Columbia River, and 13-26 days within 1,954 feet of 36-inch piles in the White Salmon River being proofed with an impact hammer. Behavioral modifications and fleeing are not expected to effect growth, but we do expect a very small number of juveniles from all 11 ESUs and DPSs considered in this opinion will experience increased risk of predation (larger fish and birds) from avoiding elevated SPLs for up to 39 days.

Very small numbers of adult LCR coho salmon (Washington Upper Gorge Tributaries/White Salmon River population) and small number of adult LCR fall-run Chinook salmon (White Salmon River fall-run population) will be returning to the White Salmon River to spawn during in-water work, and may be delayed when piles are being installed. Though pile driving may affect migratory behavior, it is not expected to prevent upstream or downstream passage because pile driving will not be every day, and will not occur at night when adults can continue upstream migration.

Daily sounds and vibrations from trains crossing the bridge will result in substrate vibrations and sounds that will create a startle response in several juvenile and adult salmon and steelhead, which will increase the risk of predation for juveniles of all species considered in this opinion, based on the use of the action area by juvenile and adults for migration, rearing, and feeding.

We expect permanent bridge piers to annually inhibit, but not prevent, migration of several adult LCR spring- and fall-run Chinook salmon, White Salmon River steelhead, and Washington Upper Gorge Tributaries/White Salmon River coho by creating and obstruction, narrowing the passage corridor, debris accumulation, scour, and creating predator habitat. We also expect permanent in-water piers will annually inhibit downstream migration and alter behavior, including altered migration and avoidance, of several juvenile White Salmon River spring-run and fall-run Chinook salmon, White Salmon River summer steelhead, and Washington Upper Gorge Tributaries/White Salmon River coho salmon, increasing their risk of predation during migration, rearing, and feeding. The risk of predation will also increase for a very small number of juveniles from all ESUs and DPSs considered in this opinion that utilize the mouth of the White Salmon River for holding and feeding during their downstream migration

Although we expect the permanent piers will inhibit upstream and downstream migration and increase predation of juvenile from all ESUs and DPSs covered in this opinion, we also expect the proposed action will result in an overall benefit to migration, rearing, and feeding in the Columbia River for fish from each of these species. Removal of approximately 44 piles in the Columbia River 0.27 miles downstream from the project will remove migration barriers and predator habitat, thereby improving upstream and downstream migration and rearing habitat for all ESUs and DPSs covered in this opinion.

By extending use of the railroad into the future, and with increased rail traffic expected with population growth, we expect there to be increased potential for a rail accident and spill to affect water quality in the White Salmon and Columbia Rivers. We would expect a hazardous chemical spill to result in injury and mortality of several juvenile and adult salmon and steelhead from any species considered in this opinion, depending on the size of spill, the timing of the spill, and the emergency spill containment measures implemented.

2.5.2. Effects on Critical Habitat

Critical habitat for UCR Chinook salmon, SR spring-run and fall-run Chinook salmon, LCR Chinook salmon, UCR steelhead, SRB steelhead, MCR steelhead, LCR steelhead, SR sockeye, and CR chum salmon is designated in the action. Habitat in the action area is not designated as critical habitat for LCR coho salmon. The action area includes PBFs for freshwater migration and rearing for all of these ESUs and DPSs and spawning PBFs for LCR Chinook salmon. The essential features in the action area for these three types of PBFs that will be affected by the proposed action include water quality, substrate/spawning gravel, forage, natural cover/riparian vegetation, water velocity, and obstruction. The effects of the proposed action on these features are summarized below.

Water Quality

Water quality will be reduced within the project area for approximately 16 months. The proposed action is expected to temporarily increase delivery of sediment to the waterway and suspend fine sediment during: installation and removal of floating silt curtains, 290 feet of sheet pile, and up to 67 steel piles (16 permanent and 51 temporary) below the OHWM; removal of 44 creosote piles from the Columbia River; and from barge and tug movements, thereby increasing turbidity in the water column.

Because erosion control measures, IMMs, and BMPs will be implemented during construction, very little sediment is expected to be released from the project site. Localized resuspension of sediment will occur during pile driving, and contained within floating silt curtains. However, installation and removal of floating silt curtains will result in pulses of increased turbidity and suspended sediment concentration up to 300 feet downstream of the in-water work area. If the contractor uses barges for construction, intermittent barge movements for 16 months will also suspend sediment and create turbidity plumes up to 300 feet downstream. We expect the pulses of elevated suspended sediment to last several minutes to a few hours, because the substrate in and around the work areas consists primarily of sand and silt, and this fine material tends to stay in suspension longer than coarser sediments. We expect turbidity plumes and fine sediments to disperse and settle up to 300 feet downstream in Bonneville Reservoir, becoming indistinguishable from background levels. NMFS also expects minor leaks and spills of petroleum-based fluids (not more than ounces) that will be contained on site in secondary containment basins and diluted by high flows in the White Salmon and Columbia Rivers. Additionally, NMFS also expects a very small improvement to water quality in the action area from removal of 44 creosote piles in 50 square feet of the Columbia River. Therefore, overall, NMFS expects small, temporary, and intermittent, negative effects to water quality at the scale of the action area for 16 months.

The proposed action will result in removal of up to seven trees (ponderosa pine and bigleaf maple) from the southern edge of the railroad prism within approximately 0.20 acres of the railroad right-of-way. Therefore, the Columbia riverbank area will experience decreased shade and increased solar radiation from the removal of vegetation. Because of the small number of trees and area affected by removal of the trees, we do not expect stream temperatures to increase.

Stormwater

During project construction, stormwater will be managed according to Volume II, Chapter 3 (Construction Stormwater Pollution Prevention), of the "Washington State Department of Ecology 2019 Stormwater Management Manual for Western Washington". This will include using sediment ponds, drainage swales, sediment fences, grading, and stabilizing disturbed soil surfaces. Based on the BMPs for erosion control and stormwater management, we expect only infrequent and small amounts of stormwater will enter the White Salmon and Columbia Rivers during the 16-months of project construction. Therefore, we do not expect stormwater during project construction to degrade water quality at the scale of the action area.

Substrate

Substrate conditions within the affected stream reach are expected to experience minor levels of sediment deposition as small turbidity plumes settle out within 300 feet downstream. We expect deposited sediment to be indistinguishable from background levels. In addition, installation of temporary work trestles and slide beams will displace up to 311 square feet in the White Salmon River for 12 months, installation of moorage dolphins will temporarily displace up to 29 square feet of substrate in the Columbia River for up to 16 months, installation of in-water piers will permanently displace 51 square feet of substrate, and scour at the piers will further reduce available substrate. Creosote piles will be removed from approximately 50 square feet of substrate in the Columbia River, providing a positive effect. These areas are used by adults and juveniles from all ESUs and DPSs covered in this opinion for rearing, feeding, and migration. Therefore, NMFS expects small (no more than 340 square feet), temporary (12 to 16 months) negative effects to substrate at the scale of the action area. We also expect a very small, permanent negative effect to substrate at the scale of the action area.

Forage

The proposed action will negatively affect the short-term availability of benthic invertebrates by crushing, covering, or temporarily displacing them from up to 311 square feet of streambed in the White Salmon River and 29 square feet in the Columbia River from construction of work trestles, slide beams, and moorage dolphins; and long-term by the permanent loss of over 51 square feet of streambed from construction of in-water piers and associated scour. An additional small area of river bottom within the floating silt curtains will be disturbed by resuspension and settling of suspended sediment. Removal of seven trees from the bank of the White Salmon River will further decrease terrestrial macroinvertebrate production and contribution to salmonid forage. However, 150 willows planted along the edge of the Columbia River will provide a source of macroinvertebrates as they grow and mature. Additionally, removal of 44 creosote piles will open up approximately 50 square feet of substrate for forage production.

Invertebrate drift will be occurring during the project in both the White Salmon and Columbia Rivers, providing a prey base and recolonizing the 79-361 square feet of disturbed substrate once temporary piles and creosote piles are removed. We expect recolonization to occur within a few days to a few months after project completion (Fowler 2004; Griffith and Andrews 1981; Yount and Nemi 1990). Given the small area of benthic habitat disturbance and permanent loss, willow plantings, the amount of available local habitat, the supply of forage from invertebrate drift, and removal of creosote piles, NMFS expects this project to have a small, negative effect on forage at the scale of the action area.

