UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
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https://doi.org/10.25923/33q2-wd96

Refer to NMFS No: WCRO-2020-01190

December 4, 2020

William D. Abadie
Chief, Regulatory Branch
U.S. Army Corps of Engineers, Portland District
P.O. Box 2946
Portland, OR 97208-2946

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the N&C Land LLC Irrigation Intake Replacement Project, John Day Reservoir (HUC 170701010601), Columbia River, Umatilla County, Oregon.

Dear Mr. Abadie:

Thank you for your letter of May 6, 2020, 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 N&C Land Irrigation Intake Replacement Project. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016).

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 (MSA) [16 U.S.C. 1855(b)] for this action.

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, or SR sockeye salmon (*O. nerka*). NMFS also determined that the action will not destroy or adversely modify designated critical habitats for these species. Rationale for our conclusions is provided in the attached biological opinion (opinion). The enclosed opinion is based on information provided in your biological assessment, email discussions, and other sources of information cited in the opinion.

As required by section 7 of the ESA, NMFS is providing an incidental take statement (ITS) with the opinion. The ITS includes reasonable and prudent measures (RPMs) NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action. The ITS also sets forth nondiscretionary terms and conditions, including reporting requirements, that the U.S. Army Corps of Engineers (Corps) must comply with to carry out the RPMs. Incidental take from actions that meet these terms and conditions will be exempt from the ESA's prohibition against the take of the listed species considered in this opinion.

Please contact Rebecca Viray, Columbia Basin Area Office, (541) 962-8524, Rebecca.Viray@noaa.gov, if you have any questions concerning this consultation, or if you require additional information.

Michael Tehan

Assistant Regional Administrator
Interior Columbia Basin Office
NOAA Fisheries, West Coast Region

Enclosure

cc: Brad Johnson, USACE, Regulatory Office, Brad.A.Johnson2@usace.army.mil
Eric Campbell, Campbell Environmental, eric@campbellenviro.com

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

N&C Land Irrigation Intake Replacement Project

NMFS Consultation Number: WCRO-2020-01190

Action Agency: U.S. Army Corps of Engineers

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat	Is action Likely to Jeopardize the Species	Is Action Likely to Adversely Affect Critical Habitat	Is Action Likely to Destroy or Adversely Modify Critical Habitat
Upper Columbia River spring Chinook salmon (*Oncorhynchus 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 steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
Middle Columbia River steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	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: ____

Assistant Regional Administrator
West Coast Region
National Marine Fisheries Service

Date: December 4, 2020

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ACRONYM GLOSSARY

A&P	Abundance and Productivity
BA	Biological Assessment
BMP	Best Management Practice
BRT	Biological Review Team
Campbell LLC	Campbell Environmental LLC
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
CH	Critical Habitat
CHART	Critical Habitat Analytical Review Team
Consultants	Campbell Environmental LLC and IRZ Consultants LLC
Corps	U.S. Army Corps of Engineers
dB	Decibels
DOC	U.S. Department of Commerce
DPS	Distinct Population Segment
DQA	Data Quality Act
EFH	Essential Fish Habitat
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
fps	Feet per Second
FR	Federal Register
ft	Feet
ft^2	Square Feet
gpm	Gallons per Minute
hrs	Hours
HUC	Hydrologic Unit Code
ICRD	Interior Columbia Recovery Domain
ICTRT	Interior Columbia Basin Technical Recovery Team
IPCC	Intergovernmental Panel on Climate Change
IRZ	IRZ Consulting LLC
ISAB	Independent Scientific Advisory Board
ITS	Incidental Take Statement
kcfs	Kilo Cubic Feet per Second
MCR	Middle Columbia River
MPG	Major Population Group
MSA	Magnuson–Stevens Fishery Conservation and Management Act
N&C	N&C Land LLC
NMFS	National Marine Fisheries Service
NWFSC	Northwest Fisheries Science Center
ODEQ	Oregon Department of Environmental Quality
OHWM	Ordinary High Water Mark
opinion	Biological Opinion
PAH	Polycyclic Aromatic Hydrocarbon
PBF	Physical or Biological Feature
PCE	Primary Constituent Element
PCP	Pollution Control Plan

PFMC	Pacific Fishery Management Council
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
SS/D	Spatial Structure and Diversity
TSS	Total Suspended Solids
U.S.C.	United States Code
UCR	Upper Columbia River
UCSRB	Upper Columbia Salmon Recovery Board
VSP	Viable Salmonid Population

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

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.), and implementing regulations at 50 CFR 402, as amended.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson–Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (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 the Columbia Basin Area Office, Ellensburg, Washington.

1.2. Consultation History

NMFS received a biological assessment (BA) from the U.S. Army Corps of Engineers (Corps) on May 7, 2020. The BA was prepared by Campbell Environmental LLC (Campbell LLC) for IRZ Consulting LLC (IRZ), on behalf of N&C Land LLC (N&C). N&C has applied for a Corps Section 10 of the Rivers and Harbors Act (33 U.S.C. 403) and Section 404 of the Clean Water Act (33 U.S.C. 1344) permit.

The Corps request letter concluded that the proposed action is likely to adversely affect Upper Columbia River (UCR) spring-run Chinook salmon (*Oncorhynchus tshawytscha*), Snake River (SR) spring/summer-run Chinook salmon, UCR steelhead (*O. mykiss*), Middle Columbia River (MCR) steelhead, Snake River Basin (SRB) steelhead, SR fall-run Chinook salmon (*O. tshawytscha*), SR sockeye salmon (*O. nerka*), and designated critical habitat for these seven species. 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 not likely to be adversely affected.

On May 21, 2020, NMFS informed the Corps via letter that the consultation initiation package was insufficient to initiate formal ESA consultation. In our letter we requested further information regarding sound levels and additional details related to the fish screen system. We also requested further descriptions of how turbidity would be controlled during in-water construction. We received additional information in an email from the consultant, Campbell LLC, on June 25, 2020. The additional information in the email provided sufficient detail for all matters but the fish screens. On July 2, 2020, NMFS informed the Corps and Campbell LLC of the need for greater detail on fish screen design. On July 8, 2020, a NMFS engineer discussed with Campbell LLC and engineers with IRZ (referred jointly as Consultants) the need for further site specific designs. All parties agreed that final designs would be submitted for approval by NMFS before construction commences.

Based on this mutual understanding, NMFS initiated formal consultation on June 25, 2020.

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 (50 CFR 402.02). Under MSA, federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a federal agency (50 CFR 600.910).

The Corps proposes to issue a permit to the N&C to remove two existing intake pipes and fish screens, and install a new intake pipe and new fish screens. The existing pump station is located on the Columbia River at river mile (RM) 287.2. This site is within the John Day Reservoir 4.5 miles downstream from McNary Dam (Figure 1). The proposed action includes removal of the two existing, 24-inch diameter intake pipes, two existing steel piles, and existing screens at the existing pump station, and replacing these features with a 42-inch diameter pipe, six new 12-inch diameter steel piles, a new manifold, and two 72-inch-wide and 202-inch-long [101 square feet (ft^2) area each] half-barrel fish screens. The replacement pipe and screens will be designed in compliance with NMFS fish passage criteria (NMFS 2011c). The initial fish screen's manufacturer's designs were reviewed by NMFS and appear appropriate. However, the final site-specific designs will be submitted and require approval by NMFS prior to construction[1]. The proposed work will occur during the in-water work window, December 1, 2020–March 31, 2021. The proposed project will require approximately 8 weeks of in-water work. The Corps' authorities for permitting this action are derived from Section 10 of the Rivers and Harbors Act (33 U.S.C. 403) and Section 404 of the Clean Water Act (33 U.S.C. 1344).

[1] Conference call held on July 8, 2020, between Jeff Brown (NMFS hydraulic engineer), Eric Campbell (Campbell LLC) and IRZ engineers discussing additional site-specific details needed for completing NMFS Fish Passage Criteria review and approval.

Figure 1. N&C Intake Project Site Location. N&C Intake Pump Station is located within the John Day Reservoir, approximately 4.5 miles downstream from the McNary Dam. The red arrow indicates the general vicinity of the project site.

The current facilities include upland buildings, an existing pump station with a concrete structure base, six vertical turbine pumps, and intake pipes extending approximately 170 feet (ft.) into the Columbia River channel. The pump station has a total pumping capacity of 19,210 gallons per minute (gpm). There is no proposed increase in water withdrawals or use above the existing water rights. The existing structure and intake pipes were built in 1968 and are deteriorating. The proposed action will remove the existing intake pipes, and install a new intake pipe and screens in the substrate buried under the Columbia River. The new intake pipe will be in the same footprint of the existing intakes (Figure 2).

Figure 2. N&C Irrigation Intake Pipeline footprint at project site. The white dotted outline represents the footprint where the excavation and construction for the intake pipeline and screen replacement will occur.

1.3.1. New Intake Pipelines, Screens and In-water Construction

The proposed action includes excavation and in-water construction for the installation of new steel piles, a sheet-wall barrier, the intake pipeline, manifold, and new screens. The contractor will install sheet wall (or piling) barrier (approximately 160-ft-long by 12-ft-wide) surrounding the in-water work area to partially isolate the excavation area (1,920 ft^2) from the flows of Columbia River during in-water construction. Approximately 500 linear ft of temporary sheet wall will be installed along the sides of the proposed excavation trench (see Figure 3). A vibratory driver will install 154 sheet-wall piles (320 ft) below the ordinary high water mark (OHWM) of the Columbia River. The sheet piling will act as a barrier wall partially surrounding the in-water work area. The sheet-wall barrier will be left open at the riverward end to allow fish to escape the in-water work area. The sheet-wall pilings will be removed after project completion.