Natural Cover and Riparian Vegetation

The proposed action will impair the natural cover PBF. Riparian vegetation provides overhead cover, shade, woody material that provides complex cover instream, and terrestrial invertebrates and allochthonous inputs. The proposed action will result in removal of up to seven trees (ponderosa pine and bigleaf maple) from the southern edge of the railroad prism within approximately 0.20 acres of the railroad right-of-way. Therefore, the Columbia riverbank area will experience several years of decreased shade from the removal of vegetation. The removed trees will be placed in the Columbia River and provide a minor amount of cover. BNSF will plant 150 willow cuttings immediately downstream of the bridge at the base of the railroad prism along the edge of the Columbia River. As the 150 willow trees grow and mature, they will provide some shade and cover. No large woody material will be removed from within either the White Salmon or Columbia Rivers. Therefore, NMFS expects a very small, negative effect to natural cover and riparian vegetation at the scale of the action area from removal of seven trees.

Unobstructed passage

As described above in Section 2.5.1 (Effects to Species) we expect the project to hinder migration, rearing, and feeding of salmon and steelhead due to elevated underwater noise levels; structure and shading created by piers, trestles, and barges; and construction of two permanent in-water piers. Up to 76 steel piles (60 temporary and 16 permanent) will be installed below the OHWM in the White Salmon and Columbia Rivers. We expect pile driving will delay, but not prevent, upstream migration of a small number of White Salmon River fall-run Chinook salmon and a very small number of adult Washington Upper Gorge Tributaries/White Salmon River coho salmon. We also expect pile driving will cause behavioral modifications and fleeing of a very small number of juveniles from all ESUs and DPSs considered in this opinion, increasing risk of predation from larger fish and birds for up to 39 days.

Permanent piers near the mouth of the White Salmon River will create upstream and downstream migration obstructions for several adult and juvenile LCR spring- and fall-run Chinook salmon (White Salmon River spring- and fall-run populations), MCR steelhead (White Salmon River population), and LCR coho (Washington Upper Gorge Tributaries/White Salmon River population) annually by narrowing the passage corridor, debris accumulation, scour, and creating predatory fish and bird habitat. The permanent piers will also inhibit juvenile salmon and steelhead feeding and rearing by creating obstacles and by providing ambush habitat for fish and avian predators.

Up to 35,320 square feet of temporary overwater structure, 340 square feet of temporary in-water structure (311 square feet in the White Salmon River and 29 square feet in the Columbia River), and up to 3,164 square feet of floating silt curtains (at any one time) will be present for 12-16 months. These structures will create perching habitat for predatory birds, ambush habitat for predatory fish, reduce light, and create in-water obstructions that inhibit or alter migration pathways of adult and juvenile salmonids. Temporary structures will not prevent upstream and downstream migration, However, altered migration caused by temporary structures will increase risk of predation by predatory birds and fish for 12-16 months.

The proposed action includes removal of approximately 44 creosote piles 0.27 miles downstream from the bridge. Removal of these piles will improve migration, rearing, and feeding habitat for adults and juveniles from all ESUs and DPSs considered in this opinion in the Columbia River. Following project construction and removal of these piles, the project will have a beneficial effect on passage in the Columbia River. However, impacts from permanent piers will persist for the life of the project. Therefore, NMFS expects a small, negative effect to passage at the scale of the action area.

Extending the Functional Life of the Railroad

Railroad traffic will continue to pose risks to water quality and critical habitat in the White Salmon and Columbia Rivers after bridge construction. We expect impacts to water quality from untreated stormwater entering the White Salmon and Columbia Rivers. Additionally, we believe that by extending use of the railroad into the future, along with anticipated increased rail traffic, there will be the increased potential for a rail accident and hazardous spill to affect water quality in the White Salmon and Columbia Rivers. We would expect a quick response to contain and clean up any hazardous spill. However, should a rail accident and associated spill occur, we would expect the hazardous spill to decrease water quality for several weeks to months at the scale of the action area. Therefore, we expect extending the life of the railroad will affect water quality for several days to several months at the scale of the action area.

Summary of Effects on Critical Habitat

The proposed action will have small, temporary, and intermittent negative effects to water quality (turbidity, sediment, chemical contaminations) at the scale of the action area for 16 months during project construction. Increases in TSS and turbidity during project construction are expected to occur intermittently, be small, extend 300 feet downstream, and persist for minutes to a few hours. Minor leaks and spills of petroleum-based fluids (not more than ounces) will be contained in secondary containment basins. Removal of 44 creosote piles will reduce a source of toxic chemicals in a very small area of the Columbia River (Bonneville Reservoir).

NMFS expects small (no more than 340 square feet), temporary (12 to 16 months) negative effects to substrate at the scale of the action area. Substrate conditions within the affected stream reach are expected to experience minor levels of sediment deposition as small turbidity plumes settle out within 300 feet downstream. We expect deposited sediment to be indistinguishable from background levels. In addition, installation of temporary work trestles and slide beams will displace up to 311 square feet in the White Salmon River for 12 months, and installation of moorage dolphins will temporarily displace up to 29 square feet of substrate in the Columbia River for up to 16 months. We also expect a very small, permanent negative effect to substrate at the scale of the action area. Permanent, negative effects to the substrate PBF in the action area will occur from permanent displacement of over 51 square feet of substrate from permanent piers and scour; although removal of creosote piles will improve substrate in 50 square feet of the Columbia River.

Given the small area of benthic habitat disturbance and permanent loss, willow plantings, the amount of available local habitat, the supply of forage from invertebrate drift, and removal of creosote piles, NMFS expects this project to have a small, negative effect on forage at the scale of the action area.

Although small, positive effects to forage are expected from planting of 150 willows and removal of creosote piles in the Columbia River, small, negative effects to the forage PBF at the scale of the action area will occur from the loss of aquatic invertebrates by crushing, covering, or displacing them for up to 16 months from up to 311 square feet in the White Salmon River and 29 square feet in the Columbia River; and permanently in over 51 square feet (piers and scour) of the White Salmon River. A very small, negative effect to natural cover and riparian vegetation at the scale of the action area will occur from removal of seven trees until planted willows become established and provide cover and shade. NMFS expects a small, negative effect to migratory habitat at the scale of the action area from pile driving, the presence of temporary in-water (up to 3,475 square feet) and overwater structures (up to 35,320 square feet), and the presence of permanent in-water structures which will result in permanent loss of some migration and rearing habitat in the action area. Although the removal of approximately 44 creosote piles 0.27 miles downstream from the bridge will improve migration, rearing, and feeding habitat for adults and juveniles from all ESUs and DPSs considered in this opinion in the Columbia River, we still expect a small, negative effect to the migration PBF at the scale of the action area.

2.6. 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 and 402.17(a)]. 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.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline versus cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described earlier in the discussion of environmental baseline (Section 2.4).

The presence and continued use of the railroad tracks and new bridge by BNSF railway, and SR 14 adjacent to the bridge, along with resource-based activities such as timber harvest, agriculture, irrigation withdrawals, mining, shipping, and energy development are likely to continue to exert an influence on the quality of freshwater habitat in the action area. Additional effects to ESA-listed salmonid and steelhead are anticipated with population growth, urban development, and increases in recreational use of the Columbia and White Salmon Rivers. The populations of Skamania and Klickitat counties in Washington are growing at a rate of 1.14 and 1.54 percent per year, respectively. NMFS assumes the populations for both counties will continue to grow for the foreseeable future. Residential development is occurring with increasing frequency in the lower watershed and along State Route 141. As the human population in the action area grows, demand for agricultural, commercial and residential development, and recreation is likely to increase as well. Although these activities are ongoing and likely to continue into the future, the future rate of development will depend on whether there are economic, administrative, and legal factors that can either support or restrict development (or in the case of contaminants, safeguards). Because the reach from the former location of Condit Dam to the mouth is within the boundaries of the Columbia River Gorge National Scenic Area, and construction within the riparian area is largely prohibited, the effects of new development are likely to be reduced. NMFS is not aware of any specific future non-Federal activities within the action area that would cause greater effects to a listed species or designated critical habitat than presently occur. Therefore, although NMFS finds it likely that the cumulative effects of these activities will have adverse effects commensurate to those of similar past activities, it is not possible to quantify these effects. Some of these future activities will require a Federal permit, and thus will undergo ESA consultation. Many future State or tribal actions would likely have some form of Federal funding or authorization and therefore would be reviewed by NMFS; including sediment stabilization, revegetation efforts, and other mitigation and restoration activities ongoing in the White Salmon River following removal of Condit Dam. This limits the scope of cumulative effects that can be factored in this analysis.