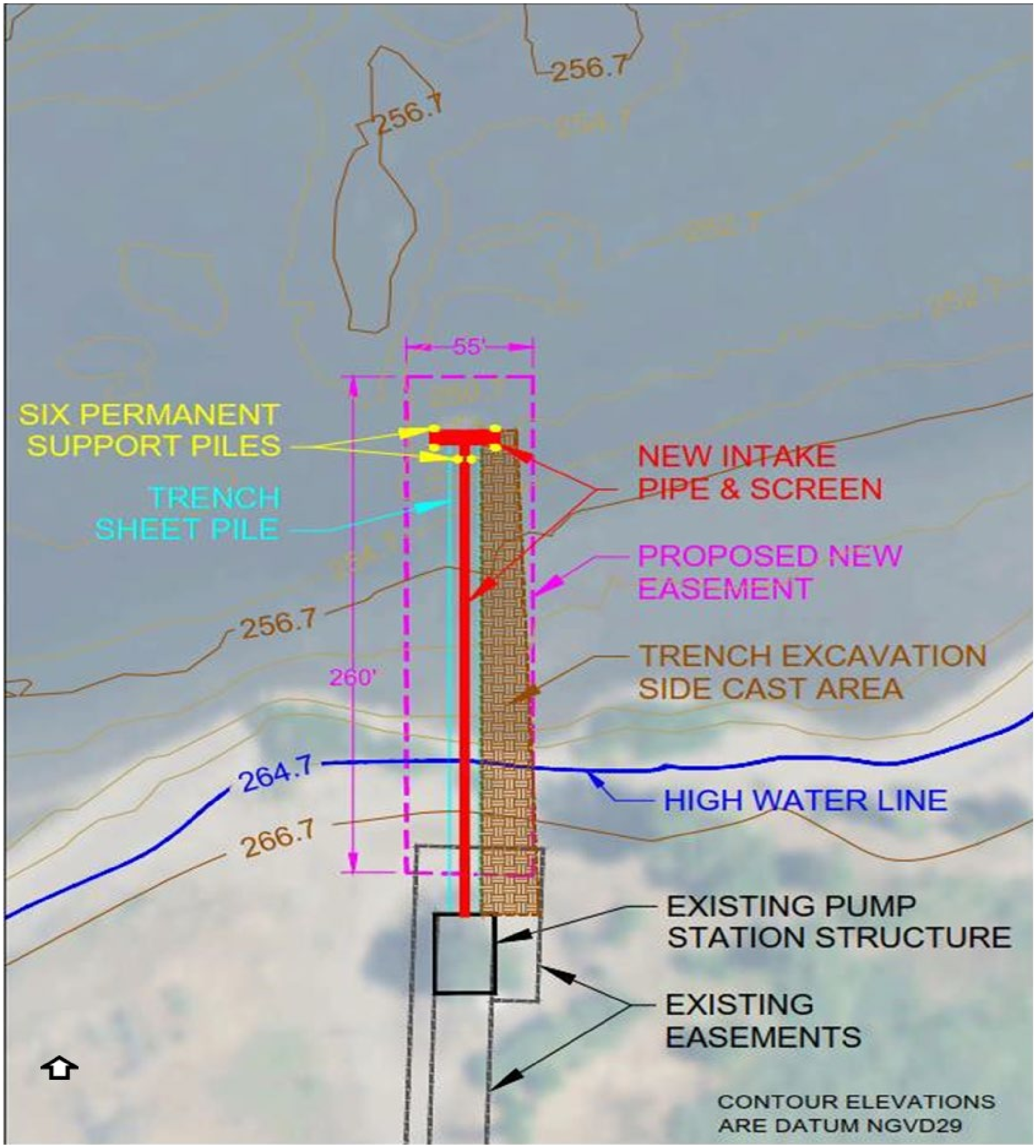

Figure 3. Proposed new intake pipes and screen for the N&C Land Irrigation Intake Project.

Two barges will be used as needed for heavy equipment and materials during the 8 weeks of in-water construction. An excavator will operate from one floating barge (30 ft.-wide by 90-ft-long) or from the bank for in-water excavation. There will be approximately 630 cubic yards (cu yd) of native substrate excavated, which will later be used to cover the installed pipe, and the riverbed contours will be restored. The sheet-wall barrier will reduce turbidity during the in-water excavation for removal of the existing intakes pipes, installation and burying the new intake pipe.

After project completion, the volume of the substrate removed and filled below the OHWM of the Columbia River will be neutral.

The new 42-inch replacement intake pipe will extend approximately 250 ft. from the upland pumping station and approximately 160 ft. into the Columbia River channel. A trench will be excavated and the existing pipes and screen will be removed. The intake pipe will be assembled above the water, filled with water, and lowered into the trench bed by a crane from the other barge (30-ft-wide by 115-ft-long). The intake pipe (560 ft^2) will be buried below the channel substrate. Water depth is approximately 15 ft at the end of the intake pipe. Once the replacement pipe is connected and installed, the trench will be backfilled and the temporary sheet-wall piling will be removed.

A manifold "tee" will be connected to the end of the 42-inch intake pipe. The manifold will have two, 72-inch-wide and 202-inch-long half-barrel screens (total area 220 ft^2). Six 12-inch-diameter steel pilings will be installed by a vibratory driver for external support to the pipe. The two northern pilings will protrude approximately 15 ft. above the OHWM. The manifold will connect to the intake pipe. The two half-barrel screens are designed to have an average approach velocity of 0.20 feet per second (fps), at an intake rate of 10,000 gpm per screen. Each screen shall include an air-burst cleaning system, with a 6-inch flanged connection and will be required to meet the 2011 NMFS fish passage criteria. The fish screens will be designed to achieve a lower approach velocity than required. The lower velocity is intended to reduce the amount of debris collecting on the screens but will have the secondary benefit of reducing the force by which fish may be compelled toward the screens. The system will include a 1,550-gallon air tank with two 50-horsepower rotary screw compressors rated at 250 cubic ft per minute each. The two compressors will accommodate the 5-minute cleaning cycle time. The rotary screw compressors are rated for continuous use.

1.3.2. Pile-driving Installation

A vibratory driver is proposed to remove two existing piles, install and remove the 320 ft of temporary sheet piles (154 sheets), remove the two existing steel piles and install the six new 12-in-diameter steel piles. If the substrate is too firm to use the vibratory driver, an impact driver may be used. Based on additional information[2] provided by the consultant on June 25, 2020, the vibratory driving will take approximately 10 minutes to install each sheet pile or piling. Removal of the sheet piles following the pipeline installation is estimated to require 1 minute of vibratory driving for each pile. Based on information provided by the consultants, we estimated installation of the sheet piles by a vibratory pile-driver to be a total duration of up to 35 hours (hrs) within a 2-week timeframe. The vibratory driving necessary to install the six sheet piles and remove the existing piles would take approximately 4 hrs each day over the 2-week timeframe. If an impact driver is used to install the piles, it is estimated at approximately 100 strikes per day and up to a maximum of 1,500 strikes would be needed for the entire project. Best management practices (BMPs) and sound attenuating methods will be used as appropriate and are detailed in the Conservation Measures section below.

[2] Email between Eric Campbell (Campbell LLC) to Rebecca Viray (NMFS) on June 25, 2020 containing additional information of total vibratory and impact driving details for removal and installation of sheet-walls and steel piles.