Based on the analysis above, the cumulative effects of future State and private activities will have a continued negative effect on ESA-listed fish and their critical habitats.

2.7. Integration and Synthesis

The Integration and Synthesis section is the final step in assessing the risk that the proposed action poses to species and critical habitat. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), 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) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

2.7.1. Species

The LCR Chinook salmon from the White Salmon River spring- and fall-run populations, LCR coho salmon from the Washington Upper Gorge Tributaries/White Salmon River population, and MCR steelhead from the White Salmon River population inhabit the action area and depend on it to support critical life functions of spawning, rearing, feeding, and migration. The action area is also used by multiple populations of UCR spring-run Chinook salmon, UCR steelhead, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, SRB steelhead, MCR steelhead, LCR Chinook salmon, LCR steelhead, LCR coho salmon, and CR chum salmon for rearing, feeding, and migration. Adults and juveniles from all 11 of these ESUs and DPSs will be affected by the proposed action. Adults and juveniles from White Salmon

River spring- and fall-run Chinook salmon populations of LCR Chinook salmon, the Washington Upper Gorge Tributaries/White Salmon River coho salmon population of LCR coho salmon, and the White Salmon River steelhead population of MCR steelhead will be impacted by permanent in-water piers and potentially water quality impacts from extending the use of the railroad many years into the future. All three UCR spring-run Chinook salmon populations, and SR sockeye salmon, have an overall viability of high risk. The other nine species are listed as threatened, and while some populations are viable, most populations within these ESUs and DPSs remain at moderate or high risk (Ford 2022). Although the overall risk ratings of White Salmon spring-run and fall-run Chinook salmon populations are very high and high, respectively, the LCR Chinook salmon ESU is at moderate risk of extinction. The White Salmon River spring-run population's expected level of contribution to recovery of the LCR Chinook salmon ESU (using the terms primary, contributing, and stabilizing), is contributing with low persistence probability (NMFS 2013). The White Salmon fall-run population's expected level of contribution to recovery of the LCR Chinook salmon ESU is contributing with a moderate persistence probability. The Washington Upper Gorge Tributaries/White Salmon River coho salmon population of LCR coho salmon is considered to be at very high risk, with the LCR coho salmon ESU at moderate risk of extinction. The Upper Gorge Tributaries/White Salmon River coho salmon population's expected level of contribution to recovery of LCR coho salmon is primary, with a high persistence probability, although this is identified as highly unlikely for various reasons by ODFW (2010). The White Salmon River steelhead population of MCR steelhead is considered extirpated, but recolonizing; and the MCR steelhead DPS is considered at moderate risk of extinction. The White Salmon River steelhead population is part of the Cascades Eastern Slope Tributaries MPG of MCR steelhead. To achieve recovery, the Klickitat River, Fifteenmile Creek, and both the Deschutes River Eastside and Deschutes River Westside populations of the Cascades Eastern Slope Tributaries MPG should reach at least viable status. MPG viability could be further bolstered if the White Salmon River population successfully recolonizes its historical habitat above Condit Dam (NMFS 2022).

As described in Section 2.5.1, the proposed action will have effects on adults and juveniles of all 11 ESUs and DPSs for 12 to 16 months. The proposed action will also have effects on adult and juvenile White Salmon River spring- and fall-run Chinook salmon, Washington Upper Gorge Tributaries/White Salmon River coho salmon, and White Salmon River steelhead from permanent in-water piers and threats to water quality for many years into the future from extending the life of the railroad. The proposed action will also affect eggs and fry of White Salmon River fall-run Chinook salmon and eggs of Washington Upper Gorge Tributaries/White Salmon River coho salmon.

Pulses of turbidity generated during installation and removal of floating silt curtains will cause short term (a few minutes to a few hours) behavioral changes including: fleeing and avoidance of turbidity plumes, and changes in feeding behavior and movement of fish within turbidity plumes, to a small number of adult LCR fall-run Chinook salmon and adult UCR, SRB, MCR, and LCR steelhead; a very small number of adult CR chum salmon and LCR coho salmon; and a very small number of juveniles from all ESUs and DPSs, within 300 feet downstream. Pulses of turbidity generated during barge movements will also cause short term (several minutes to a few hours) behavioral changes to a small number of adult and juveniles from all ESUs and DPSs within 300 feet downstream, for up to 16 months. Additionally, we expect large rain and high flow events will cause elevated turbidity levels for a few hours to a few days, and be sufficient to cause a small number of adults and juveniles from all ESUs and DPSs to alter their behavior within 300 feet downstream of project construction. We expect adults and some juveniles will flee the areas of higher turbidity, which will increase the risk of predation to juveniles. We also expect a very small number of juvenile fish from all ESUs and DPSs covered in this opinion may experience reduced feeding, growth, and fitness; injury; and death from being trapped in up to 5,705 square feet of floating silt curtains (3,125 square feet along the streambank and 2,580 square feet around the steel and creosote piles).

We expect up to 35,320 square feet of overwater structures will alter the behavior of several individual juvenile salmon and steelhead from all 11 ESUs and DPSs considered in this opinion, including altered migration and avoidance, which will increase the risk of predation.

Neither vibratory or impact pile driving is expected to result in instantaneous injury to salmon or steelhead. NMFS expects a very small number of adult LCR coho salmon (Washington Upper Gorge Tributaries/White Salmon River population) and a small number of adult LCR fall-run Chinook salmon (White Salmon River fall-run population) will delay their migration for up to 12 hours; a very small number of adult CR chum salmon, and a small number of adult UCR, SRB, MCR, and LCR steelhead will move short distances away from the sound; and a small number of juveniles from all ESUs and DPSs considered in this opinion will alter their behavior in response to vibratory pile driving of 36-inch steel piles for 13 to 26 days, which will increase their risk of predation. We do not believe that vibratory driving will result in immediate direct injury or death to juvenile or adult salmon or steelhead.

Adults and most juveniles will flee the action area once impact pile driving begins, and not be injured or killed by the cumulative effects of repeated pile strikes. However, we expect a very small number of juvenile salmon and steelhead within 210 feet of 24-inch piles in the Columbia River, 2,415 feet of 36-inch piles in the Columbia River, and 1,954 feet of 36-inch piles in the White Salmon River, will be injured or killed by the cumulative effects of repeated pile strikes for 20 to 39 days. Injuries to juvenile salmon and steelhead will include non-auditory tissues as well as temporary threshold shifts in hearing sensitivity; which can lead to reductions in survival, growth, and reproduction of the affected fish by increasing the risk of predation and reducing foraging or spawning success. The juvenile fish injured or killed will likely be distributed among the populations of each ESU and DPS that could be present. We also expect a very small number of White Salmon River fall-run Chinook salmon eggs and fry and a very small number of Washington Upper Gorge Tributaries/White Salmon River coho salmon eggs will be injured or killed in 370 linear feet of the White Salmon River by the cumulative effects of repeated pile strikes of 36-inch piles for 20 to 39 days.

We expect a small number of adult LCR fall-run Chinook salmon and UCR, SRB, MCR, and LCR steelhead; a very small number of adult LCR coho salmon and CR chum; and a small number of juveniles from all 11 ESUs and DPSs considered in this opinion will alter their behavior and flee the immediate area for the duration of impact pile driving activity. Behavioral modifications of adult and juvenile salmon and steelhead are expected to occur for 7-13 days within 519 feet of 24-inch piles, 13 to 26 days within 11,205 feet of 36-inch piles in the Columbia River, and 13 to 26 days within 1,954 feet of 36-inch piles in the White Salmon River being proofed with an impact hammer. Behavioral modifications and fleeing are not expected to affect growth, but we do expect a very small number of juveniles from all 11 ESUs and DPSs considered in this opinion will experience increased risk of predation (larger fish and birds) from avoiding elevated SPLs for up to 39 days.

Very small numbers of adult LCR coho salmon (Washington Upper Gorge Tributaries/White Salmon River population) and small number of adult LCR fall-run Chinook salmon (White Salmon River fall-run population) will be returning to the White Salmon River to spawn during in-water work, and may be delayed when piles are being installed. Though pile driving may affect migratory behavior, it is not expected to prevent upstream or downstream passage because pile driving will not be every day, and will not occur at night when adults can continue upstream migration.