The upland site contains the existing pump station structures, buildings, pumps, parking areas, and a gravel road with minimal vegetation. All upland areas disturbed during project staging and construction will be restored to their preconstruction grade and revegetated (as necessary) with hydroseed and/or native plantings. Upon project completion, the intake pumps will be operated in accordance with state water rights and typically be in operation during the irrigation season months of April to October. As mentioned above, the existing maximum allowable water withdrawal rate for the pumping station is 19,210 gpm.

There will be no changes made to the existing pump capacities at the station. There will be no changes to water rights or increases in water withdrawal associated with the project.

<u>1.3.3. Conservation Measures</u>

The following conservation measures and BMPs are identified in the submitted BA to minimize or avoid environmental impact to listed species or critical habitat:

- All work conducted below the OHWM of the Columbia River will occur during the Oregon Department of Fish and Wildlife recommended in-water work period from December 1 to March 31.
- All heavy equipment (i.e., crane and excavator) will access the project site using existing roadways, parking areas, disturbed upland areas, or floating barges.
- All sheet piling and new steel pilings will be installed by a vibratory driver to a depth of 15–20 ft. below the substrate. In the event that the vibratory driver cannot fully embed the sheet pile or pilings to the required substrate depth, an impact driver may be required to complete installation. Use of an impact driver will be limited to daylight hours between 7 a.m. and 7 p.m.
- The contractor will initiate daily "soft start" procedures to provide an opportunity for any individual fish in the vicinity to swim from the area prior to a vibratory driver (or impact driver) operating at full capacity.
    - A "soft start" procedure will be used at the beginning of in-water piling removal and installation, or any time piling removal/installation has ceased for more than 30 minutes.
    - For vibratory driver operation, the contractor will initiate noise from vibratory drivers for 15 seconds at reduced energy followed by a 30-second waiting period. The procedure shall be repeated two additional times.
    - For impact pile-driving (if necessary), the contractor will provide initial impact driver strikes at reduced energy[3], followed by a 30-second waiting period, then two subsequent sets.
- Sound attenuation methods will be used during any impact driver installation. A multi-level bubble curtain will be installed to reduce sound pressure levels (SPLs). The bubble curtain system shall conform to the following:

[3] The reduced energy of an individual driver cannot be quantified given the variations between individual drivers. In addition, the number of strikes will vary at reduced energy given that raising the driver at less than full power and then releasing it results in the driver bouncing as it strikes the pile, resulting in multiple strikes.

    - If water velocity is greater than 1.6 fps, a confined bubble curtain will surround the pile.
    - Piling shall be completely engulfed in bubbles over the full depth of the water column at all times when an impact pile-driver is in use.
- All excavated materials and debris will be suitable for in-water disposal.
- A Pollution Control Plan (PCP) will be prepared by the contractor and carried out commensurate with the scope of the project that includes the following:
    - BMPs to confine, remove, and dispose of construction waste.
    - Procedures to contain and control a spill of any hazardous material.
    - Steps to cease work under high flow conditions.
- All conditions of the Oregon Department of Environmental Quality's (ODEQ) 401 Water Quality Certification will be followed.
- Only enough supplies and equipment to complete the project will be stored on site.
- All equipment will be inspected daily for fluid leaks. Any leaks detected will be repaired before operation is resumed.
- All equipment that will be used below the OHWM will be steam cleaned until all visible oil, grease, mud, and other visible contaminants are removed.
- Stationary power equipment operated within 150 ft. of the river will be diapered to prevent leaks.
- The new half-barrel intake screens will be affixed with NMFS-approved slotted fish screen to reduce juvenile salmonids impingement or entrainment.
- The new intake screens will be equipped with a self-monitoring system that will measure hydraulic head and reduce intake velocities. An approach velocity of 0.2 fps, will be maintained in compliance with NMFS screen criteria.
- The new intake screens will also be equipped with an airburst system that will actively clean the screens to maintain an approach velocity of 0.2 fps, in compliance with NMFS criteria.

We considered whether or not the proposed action would cause any other activities and determined that it would not. The effects of the future use of the intakes and screens at the pump station are considered in Effects of the Action, Section 2.5. The water withdrawal is an existing water right that is currently being exercised and is not considered an effect of the action.

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 non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

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 relies on the 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 some of the above species use the term primary constituent element (PCE) or essential features. The 2016 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 2019 regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the regulations (84 FR 44977), that definition 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 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

This opinion examines the status of each species that would 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" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the function of the PBFs that are essential for the conservation of the species.

One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large, is climate change. Climate change is likely to play an increasingly important role in determining the abundance and distribution of ESA-listed species, and the conservation value of its designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. The largest hydrologic responses are expected to occur in basins with significant snow accumulation, where warming decreases snowpack, increases winter flows, and advances the timing of spring melt (Mote et al. 2014; Mote et al. 2016). Rain-dominated watersheds and those with significant contributions from groundwater may be less sensitive to predicted changes in climate (Mote et al. 2014; Tague et al. 2013).

During the last century, average regional air temperatures in the Pacific Northwest increased by 1 to 1.4°F as an annual average, and up to 2°F in some seasons, based on average linear increase per decade (Abatzoglou et al. 2014; Kunkel et al. 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3 to 10°F, with the largest increases predicted to occur in the summer (Mote et al. 2014).

Decreases in summer precipitation of as much as 30% by the end of the century are consistently predicted across climate models (Mote et al. 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007; Mote et al. 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote et al. 2014). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez et al. 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote et al. 2014).