Temporary in-water (340 square feet) and overwater structure (35,320 square feet) will cause behavior modifications of several individual juvenile salmon and steelhead from all ESUs and DPSs considered in this opinion, including altered migration and avoidance that may increase risk of predation by predatory birds and fish for 12 to 16 months.

Because the construction of two in-water piers near the mouth of the White Salmon River will create upstream and downstream migration obstructions by narrowing the passage corridor, debris accumulation, scour, and creating predator habitat, we expect several adult and juvenile White Salmon River spring- and fall-run Chinook salmon, White Salmon River steelhead, and Washington Upper Gorge Tributaries/White Salmon River coho salmon will experience behavior modifications, including altered migration and avoidance. Juveniles will be exposed to increased predation. We also expect a very small number of juveniles from all DPSs and ESUs covered in this opinion will utilize rearing and feeding habitat near the bridge piers and also be exposed to increased predation. Removal of creosote piles will permanently improve migration and rearing habitat in approximately 1,380 square feet of the Columbia River for several adults and juveniles from all ESUs and DPSs covered in this opinion. Creosote pile removal will also permanently decrease predation and annually increase survival of several juveniles from all ESUs and DPSs covered in this opinion that migrate and rear in this location.

By extending use of the railroad into the future, and with increased rail traffic expected with population growth, we expect there to be increased potential for a rail accident and spill to affect water quality in the White Salmon and Columbia Rivers. We would expect a hazardous chemical spill to result in injury and mortality of several juvenile and adult salmon and steelhead from all species considered in this opinion, depending on the size of spill, the timing of spill, and emergency spill containment measures implemented.

We expect permanent bridge piers to annually inhibit, but not prevent, migration of several adult LCR spring- and fall-run Chinook salmon, White Salmon River steelhead, and Washington Upper Gorge Tributaries/White Salmon River coho. We also expect permanent in-water piers will annually inhibit downstream migration of several juvenile White Salmon River spring-run and fall-run Chinook salmon, White Salmon River summer steelhead, and Washington Upper Gorge Tributaries/White Salmon River coho salmon and increase their risk of predation during migration, rearing, and feeding. The risk of predation will also increase for a very small number of juveniles from all ESUs and DPSs considered in this opinion that utilize the mouth of the White Salmon River for holding and feeding during their downstream migration

Although we expect the permanent piers will inhibit upstream and downstream migration and increase predation of juvenile from all ESUs and DPSs covered in this opinion, we also expect the proposed action will result in an overall benefit to migration, rearing, and feeding in the Columbia River for fish from each of these species. Removal of approximately 44 piles in the Columbia River 0.27 miles downstream from the project will remove migration barriers and predator habitat, thereby improving upstream and downstream migration and rearing habitat for several adults and juveniles from all ESUs and DPSs covered in this opinion.

We expect sounds and vibrations from trains crossing the bridge will result in substrate vibrations and sounds that will create a startle response daily in several juvenile and adult salmon and steelhead, which will increase the risk of predation for juveniles of all species considered in this opinion, based on the use of the action area by juvenile and adults for migration, rearing, and feeding.

These effects and reductions are not expected to appreciably alter the abundance, productivity, spatial structure, or diversity of any populations of UCR spring-run Chinook salmon, UCR steelhead, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, SRB steelhead, LCR steelhead, or CR chum salmon. It is NMFS' opinion that when the effects of the action and cumulative effects are added to the environmental baseline, and in light of the status of the species, the effects of the action will not cause reductions in reproduction, numbers, or distribution that would reasonably be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of UCR spring-run Chinook salmon, UCR steelhead, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, SRB steelhead, LCR steelhead, or CR chum salmon.

These effects and reductions are also not expected to appreciably alter the abundance, productivity, spatial structure, or diversity of the White Salmon River spring-run and fall-run populations of LCR Chinook salmon, the White Salmon River summer steelhead population of MCR steelhead, and the Washington Upper Gorge Tributaries/White Salmon River population of LCR coho salmon. It is NMFS' opinion that when the effects of the action and cumulative effects are added to the environmental baseline, and in light of the status of each species, the effects of the action will not cause reductions in reproduction, numbers, or distribution that would reasonably be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of LCR Chinook salmon, LCR coho salmon, and MCR steelhead.

2.7.2. Critical Habitat

Critical habitat in the action area is degraded due to transportation infrastructure, the Columbia River System dams and reservoirs, marinas, docks, and riprap. Dams and reservoirs within the migratory corridor have altered the river environment and affected fish passage. Water impoundment, dam operations, and upstream land use activities affect downstream water quality characteristics. Salmon and steelhead are exposed to high rates of natural predation during all life stages from fish, birds, and marine mammals, exacerbated in some locations (by providing perch sites or hiding spots for predators) by development. Shoreline development has reduced the quality of nearshore salmon and steelhead habitat by eliminating native riparian vegetation, displacing shallow water habitat with fill materials, and by further disconnecting the White Salmon and Columbia Rivers from historic floodplain areas. Further, riparian species that evolved under the environmental gradients of riverine ecosystems are not well suited to the present hydraulic setting of the action area (i.e., static, slackwater pools), and are thus often replaced by non-native species. The riparian system provides inadequate protection of habitats and refugia for sensitive aquatic species. In addition, the cumulative effects of State and private actions within the action area are anticipated to continue to have negative effects on ESA-listed salmonids.

As noted in Section 2.2.3, climate change is likely to further impact designated critical habitat. Increases in water temperature and changes to the hydrological regime will reduce suitable salmon habitat and cause earlier migration of smolts. Warmer temperatures will likely lead to increased predation on juvenile salmonids in mainstem reservoirs (ISAB 2007). This is particularly true of non-native species such as bass and channel catfish where climate change will likely further accelerate their expansion (ISAB 2007). In addition, the warmer water temperatures will increase consumption rates by predators due to increased metabolic rates, which influence food demand.

The potential effects of the proposed action on critical habitat are described in Section 2.5.2. Critical habitat is present for 10 salmon and steelhead ESUs and DPSs considered in this opinion. Critical habitat is not present for LCR coho salmon. NMFS expects adverse effects to water quality, substrate, forage, and passage PBFs for 10 ESUs and DPSs covered in this opinion from installation and removal of floating silt curtains; barge movements; operation of machinery from work trestles and barges within the White Salmon and Columbia Rivers, and from the shore adjacent to both rivers; the presence of temporary in- and over-water structures and permanent in-water structures; removal of seven trees; pile driving; and extending the life of the railroad.

The proposed action will have small, temporary, and intermittent negative effects to water quality (turbidity, sediment, chemical contaminations) at the scale of the action area for 16 months during project construction. Increases in TSS and turbidity during project construction are expected to occur intermittently, be small, extend 300 feet downstream, and persist for minutes to a few hours. Minor leaks and spills of petroleum-based fluids (not more than ounces) will be contained in secondary containment basins. Removal of 44 creosote piles will reduce a source of toxic chemicals in a very small area of the Columbia River (Bonneville Reservoir).

Small (no more than 340 square feet), temporary (12 to 16 months) negative effects to the substrate PBF will occur at the scale of the action area from: minor levels of sediment deposition as small turbidity plumes settle out within 300 feet downstream; from installation of temporary work trestles and slide beams which will displace up to 311 square feet in the White Salmon River for 12 months; and from installation of moorage dolphins which will temporarily displace up to 29 square feet of substrate in the Columbia River for up to 16 months. We also expect a very small, permanent negative effect to the substrate PBF at the scale of the action area. Permanent, negative effects to the substrate PBF in the action area will occur from permanent displacement of over 51 square feet of substrate from permanent piers and scour; although removal of creosote piles will improve substrate in 50 square feet of the Columbia River.

Removal of 44 creosote piles will open up approximately 50 square feet of substrate for forage production. However, small, negative effects to the forage PBF at the scale of the action area will occur from the loss of aquatic invertebrates by crushing, covering, or displacing them for up to 16 months from 311 square feet in the White Salmon River and 29 square feet in the Columbia River from construction of work trestles, slide beams, and moorage dolphins; and permanently in over 51 square feet of the White Salmon River from permanent piers and associated scour. A very small, negative effect to natural cover and riparian vegetation at the scale of the action area will occur from removal of seven trees until planted willows become established and provide cover and shade.