Overall, about one-third of the current cold-water salmonid habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Mantua et al. 2010). Higher temperatures will reduce the quality of available salmonid habitat for most freshwater life stages (ISAB 2007). Reduced flows will make it more difficult for migrating fish to pass physical and thermal obstructions, limiting their access to available habitat (Mantua et al. 2010). Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic foodwebs (Crozier et al. 2011; Tillmann and Siemann 2011; Winder and Schindler 2004). Higher stream temperatures will also cause decreases in dissolved oxygen and may also cause earlier onset of stratification and reduced mixing between layers in lakes and reservoirs, which can also result in reduced oxygen (Meyer et al. 1999; Winder and Schindler 2004). Higher temperatures are likely to cause several species to become more susceptible to parasites, disease, and higher predation rates (Crozier et al. 2008; Wainwright and Weitkamp 2013).

As more basins become rain-dominated and prone to more severe winter storms, higher winter stream flows may increase the risk that winter or spring floods in sensitive watersheds will damage spawning redds and wash away incubating eggs (Goode et al. 2013). Earlier peak stream flows will also alter migration timing for salmon smolts and may flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and reducing smolt survival (Lawson et al. 2004; McMahon and Hartman 1989).

In addition to changes in freshwater conditions, predicted changes for coastal waters in the Pacific Northwest as a result of climate change include increasing surface water temperature, increasing but highly variable acidity, and increasing storm frequency and magnitude (Mote et al. 2014). Elevated ocean temperatures already documented for the Pacific Northwest are highly likely to continue during the next century, with sea surface temperature projected to increase by 1.0 to 3.7ºC by the end of the century (IPCC 2014). Habitat loss, shifts in species' ranges and abundances, and altered marine food webs could have substantial consequences to anadromous, coastal, and marine species in the Pacific Northwest (Tillmann and Siemann 2011).

Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. A 38% to 109% increase in acidity is projected by the end of this century in all but the most stringent CO^2 mitigation scenarios, and is essentially irreversible over a time scale of centuries (IPCC 2014). Regional factors appear to be amplifying acidification in Northwest ocean waters, which is occurring earlier and more acutely than in other regions and is already impacting important local marine species (Barton 2012; Feely et al. 2012). Acidification also affects sensitive estuary habitats, where organic matter and nutrient inputs further reduce pH and produce conditions more corrosive than those in offshore waters (Feely et al. 2012; Sunda and Cai. 2012).

Global sea levels are expected to continue rising throughout this century, reaching likely predicted increases of 10 to 32 inches by 2081–2100 (IPCC 2014). These changes will likely result in increased erosion and more frequent and severe coastal flooding and shifts in the composition of nearshore habitats (Tillmann and Siemann 2011). Estuarine-dependent salmonids such as chum and Chinook salmon are predicted to be impacted by significant reductions in rearing habitat in some Pacific Northwest coastal areas (Glick et al. 2007). Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances, and therefore these species are predicted to fare poorly in warming ocean conditions (Scheuerell and

Williams 2005; Zabel et al. 2006). This is supported by the recent observation that anomalously warm sea surface temperatures off the coast of Washington and Oregon in June 2015 resulted in poor coho and Chinook salmon body condition for juveniles caught in those waters (NWFSC 2015). Changes to estuarine and coastal conditions, as well as the timing of seasonal shifts in these habitats, have the potential to impact a wide range of listed aquatic species (Reeder et al. 2013).

The adaptive ability of these threatened and endangered species is depressed due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. Without these natural sources of resilience, systematic changes in local and regional climatic conditions due to anthropogenic global climate change will likely reduce long-term viability and sustainability of populations in many of these Evolutionarily Significant Units (ESUs) (NWFSC 2015). New stressors generated by climate change, or existing stressors with effects that have been amplified by climate change, may also have synergistic impacts on species and ecosystems (Doney et al. 2012). These conditions will possibly intensify the climate change stressors inhibiting recovery of ESA-listed species in the future.

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).

The summary that follows describes the status of seven ESA-listed species, and their designated critical habitats that occur within the geographic area of this proposed action and are considered in this opinion. More detailed information on the status and trends of these listed resources, and their biology and ecology, are in the listing regulations and critical habitat designations published in the Federal Register (Table 1), as well as applicable recovery plans and 5-year status reports. These additional documents are incorporated by reference (NMFS 2009; NMFS 2015; NMFS 2016a; NMFS 2016b; NMFS 2016c; NMFS 2017a; NMFS 2017b; UCSRB 2007). These documents are available on NMFS West Coast Region website (http://www.westcoast.fisheries.noaa.gov). The next 5-year status reviews will be completed in 2021.

Table 1. Listing status, status of critical habitat designations and protective regulations, and relevant Federal Register (FR) decision notices for ESA-listed species considered in this opinion. Listing status: 'T' means listed as threatened; 'E' means listed as endangered.

Species	Listing Status	Critical Habitat	Protective Regulations
Chinook salmon *(Oncorhynchus tshawytscha)*			
Upper Columbia River spring-run	E 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	ESA section 9 applies
Snake River spring/summer-run	T 6/28/05; 70 FR 37160	10/25/99; 64 FR 57399	6/28/05; 70 FR 37160
Snake River fall-run	T 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543	6/28/05; 70 FR 37160
Sockeye salmon *(O. nerka)*			
Snake River	E 8/15/11; 70 FR 37160	12/28/93; 58 FR 68543	ESA section 9 applies
Steelhead (*O. mykiss*)			
Middle Columbia River	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Columbia River	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	2/1/06; 71 FR 5178
Snake River Basin	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160

Upper Columbia River Spring-run Chinook Salmon ESU

The UCR spring-run Chinook salmon ESU was originally listed as endangered under the ESA in 1998 (64 FR 14308), and the status was affirmed in 2005 and 2012. In 2016, the 5-year status review for UCR spring-run Chinook salmon concluded that the species should maintain its endangered listing classification (NMFS 2016c; NWFSC 2015).