A small, negative effect to migratory habitat at the scale of the action area will occur from pile driving, the presence of temporary in-water (up to 3,475 square feet) and overwater structures (up to 35,320 square feet), and the presence of permanent in-water structures which will result in permanent loss of some migration and rearing habitat in the action area. Although the removal of approximately 44 creosote piles 0.27 miles downstream from the bridge will improve migration, rearing, and feeding habitat for adults and juveniles from all ESUs and DPSs considered in this opinion in a small area of the Columbia River, we still expect a small, negative effect to the migration PBF at the scale of the action area.

Based on our analysis that considers the current status of PBFs, adverse effects from the proposed action will cause a small and localized decline in the quality and function of PBFs in the action area. However, because of the scale and extent of the effects to PBFs, we do not expect a reduction in the conservation value of critical habitat in the action area. As we scale up from the action area to the designation of critical for each species, the proposed action is not expected to appreciably reduce the conservation value of the designated critical habitat.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of UCR spring-run Chinook salmon, UCR steelhead, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye, SRB steelhead, MCR steelhead, LCR Chinook salmon, LCR steelhead, LCR coho salmon, or CR chum salmon, or destroy or adversely modify designated critical habitat for UCR spring-run Chinook salmon, UCR steelhead, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye, SRB steelhead, MCR steelhead, LCR Chinook salmon, LCR steelhead, or CR chum salmon.

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). "Harass" is further defined by interim guidance as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." "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). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1. Amount or Extent of Take

In this biological opinion, NMFS determined that incidental take of juvenile salmon and steelhead is reasonably certain to occur and will include harm and harassment as follows: (1) behavioral changes due to temporary increases in turbidity, which will increase risk of predation; (2) behavioral changes from the presence of temporary in- and over-water structures, and permanent in-water structures, which will increase risk of predation; and (3) behavioral changes from vibratory pile driving; and behavioral changes, injury, and death from hydroacoustic disturbance generated from impact pile-driving activities. NMFS is reasonably certain the incidental take described here will occur because: (1) ESA-listed species are known to occur in the action area; and (2) the proposed action includes in-water activities that are reasonably certain to harm or kill juvenile salmon and steelhead.

Incidental Take from Increased Turbidity and Disturbance

Take in the form of harm caused by the temporary increases in turbidity will be manifested in altered behaviors including avoidance of the area, abandonment of cover, and exposure to predators. We expect turbidity plumes to extend no further than 300 feet and persist for no more than a few hours. It is not possible to determine the number of fish killed by the turbidity plumes. Therefore, NMFS uses a surrogate for incidental take caused by the turbidity. The surrogate is the areal extent of the turbidity plume. The surrogate is causally linked to the take pathways the scale of the effect is related to the size of the turbidity plume. Thus, the extent of take will be exceeded if turbidity plumes exceed 300 feet below the work area.

Incidental Take from Increased Predation from Presence of In-water and Overwater Structures

NMFS expects the proposed action will result in harm, harassment, injury and death to juvenile salmon and steelhead by increases in exposure to avian and fish predators. We expect injury or death of juvenile salmon and steelhead from increased predators due to the increase in ambient light and shade from temporary in-water and overwater structures; the temporary increase in number and area of perches for avian predators; and the increase in permanent in-water structures. It is not possible to determine the number of fish killed by the presence of temporary in-water and overwater structures, or permanent in-water structures. Therefore, NMFS uses surrogates for incidental take. The surrogates are causally linked to the take pathways because, for in-water and over-water structures, the risk of predation increases with the amount/size of in-water and overwater structures and the duration of structure presence. The risk of death increases with the size of the structures because larger structures are expected to harbor more predators. The risk of death increases with duration of the structure presence because the longer the structures are present and harboring predators, the more opportunity there is for interaction of juvenile salmon and steelhead and predators.

The best available indicators to measure the extent of incidental take caused by increased predation are:

- The amount and duration of temporary in-water structures.
- The amount and duration of temporary overwater structures.
- The amount of permanent in-water structures

The extent of take will be exceeded if:

- More than 311 square feet and 29 square feet of temporary in-water structure is constructed in the White Salmon and Columbia Rivers, respectively.
- If temporary in-water structures are present in either river for more than 16 months.
- More than 3,500 square feet and 32,500 square feet of temporary overwater structure is constructed in the White Salmon and Columbia Rivers, respectively.
- If temporary overwater structures are present in either river for more than 16 months.
- If more than 51 square feet of permanent structure is constructed in the White Salmon River.

Incidental Take from Hydroacoustic Sound Pressure Levels during Pile-Driving

NMFS expects harm, harassment, injury, or death to juvenile salmon and steelhead from all 11 ESUs and DPS covered in this opinion; and harm and harassment of adult LCR coho salmon, LCR fall-run Chinook salmon, CR chum salmon, and UCR, MCR, SRB, and LCR steelhead by exposure to hydroacoustic SPLs during vibratory and impact pile-driving activities. It is not possible to determine the number of fish that will be harmed or harassed by vibratory pile driving or by the cumulative effects of sound pressure waves from repeated pile strikes. Therefore, NMFS uses a surrogate for incidental take. The surrogate is causally linked to the take pathways because the risk of injury and severity of injury from sound pressure waves increase with additional pile strikes, and more fish are exposed to possible injury when the time period of pile driving is longer.

The best available indicators to measure the extent of incidental take caused by pile driving are:

- The number of piles installed.
- The number of pile strikes from an impact driver performed with a bubble curtain over the course of a single day.
- The duration of pile driving.

The extent of take will be exceeded if:

- More than 51 36-inch steel piles are installed.
- More than 25 24-inch steel piles are installed.
- More than 7,200 pile strikes from an impact pile driver occur in a single day.
- Pile driving occurs for more than 39 days.

If at any time the level or method of take exempted from take prohibitions and quantified in this opinion is exceeded, reinitiation of consultation may be required.

2.9.2. Effect of the Take

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to any of the species considered, or destruction or adverse modification of their critical habitat.

2.9.3. Reasonable and Prudent Measures

"Reasonable and prudent measures" are measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

The Corps shall:

1. Avoid or minimize take from sound.
2. Avoid or minimize take from reduced water quality.
3. Avoid or minimize take from increased predation.
4. Track, monitor, and report on the project to ensure that the project is implemented as proposed and the amount and extent of take is not exceeded.

2.9.4. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. The Corps or any applicant 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 ITS (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.

1. The following terms and conditions implement reasonable and prudent measure 1:

   a. Use a bubble curtain and cushion block to reduce underwater sound pressure levels.
      i. When possible, place a cushion block between the hammer and pile.
      ii. Ensure the bubble curtain distributes air bubbles around 100 percent of the perimeter of the piles over the full depth of the water column.

   b. Use 24-inch pipe piles for the North Work Trestle, unless load requirements substantiate use of 36-inch pipe piles.

3. The following terms and conditions implement reasonable and prudent measure 2:

   a. Conduct turbidity monitoring as follows:
      i. Monitoring will be conducted daily, every 4 hours during daylight hours, when in-water work is conducted.
      ii. Observations shall occur daily before, during, and after commencement of in-water work and compared to observable sediment load upstream of the action area.
      iii. Measure or observe background turbidity levels at an undisturbed site within the flow channel approximately 100 feet upstream of the project area.
      iv. Measure or observe compliance measures in the flowing channel approximately 300 feet downstream from the project area, or within any visible turbidity plume.
      v. If a visible plume is observed at 300 feet downstream, measurements should not exceed 10 percent of the background measurements. If there is exceedance, IMMs and BMPs will be modified to minimize downstream increase of turbidity and fine sediments. Monitoring will be continued every 4 hours. If plume is observed after 8 hours, work shall be stopped for the remainder of the 24-hour day.
   b. Vehicles must be fueled, operated, maintained, and stored as follows:
      i. Vehicle staging, cleaning, maintenance, refueling, and fuel storage must take place in a vehicle staging area 150 feet or more from any stream, waterbody or wetland to the extent practicable, or on an adjacent hardened area or established road.
      ii. All vehicles operated within 150 feet of any stream, waterbody or wetland must be inspected daily for fluid leaks. Any leaks detected must be repaired before the vehicle resumes operation. Inspections must be documented in a record that is available for review on request by NMFS.
      iii. All equipment operated must be cleaned before beginning operations to remove all external oil, grease, dirt, and mud.
   c. A chemical and pollution control plan will be prepared and carried out, commensurate with the scope of the project, which includes:
      i. The name, phone number, and address of the person responsible for accomplishing the plan.
      ii. Best management practices to confine, remove, and dispose of construction waste, including every type of debris, discharge water, concrete, petroleum product, or other hazardous materials generated, used, or stored on-site including notification of proper authorities.

3. The following terms and conditions implement reasonable and prudent measure 3:

   a. Use the minimum number of barges needed for project construction.
   b. Remove all barges from the action area as soon as they are no longer needed and once in-water construction is complete.

c. Install pile caps or other avian deterrent measures on piles and dolphins.

4. The following terms and conditions implement reasonable and prudent measure 4:

   a. Track and monitor construction activities to ensure that the conservation measures are meeting the objective of minimizing take.
   b. Submit a completion of project report to NMFS 2 months after project completion. The completion report shall include, at a minimum, the following:
      i. Starting and ending dates for work completed, with in-water work period specified.
      ii. Summary and details of turbidity monitoring.
      iii. Methods used to contain sediment, erosion and turbidity.
      iv. Any daily observed sediment plume from the in-channel work area to 300 feet downstream during the in-water construction period.
      v. A summary of pollution and erosion control inspection results, including results of implementing required BMPs and IMMs, and including a description of any erosion control failure, contaminant release, and efforts to correct such incidences.
      vi. Total amount and area of vegetation removal.
      vii. Number and species of fish observed injured or killed in the White Salmon and Columbia Rivers.
      viii. Date, number of piles installed by size, method of installation, type and size of hammer, water depth, substrate, and number of pile strikes per 12-hour day.
      ix. Number of piles removed by size, date, and removal method.
      x. Date, location, and number of willow cuttings installed.
      xi. Date, methods, number of in-water piles removed to offset project impacts, and number of piles left in place and cut at the substrate surface.
      xii. Reference to NMFS consultation number WCRO-2021-02662.

   c. All reports sent to: crbo.consultationrequest.wcr@noaa.gov.
   d. If the amount or extent of take is exceeded, stop project activities and notify NMFS immediately.

2.10. Reinitiation of Consultation

This concludes formal consultation for BNSF Railway Bridge 0047-0072.8 Replacement Project, White Salmon River Crossing.

Under 50 CFR 402.16(a): "Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and: (1) If the amount or extent of taking specified in the incidental take statement is exceeded; (2) If new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or (4) If a new species is listed or critical habitat designated that may be affected by the identified action."

2.11. "Not Likely to Adversely Affect" Determinations

NMFS received the Corps' request for written concurrence that the proposed action is not likely to adversely affect the southern DPS of Pacific eulachon and the southern resident killer whale, and their designated critical habitat on October 12, 2021. NMFS prepared this response to the Corps' request pursuant to section 7(a)(2) of the ESA, implementing regulations at 50 CFR 402, and agency guidance for the preparation of letters of concurrence.

2.11.1. Southern DPS of the Pacific Eulachon

NMFS listed the southern DPS of Pacific eulachon as threatened under the ESA in 2010 (75 FR 13012) and designated critical habitat in 2011 (76 FR 65323).

Southern DPS eulachon enter the Columbia River from late fall through winter and spawn in lower Columbia River tributaries downstream of Bonneville Dam. Eulachon critical habitat does not extend above Bonneville Dam. Although eulachon have historically been reported as far upstream as Hood River, they have rarely passed Bonneville Dam since its completion in 1937. Eulachon reportedly are unable to ascend fish ladders designed for Pacific salmon (LCFRB 2004a, as cited in Gustafson et al. 2010). They will not be exposed to any of the short-term or long-term effects of project construction (discountable). Therefore, NMFS concurs that the proposed action is NLAA the southern DPS of Pacific eulachon and its designated critical habitat.

2.11.2. Southern Resident Killer Whale

NMFS listed the Southern Resident killer whale (SRKW) DPS, composed of J, K, and L pods, as endangered on February 16, 2006 (70 FR 69903); updated the listing in 2014 (79 FR 20802); and designated critical habitat in inland waters of Washington for the DPS in 2006 (71 FR 69054). A recovery plan was completed in 2008 (NMFS 2008b). More recently, a five-year status review completed in 2021 concluded that Southern Resident killer whales should remain listed as endangered and includes recent information on the population, threats, and new research results and publications (NMFS 2021).

NMFS considers SRKWs to be one of the eight most at-risk species because the population has relatively high mortality and low reproduction and they are currently well below the population growth goals identified in their ESA Recovery Plan (NMFS 2008b). Unlike other North Pacific killer whale populations, which have generally been increasing since federal protection was initiated in the 1970s, the Southern Resident population remains small and vulnerable and has not had a net increase in abundance since the mid-1980s.

Limiting Factors

Several factors identified in the final recovery plan for SRKWs may be limiting recovery, including: (1) quantity and quality of prey, (2) toxic chemicals that accumulate in top predators, and (3) disturbance from sound and vessels. Oil spills are also a risk factor. It is likely that multiple threats are acting together 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 2008b).

Abundance and Productivity

The SRKW population has declined to near historically low levels. NMFS funds the Center for Whale Research to conduct an annual census of the SRKW population. As of December 31, 2021, Southern Residents totaled 73 individuals (24 in J pod, 16 in K pod, and 33 in L pod; Center for Whale Research 2022); a decline from 74 whales reported in 2017. The NWFSC continues to evaluate changes in fecundity and mortality rates, and has updated the population viability analyses conducted for the 2004 status review for SRKWs and the 2011 science panel review of the effects of salmon fisheries (Krahn et al. 2004; Hilborn et al. 2012; Ward et al. 2013). As a result of that work, the data now suggest a downward trend in population growth projected over the next 50 years. As the model projects out over a longer time frame (50 years) there is increased uncertainty around the estimates; however, if all of the parameters in the model remain the same, the overall trend shows a decline in later years. This downward trend is in part due to the changing age and sex structure of the population, but is also related to the relatively low fecundity rate observed over the period from 2011 to 2016 (NMFS 2016b). Recent evidence indicates pregnancy hormones (progesterone and testosterone) can be detected in SRKW feces and have indicated several miscarriages, particularly in late pregnancy (Wasser et al. 2017); the authors suggest this reduced fecundity is largely due to nutritional limitation. Lack of sufficient prey availability is a significant risk factor for the SRKW population (NMFS 2016b). Specifically, low Chinook salmon abundance has been associated with low killer whale fecundity and survival (Ward et al. 2009; Ford et al. 2010; Wasser et al. 2017).

To explore potential demographic projections, Lacy et al. (2017) constructed a population viability assessment that considered sublethal effects and the cumulative impacts of threats (contaminants, acoustic disturbance, and prey abundance). They found that over the range of scenarios tested, the effects of prey abundance on fecundity and survival had the largest impact on the population growth rate.

Recent concerns have been raised that the DPS' small size and insularity has resulted in inbreeding depression, which could affect fitness (Ford et al. 2018). They found that only two adult males sired 52 percent of the sampled progeny born since 1990. Based on the pedigree, four sampled offspring were the result of inbred mating; two between a parent and offspring, one between paternal half-siblings, and one between uncle and half-niece. There is no evidence to date that the survival or fecundity of these individuals is lower than normal. There was some evidence for inbreeding depression in the form of a weakly supported relationship between multi-locus heterozygosity and annual survival probability, but the power of their data to quantify this effect was low. They found no evidence of inbreeding avoidance in the population, but a late age of breeding success for males may indirectly limit the frequency of parent/offspring mating. This information shows that the role of various factors in the status of SRKWs is likely a complex interaction of various factors.

Geographic Range and Distribution

Southern Resident killer whales inhabit coastal waters off Washington, Oregon, and Vancouver Island and are known to travel as far south as central California and as far north as Southeast Alaska (NMFS 2008b, Carretta et al. 2021). SRKWs are highly mobile and can travel up to approximately 86 miles (160 km) in a single day (Erickson 1978; Baird 2000), with seasonal movements likely tied to the migration of their primary prey, salmon. From spring through fall, SRKWs spend a substantial amount of time in the inland waterways of the Strait of Georgia, Strait of Juan de Fuca, and Puget Sound, making frequent trips to the outer coasts of Washington and southern Vancouver Island (Ford et al. 2000). This spring through fall distribution coincides with the seasonal return of adult Chinook and coho salmon to their natal rivers to spawn, when the fish are found in relatively high densities in the narrow passages of the inland waters. During summer months the Southern Resident killer whales' range is generally confined to the Salish Sea (Ford and Ellis 2006; Hanson et al. 2010; Ford et al. 2016). During fall and early winter, SRKWs, and J pod in particular, expand their routine movements into Puget Sound, likely to take advantage of chum, coho, and Chinook salmon runs (Osborne 1999; Hanson et al. 2010; Ford et al. 2016).