A recovery plan is available for this species (UCSRB 2007). A 5-year status review was completed in 2016 (NMFS 2016c). Achieving recovery (i.e., delisting the species) of each ESU via sufficient improvement in the abundance, productivity, spatial structure, and diversity is the longer-term goal of the Upper Columbia Salmon Recovery Board (UCSRB) Plan. The recovery plan calls for meeting or exceeding the same basic spatial structure and diversity criteria adopted from the Interior Columbia Technical Recovery Team (ICTRT) viability report for recovery (NWFSC 2015). None of the three extant populations in this ESU are viable with respect to abundance and productivity (A&P), and they all have a greater than 25% chance of extinction in 100 years (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; NWFSC 2015). The remaining North Cascades MPG is comprised of three extant populations: the Wenatchee River, the Methow River, and the Entiat River populations.

The composite spatial structure and diversity (SS/D) risks for all three of the extant populations in this MPG are rated at high risk. The natural processes component of the SS/D risk is low for the Wenatchee River and Methow River populations and moderate for the Entiat River population. All three populations are rated at high risk for diversity, driven primarily by chronically high proportions of hatchery-origin spawners (26 to 76%) in natural spawning areas and a lack of genetic diversity among the natural-origin spawners (ICTRT 2007; NWFSC 2015). This effect is particularly high in the Wenatchee and Methow populations with hatchery spawners composing 66% and 76%, respectively (NMFS 2015). The high proportion of hatchery spawners reflects the large increase in releases from the directed supplementation programs in those two drainages. The hatchery supplementation program in the Entiat was discontinued in 2007 and hatchery fish on the spawning grounds in the Entiat have declined in recent years.

Abundance and productivity. NMFS (2020) discussed updated adult abundance estimates for UCR spring-run Chinook salmon. These indicate a substantial downward trend in natural-origin spawners at the ESU level from 2015 to 2019. Returns through 2018, for each of the three extant populations, remained considerably below the minimum abundance thresholds established by the ICTRT with substantial numbers of hatchery-origin fish on the spawning grounds.

Estimated productivity (returns-per-spawner) was on average about the same in 2009 to 2018 as in 1999 to 2008, and indicates that UCR spring-run Chinook salmon populations are not replacing themselves. Possible contributing factors include density dependent effects, differences in spawning distribution relative to habitat quality, and reduced fitness of hatchery-origin spawners. As of the last status review, the combinations of recent A&P for each population had resulted in a high risk rating for the ESU when compared to the ICTRT viability curves (NWFSC 2015).

There have been improvements in the viability ratings for some of the component populations, but overall several of the factors cited by the ICTRT (2007) remain as concerns or key uncertainties. Since 2016, observations of coastal ocean conditions indicate that recent outmigrant year classes have experienced below average ocean survival during a marine heatwave and its lingering effects, which led researchers to predict the drop in adult returns observed through 2019 (Werner et al. 2017). Expectations for marine survival are relatively mixed for juvenile Chinook salmon that reached the ocean in 2019 (Zabel et al. 2020). NMFS will evaluate the implications for viability risk of more recent adult returns in the upcoming 5-year status review, expected in 2021. The status review will also consider new information on population productivity, diversity, and spatial structure.

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

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

Snake River Spring/Summer-run Chinook Salmon ESU

NMFS listed the SR spring/summer-run Chinook salmon ESU as a threatened species in 1992. The status was affirmed in 2005 and updated in 2014. NMFS released a final recovery plan for this species in October of 2017 (NMFS 2017a), and the most recent status review was completed in 2016 (NMFS 2016b). 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 10 artificial propagation programs (DOC 2014). The 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 and Cooney 2005). All but one extant population (Chamberlain Creek) are at “high” risk of extinction (Ford 2011; NWFSC 2015).

Spatial structure and diversity. Spatial structure ratings remain unchanged or stable with low or moderate risk levels for the majority of the populations in the ESU. Four populations from three MPGs (Catherine Creek and Upper Grande Ronde of the Grande Ronde/Imnaha River MPG, Lemhi River of the Upper Salmon River MPG, and Lower Middle Fork Salmon of the Middle Fork Salmon River MPG) remain at high risk for spatial structure loss. Three 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 that limit hatchery contribution to natural spawning based on the abundance of natural-origin fish returning to spawn—the more natural-origin fish that return, the fewer hatchery fish that are needed to spawn naturally. Sliding-scale management is designed to maximize hatchery benefits in low abundance years and reduce hatchery risks at higher spawning levels.

Abundance and productivity. NMFS (2020) discussed updated adult abundance estimates for SR spring/summer Chinook salmon. These indicated a substantial downward trend in natural-origin spawners at the ESU level from 2014 to 2019. Returns during the last 3 years in the series, 2017 through 2019, were the lowest since 1999. These data also showed recent and substantial downward trends for most of the MPGs and populations, except those in the Lemhi River, Camas Creek, and Upper Grande Ronde Mainstem, when compared to the 2009 to 2013 period. All populations except Chamberlain Creek remained considerably below the minimum abundance thresholds established by the ICTRT. For many populations, the total spawner counts include substantial numbers of hatchery-origin adults. Exceptions were the entirety of the Middle Fork MPG and several populations in the Upper Salmon MPG. NMFS will evaluate the implications for viability risk of these more recent returns in the upcoming 5-year status review, expected in 2021. The status review will also consider new information on population productivity, diversity, and spatial structure.

Most populations will need to see increases in A&P in order for the ESU to recover. As of the last status review, NWFSC (2015) stated that the SR spring/summer-run Chinook salmon ESU remained at high overall risk, with the exception of the Chamberlain Creek population in the Middle Fork Salmon River MPG.

Limiting factors. Limiting factors for this species include:

- Degradation of floodplain connectivity and function, channel structure and complexity, riparian areas and large woody debris recruitment, stream flow, and water quality.
- Effects related to the hydropower system in the mainstem Columbia River, including reduced upstream and downstream fish passage, altered ecosystem structure and function, altered flows, and degraded water quality.
- Harvest-related effects.
- Predation.