By late fall, all three pods are seen less frequently in inland waters. Several sightings and acoustic detections of SRKWs have been obtained off the Washington and Oregon coasts in the winter and spring (Hanson et al. 2013). Satellite-linked tag deployments (2012-2016) have also provided data on SRKW movements in the winter. The K and L pods occurred almost exclusively on the continental shelf December to mid-May, primarily on the Washington coast, with a continuous high use area between Grays Harbor and the Columbia River and off Westport, and are most common in March (Hanson et al. 2017, 2018). The occurrence of K and L pods off the Columbia River in March suggests the importance of Columbia River spring-run stocks of Chinook salmon in their diet at that time of year (Hanson et al. 2013). The J pod has only been detected on one of seven passive acoustic recorders positioned along the outer coast (Hanson et al. 2013). The limited range of the sightings/acoustic detections of J pod whales in coastal waters, the lack of coincident occurrence during the K and L pod sightings, and the results from satellite tagging in 2012–2016 (NMFS 2018) indicate the J pod's limited occurrence along the outer coast and extensive occurrence in inland waters, particularly in the northern Georgia Strait.

Quantity and Quality of Prey

Southern Resident killer whales consume a variety of fish species (22 species) and one species of squid, but salmon are identified as their primary prey (Ford et al. 1998; Ford et al. 2000; Ford and Ellis 2006; Hanson et al 2010; Ford et al. 2016; Hanson et al. 2021).

May-September. Scale and tissue sampling from May to September in inland waters of Washington and British Columbia, Canada indicate that the SRKWs summer and fall diet consists of a high percentage of Chinook salmon (monthly proportions as high as over 90 percent) (Hanson et al. 2010; Ford et al. 2016). The diet data also indicate that the whales are consuming mostly larger (i.e., older) Chinook salmon. Chinook salmon have the highest value of total energy content compared to other salmonids because of their larger body size and higher energy density (kilocalorie/kilogram) (O'Neill et al. 2014).

Ford et al. (2016) confirmed the importance of Chinook salmon to the Southern Residents in the summer months using DNA sequencing from whale feces. Salmon and steelhead comprised up to 98 percent of the inferred diet, of which almost 80 percent were Chinook salmon. Coho salmon and steelhead are also found in the diet in spring and fall months when Chinook salmon are less abundant. Specifically, coho salmon contribute to over 40 percent of the diet in late summer (Ford et al. 1998; Ford and Ellis 2006; Hanson et al. 2010b; Ford et al. 2016). Less than 3 percent each of chum salmon, sockeye salmon, and steelhead were observed in fecal DNA samples collected in the summer months (May through September). Warlick et al. (2020) also found that Chinook salmon is the primary prey for all pods in summer months followed by coho and then other salmonids.

Fraser River Chinook salmon stocks dominate the diet of SRKWs in the summer (Hanson 2021), comprising 80-90 percent of the diet in the Strait of Juan de Fuca and San Juan Islands.

October-December. Prey remains and fecal samples collected in U.S. inland waters during October through December indicate Chinook and chum salmon are primary contributors of the whale's diet during this time (NWFSC unpublished data).

January-April. Observations of whales overlapping with salmon runs (Wiles 2004; Zamon et al. 2007; Krahn et al. 2009), and collections of prey and fecal samples have also occurred in coastal waters in the winter and spring months. Hanson et al. (2021) identified Chinook salmon as an important prey item year-round, averaging approximately 50 percent of the SRKWs diet in the fall, increasing to 70–80 percent in the mid-winter/early spring, and increasing to nearly 100 percent in the spring. Steelhead, chum salmon, lingcod, and halibut also made substantial dietary contributions.

Chinook salmon genetic stock identification from samples collected in winter and spring in coastal waters from California through Washington included 12 U.S. west coast stocks, and over half of the Chinook salmon consumed by the K and L pods originated in the Columbia River (Hanson et al. 2021). Columbia River Chinook salmon consumed across winter months in outer coast waters tended to be mainly from fall- and summer-run stocks in the early part of winter, and spring-run stocks later in winter. Samples from six genetic stock groups were collected in February, most from the Columbia River, and in particular Lower Columbia fall-run stocks, and Upper Columbia summer- and fall-run stocks. In March, seven Columbia River stocks were consumed; spring-run Chinook salmon accounted for 30 percent of the stocks. By April, Columbia River spring-run Chinook salmon were most prominent, mostly from the Middle/Upper Columbia River stock grouping. In outer coast waters, the majority of Chinook salmon (60 percent) were 4 years-old, with nearly twice as many 5 as 3 years-old. Coho salmon were all 3 years of age and all the steelhead were 5 or 6 years old. Chinook salmon prey also included fish from stocks as far north as the Taku River (Alaska and British Columbia stocks) and as far south as the Central Valley California (Hanson et al. 2021).

In June 2018, NMFS and the WDFW published The Southern Resident Killer Whale Priority Stocks Report.[7] NMFS and WDFW developed a framework to identify Chinook salmon stocks that are important to SRKWs to assist in prioritizing actions to increase critical prey for the whales. The framework considers three evaluation factors: whether the potential prey item is an observed part of the whale diet, whether the prey item is consumed during reduced body condition or increased diet diversity, and the degree of spatial and temporal overlap of the prey item and whales. The highest-priority Chinook salmon stocks, based on this framework, are fall runs from the Northern Puget Sound and the Southern Puget Sound, followed by the fall runs from the lower Columbia River and the Strait of Georgia. Next are the fall runs from the Upper Columbia and Snake Rivers, spring runs from the Fraser River, and spring runs from the lower Columbia River. The complete list of 31 combined runs is presented in the 2018 report. The information presented in this report confirms the importance of a diversity of Chinook salmon runs to the prey base of SRKWs. Further, for K and L pods, fall Chinook salmon populations from the Columbia River are an important part of their diet during the winter months.

Hatchery production is a significant component of the salmon prey base returning to watersheds within the range of SRKWs (Barnett-Johnson et al. 2007; NMFS 2008a). The release of hatchery fish has not been identified as a threat to the survival or persistence of SRKWs and there is no evidence to suggest the whales prefer wild salmon over hatchery salmon. Increased Chinook salmon abundance, including hatchery fish, benefit this endangered population of whales by enhancing prey availability to SRKWs and hatchery fish often contribute significantly to the salmon stocks consumed (Hanson et al. 2010, Hanson 2021). Currently, hatchery fish play a mitigation role of helping sustain Chinook salmon numbers while other, longer term, recovery actions for natural fish are underway. Although hatchery production has contributed some offset of the historical declines in the abundance of natural-origin salmon within the range of the whales, hatcheries also pose risks to natural-origin salmon populations (Nickelson et al. 1986; Ford 2002; Levin and Williams 2002; Naish et al. 2007). Healthy natural-origin salmon populations are important to the long-term maintenance of prey populations available to Southern Residents because it is uncertain whether a hatchery dominated mix of stocks is sustainable indefinitely and because hatchery fish can differ, relative to natural-origin Chinook salmon, for example, in size and hence caloric value and in availability/migration location and timing.

Effects of the Proposed Action on Southern Resident Killer Whales

The proposed action may affect SRKWs through effects to their primary prey. This effects analysis focuses on effects to Chinook salmon availability in the ocean because the best available information indicates that salmon are the preferred prey of Southern Resident killer whales year-round, including in coastal waters; and that Chinook salmon, particularly large Chinook salmon, are the preferred salmon prey species.

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[7] The report can be found at: https://www.westcoast.fisheries.noaa.gov/publications/protected_species/marine_mammals/killer_whales/recovery/srkw priority Chinook stocks conceptual model report list 22june2018.pdf Last accessed November 5, 2018.

We determined that the project will cause mortality of a very small number of migrating and rearing wild (i.e., natural-origin) LCR spring- and fall-run, UCR spring-run, and SR spring/summer- and fall-run juvenile Chinook salmon; SR sockeye; LCR coho salmon; and UCR, SRB, MCR, and LCR steelhead for 16 months during project construction. Mortalities will be spread out among multiple populations and ESUs. The project will also cause annual mortality of a several juvenile LCR spring- and fall-run Chinook Salmon, LCR coho, and MCR steelhead from the White Salmon River for the life of the in-water piers. Although some of these juveniles would not survive to adult, as a worst-case scenario we assume the loss of a very small number of juveniles from each ESU and DPS during project construction and the annual loss of several juvenile LCR spring- and fall-run Chinook salmon in the White Salmon River will result in the loss of a very small number of adult Chinook salmon, Coho salmon, and steelhead each year in the ocean.

Chinook stocks from the Columbia River comprise over half of the Chinook salmon consumed by the K and L pods in winter and spring (Hanson et al. 2021). Chinook salmon consumed across winter months in outer coast waters tend to be mainly from Lower Columbia fall-run stocks and Upper Columbia summer- and fall-run stocks in the early part of winter, and Middle/Upper Columbia River spring-run stocks later in winter. According to NMFS and WDFW 2018 analysis of priority Chinook stocks for the Southern Resident Killer Whale's diet, fall runs from the lower Columbia River tied for third as most important; and fall runs from the Snake River and spring runs from the lower Columbia River tied for fifth, among the 31 stocks analyzed. The White Salmon River spring-run and fall-run populations are the only LCR spring-run and fall-run Chinook salmon populations that will be affected by the proposed action and the presence of two permanent in-water piers. Both populations are currently small, 5-year geometric mean natural spawner abundance of 8 spring-run and 283 fall-run. White Salmon River spring-run Chinook salmon comprise less than 0.23 percent of the five-year geometric mean of raw natural spawner counts for all LCR spring-run populations with available data, and less than 0.51 percent of five-year geometric mean of total LCR spring-run spawner counts. White Salmon River all-run Chinook salmon comprise less than 0.90 percent of the five-year geometric mean of raw natural spawner counts for all LCR fall-run populations, and 1.5 percent of five-year geometric mean of total LCR fall-run spawner counts. Therefore, we do not expect the loss of a very small number juveniles LCR spring- and fall-run Chinook salmon, UCR spring-run Chinook salmon, SRB spring/summer-run Chinook salmon, and SRB fall-run Chinook salmon during the 16 months of project construction, or the annual loss of several LCR spring- and fall-run Chinook salmon and LCR coho salmon, which in a worst-case scenario would result in the loss of a very small number of adult Chinook salmon in the ocean, will alter prey availability for SRKWs, and we consider the loss of a few adult Chinook salmon and coho salmon an insignificant effect on the prey availability. And thus, the effect on SRKWs to be insignificant. We also do not expect the annual loss of a few juveniles from the White Salmon River spring- and fall-run Chinook salmon populations (LCR Chinook salmon), translating into a possible loss of a few adults each year, will alter the availability of food for southern resident killer whales, and thus the effect of the proposed action on Southern Resident killers whales is insignificant. Thus, the annual loss of some/a few juvenile salmon and steelhead from the White Salmon River spring- and fall run populations, LCR Chinook salmon ESU, for the life of the piers, and the effect to the prey base of Southern Resident killer whales, is anticipated to be insignificant. Therefore, the effects of the proposed action on the prey base for Southern Resident killer whales is insignificant.

Effects of the Proposed Action on Southern Resident Killer Whale Critical Habitat

NMFS designated critical habitat for the SRKW DPS on November 29, 2006 (71 Fed. Reg. 69054). On September 01, 2021 NMFS revised the critical habitat designation for the SRKW DPS by designating six additional coastal critical habitat areas along the U.S. West Coast (86 FR 41668). Critical habitat consists of nine specific areas: (1) the Summer Core Area in Haro Strait and waters around the San Juan Islands; (2) Puget Sound; (3) the Strait of Juan de Fuca; (4) Coastal Washington/Northern Oregon Inshore Area; (5) Coastal Washington/Northern Oregon Offshore Area; (6) Coastal Washington/Northern Oregon Offshore Area; (7) Northern California Coast Area; (8) North Central California Coast Area; and (9) Monterey Bay Area. These areas comprise approximately 18,470 square miles of marine habitat.

Based on the natural history of the SRKWs and their habitat needs, NMFS identified the following PBFs essential to conservation: (1) water quality to support growth and development; (2) prey species of sufficient quantity, quality and availability to support individual growth, reproduction, and development, as well as overall population growth; and (3) passage conditions to allow for migration, resting, and foraging.

The proposed action occurs outside of the designated critical habitat. However, Columbia River Chinook salmon are an important component of the SRKW's diet. Age, size, and caloric content all affect the quality of prey, as do contaminants and pollution. The availability of key prey is essential to the whales' conservation. Availability of prey along the coast is likely limited at particular times of year due to the small run sizes of some important Chinook salmon stocks, as well as the distribution of preferred adult Chinook salmon that may be relatively spread out prior to their aggregation when returning to their natal rivers.

Because so few Columbia River fish from any one of the Chinook salmon ESUs would be encountered; Chinook salmon from Fraser River stocks dominate the diet of Southern Resident killer whales in the summer (Hanson 2021), and the proposed project will have no effect on Fraser River stocks; the small number of Chinook salmon affected by the project and the presence of permanent in-water piers is small compared to LCR Chinook salmon production; and hatchery fish comprise 50-80 percent of Chinook salmon runs in the Columbia Basin; suggesting a large portion of hatchery Chinook salmon comprise the diet of at least K and L pods in the mid-winter/early spring, and we expect hatchery production to continue at current levels, we expect the effect to the prey base PBF is insignificant.

Conclusion

Based on this analysis, NMFS concurs with the Corps that the proposed action is not likely to adversely affect SRKWs or their designated critical habitat.

3. MAGNUSON–STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). 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) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)].

This analysis is based, in part, on the EFH assessment provided by the Corps and descriptions of EFH for Pacific Coast Salmon (PFMC 2014), contained in the fishery management plans developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

3.1. Essential Fish Habitat Affected by the Project

The proposed project action area includes EFH for various life-history stages of Chinook salmon (*O. tshawytscha*) and coho salmon (*O. kitsutch*) (PFMC 2014).

3.2. Adverse Effects on Essential Fish Habitat

Based on information provided in the BE and the analysis of effects presented in Section 2 of this document, NMFS concludes that the proposed action will adversely affect EFH designated for Chinook and coho salmon because it will have effects on water quality, benthic communities, and channel substrate.

The proposed project does include removal of 44 creosote piles which will improve substrate and forage production in 50 square feet of the Columbia River. However, the proposed project also includes disturbance of channel substrate, pile-driving, installation of two new permanent bridge piers, temporary installation of sheet pile, and installation and removal of up to 51 steel piles (for dolphins, slide beams, work trestles) below the OHWM. This will temporarily alter approximately 311 square feet of river bottom in the White Salmon River and 29 square feet in the Columbia River; and permanently alter at least 51 square feet of river bottom in the White Salmon River, altering benthic habitat and macroinvertebrate production. This action will also result in increased turbidity resulting in short-term and long-term effects to water quality and feeding habitat.

Specifically, NMFS has determined that the action will adversely affect EFH as follows:

1. Short-term elevation of turbidity and sedimentation up to 300 feet downstream from the project area and construction activities.
2. Temporary reduction in prey availability from disturbance of up to 340 square feet from temporary piles, and settling of suspended sediment and turbidity plumes up to 300 feet downstream of sediment disturbing activities.
3. Permanent reduction in prey availability from construction of two permanent in-water piers and loss of 51 square feet of substrate.
4. Temporary increased risk of predation from the presence of temporary in-water piles, work trestles, slide beams, and/or barges.
5. Permanent increased risk of predation from construction of two permanent in-water piers.

3.3. Essential Fish Habitat Conservation Recommendations

NMFS determined that the following conservation recommendations are necessary to avoid, minimize, mitigate, or otherwise offset the impact of the proposed action on EFH.

We provide the following conservation recommendation:

1. Implement RPM 1 and RPM 2, and their terms and conditions described in the ITS in the ESA portion of this document, to minimize adverse effects to EFH due to operation of heavy equipment, in-water construction, and sediment disturbance.
2. Implement RPM 4, and its terms and conditions described in the ITS in the ESA portion of this document, to ensure completion of monitoring and reporting to confirm that these terms and conditions are effective for avoiding and minimizing adverse effects to EFH.

Fully implementing this EFH conservation recommendation would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, for Pacific Coast salmon.

3.4. Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the Corps 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 the measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise 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 Corps 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 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 user of this opinion is the Corps. Other interested users include BNSF railway and Yakima Indian Nation. Individual copies of this opinion were provided to the Corps. The document will be available within 2 weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere 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 part 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 reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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