Snake River Fall-run Chinook Salmon ESU

Snake River fall-run Chinook salmon were originally listed as threatened in 1992 (57 FR 14653). The status was affirmed in 2005 and updated in 2014. NMFS released a final recovery plan for this species in November 2017 (NMFS 2017b). A 5-year status review was completed in 2016 (NMFS 2016b). 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, and it spawns 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 and Cooney 2005). The extant population has a high proportion of hatchery-origin spawners.

NMFS (2020) discussed updated adult abundance estimates for SR fall Chinook salmon. These indicated a substantial downward trend in the abundance of natural-origin spawners at the ESU level during 2013 to 2019. However, overall abundance remained higher than before 2005. NMFS will evaluate the implications for viability risk of these more recent returns in the upcoming 5-year status review, expected in 2021. The status review will also consider new information on productivity, diversity, and spatial structure.

The SR fall Chinook salmon ESU is composed of a single demographically independent population. Five-year geometric means in the numbers of natural-origin and total (natural- plus hatchery-origin) spawners through 2018 indicated very small negative changes in abundance between the two most recent 5-year periods (NMFS 2020).

As of the last status review, the ESU was considered viable, but would need to see an increase in productivity combined with a reduction in diversity risk to recover (ICTRT 2010; NWFSC 2015). The single population delisting options provided in the draft Snake River Fall Chinook Recovery Plan would require the population to meet or exceed minimum requirements for Highly Viable with a high degree of certainty (NWFSC 2015).

Limiting factors. Limiting factors for this species include:

- Degradation of floodplain connectivity and function and channel structure and complexity.
- Harvest-related effects.
- Loss of access to historical habitat above Hells Canyon and other Snake River dams.
- Impacts from mainstem Columbia River and Snake River hydropower systems.
- Hatchery-related effects.
- Degraded estuarine and nearshore habitat.

Snake River Sockeye Salmon ESU

The SR sockeye salmon were ESA-listed in November 1991 (56 FR 58619) as endangered. We reaffirmed the listing in 2005 (70 FR 2853). Best available information indicates that the SR sockeye salmon ESU is at high risk and remains at endangered status. NMFS released a final recovery plan for this species on June 8, 2015 (NMFS 2015). The most recent 5-year status review was completed in 2016 (NMFS 2016b). Overall, the recovery strategy aims to reintroduce and support adaptation of naturally self-sustaining sockeye salmon populations in the Sawtooth Valley lakes.

Spatial structure and diversity. This species includes all anadromous and residual sockeye salmon from the SRB, Idaho, and artificially-propagated sockeye salmon from the Redfish Lake Captive Broodstock Programs (DOC 2014). 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 2015). 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 2015). 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 (NWFSC 2015).

Abundance and productivity. NMFS (2020) discussed updated adult abundance estimates for SR sockeye salmon. These indicate a substantial downward trend in the returns of hatchery-origin and natural-origin adults to the Sawtooth Valley since 2014. The 5-year geometric mean of total spawner counts declined 6% in 2014 to 2018 when compared to 2009 to 2013. NMFS will evaluate the implications for viability risk of these more recent returns in the upcoming 5-year status review, expected in 2021. The status review will also consider new information on productivity, diversity, and spatial structure.

Limiting factors. The key factor limiting recovery of the SR sockeye salmon ESU is survival. In the Sawtooth Valley natal lakes, limiting factors include blocked access; low zooplankton density (which can restrict sockeye salmon growth and fitness); current and legacy effects of land use and other human activities such as mining, grazing, recreational use, lakeshore development, and irrigation diversions; lake poisoning; and introduction and continued stocking of non-native species (such as brook trout, rainbow trout, lake trout, and kokanee).

Portions of the migration corridor in the Salmon River are impaired by reduced water quality and elevated temperatures (IDEQ 2011). The natural hydrological regime in the upper mainstem Salmon River Basin has been altered by water withdrawals. Survival rates from Lower Granite Dam to the spawning grounds are low in some years (e.g., average of 31%, range of 0–67% for 1991–1999) (Keefer et al. 2008b). Keefer et al. (2008b) conducted a radio tagging study on adult SR sockeye salmon passing upstream from Lower Granite Dam in 2000 and concluded that high in-river mortalities could be explained by “a combination of high migration corridor water temperatures and poor initial fish condition or parasite loads.” Keefer et al. (2008b) also examined current run timing of SR sockeye salmon versus records from the early 1960s, and concluded that an apparent shift to earlier run timing recently may reflect increased mortalities for later migrating adults. In the Columbia and lower Snake River migration corridor, predation rates on juvenile sockeye salmon are unknown, but terns and cormorants consume 12% of all salmon smolts reaching the estuary, and piscivorous fish consume an estimated 8% of migrating juvenile salmon (NOAA 2011), a significant source of mortality.

Upper Columbia River Steelhead DPS

The UCR steelhead distinct population segment (DPS) was originally listed under the ESA in 1997 (62 FR 43937). The Upper Columbia Recovery Plan calls for “…restoring the distribution of naturally-produced spring-run Chinook salmon and steelhead to previously occupied areas where practical, and conserving their genetic and phenotypic diversity” (UCSRB 2007). In 2015, the 5-year review for the UCR steelhead concluded the species should maintain its threatened listing classification (NMFS 2016c).

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 SS/D (NWFSC 2015). With the exception of the Okanogan population, the UCR steelhead populations were 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.

Abundance and productivity. NMFS (2020) discussed updated adult abundance estimates for UCR steelhead. These indicate a substantial downward trend in the number of natural-origin spawners at the DPS level from 2014 to 2019. Population level estimates of natural-origin and total (natural- and hatchery-origin) spawners through 2018 also showed recent and substantial downward trends for most of the populations. All populations remain considerably below the minimum abundance thresholds established by the ICTRT.

NMFS will evaluate the implications for viability risk of these more recent returns in the upcoming 5-year status review, expected in 2021. The status review will also consider new information on productivity, diversity, and spatial structure.

Limiting Factors. Limiting factors for this species include (NOAA 2011; UCSRB 2007):

- Adverse effects related to the mainstem Columbia River hydropower system.
- Impaired tributary fish passage.
- Degradation of floodplain connectivity and function, channel structure and complexity, riparian areas, large woody debris recruitment, stream flow, and water quality.
- Hatchery-related effects.
- Predation and competition.
- Harvest-related effects.

Snake River Basin Steelhead DPS

This ESU was first listed as endangered under the ESA in 1991 (62 FR 43937). In October of 2017, NMFS released the final SR Spring/Summer-run Chinook Salmon and Steelhead Recovery Plan (NMFS 2017a). The most recent 5-year status review was completed in 2016 (NMFS 2016b). The overall viability ratings for natural populations in the SRB steelhead DPS range from moderate to high risk. Four out of the six MPGs are not meeting the specific objectives in the recovery plan; the Grande Ronde MPG is tentatively rated as viable.

Spatial structure and diversity. The SRB steelhead DPS includes all naturally-spawned anadromous steelhead populations originating below natural and manmade impassable barriers in streams in the Snake River Basin of southeast Washington, northeast Oregon, and Idaho. Twenty-four historical populations (an additional three are extirpated) within six 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, spatial structure ratings for all of the SRB steelhead populations were low or very low risk, given the evidence for distribution of natural production within populations. The exception was the Panther Creek population, which was given a high risk rating for spatial structure based on the lack of spawning in the upper sections. No new information was provided for the 2015 status technical review that would change those ratings (NWFSC 2015).

Abundance and productivity. NMFS (2020) discussed updated adult abundance estimates for SRB steelhead. These indicate a substantial downward trend in the abundance of natural-origin spawners at the DPS level from 2014 to 2019. The number of natural-origin spawners in the Upper Grande Ronde Mainstem population appears to have been 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). The 2019 abundance level for the Tucannon River population was lower than the most recent 5-year geomean. For many other SRB steelhead populations, spawning ground surveys are not feasible due to high spring flows that would wash out weirs and low visibility that precludes redd counts. The Idaho Department of Fish and Game, Columbia River Inter-Tribal Fish Commission, and the Northwest Fisheries Science Center (NWFSC) therefore collect tissue samples from adult steelhead trapped at Lower Granite Dam and assign these fish to genetic stocks by comparing them to samples taken inside the boundary of each spawning population (NMFS 2020). The genetic stock identification groups are broader than spawning populations, but fit within the MPGs. The most recent 5-year geometric means indicate large decreases in natural-origin abundance for most of the genetic stocks/MPGs, with a smaller decrease for the Upper Clearwater genetic stock group.

NMFS will evaluate the implications for viability risk of these more recent returns in the upcoming 5-year status review, expected in 2021. The status review will also consider new information on population productivity, diversity, and spatial structure.

Limiting factors. Limiting factors for this species include (NMFS 2011a; NMFS 2011b):

- Adverse effects related to the mainstem Columbia River hydropower system.
- Impaired tributary fish passage.
- Degradation of floodplain connectivity and function, channel structure and complexity, riparian areas and large woody debris recruitment, stream flow, and water quality.
- Increased water temperature.
- Harvest-related effects, particularly for B-run steelhead.
- Predation.
- Genetic diversity effects from out-of-population hatchery releases.
- Harvest-related effects.
- Effects of predation, competition, and disease.

Middle Columbia River Steelhead DPS

In 1999, NMFS listed MCR steelhead under the ESA as a threatened species (64 FR 14517). A recovery plan is available for this species (NMFS 2009), and this plan details much of the existing status information for the MCR steelhead. The most recent 5-year status review was completed in 2016 (NMFS 2016a).

Spatial structure and diversity. This species includes all naturally-spawned steelhead populations originating below natural and manmade impassable barriers from the Columbia River and its tributaries upstream of the Wind and Hood rivers (exclusive) to and including the Yakima River, excluding steelhead originating from the SRB. This DPS includes steelhead from seven artificial propagation programs (DOC 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 (DOC 2014). The ICTRT identified 17 extant populations in this DPS (ICTRT 2003; McClure and Cooney 2005). The populations fall into four MPGs: Cascade eastern slope tributaries (five extant and two extirpated populations), the John Day River (five extant populations), the Walla Walla and Umatilla rivers (three extant and one extirpated populations), and the Yakima River (four extant populations) (ICTRT 2003; McClure and Cooney 2005). Viability ratings for these populations range from extirpated to viable (NMFS 2009; NWFSC 2015).

Abundance and productivity. NMFS (2020) discussed updated adult abundance estimates for MCR steelhead. These indicate a substantial downward trend in the abundance of natural-origin spawners at the DPS level from 2014 to 2019. Population level estimates of natural-origin and total (natural- plus hatchery-origin) spawners through 2018 or 2019 also showed recent and substantial downward trends in abundance for most of the MPGs and populations (exceptions are the Klickitat and Yakima River populations) when compared to the 2009 to 2013 period. In many cases, the most recent 5-year geometric mean in natural-origin abundance is considerably below the minimum abundance thresholds established by the ICTRT. However, the Klickitat, Middle Fork John Day, and Umatilla River populations are well above these thresholds. A relatively limited number of hatchery fish is present on the spawning grounds within this DPS.

NMFS will evaluate the implications for viability risk of these more recent returns in the upcoming 5-year status review, expected in 2021. The status review will also consider new information on productivity, diversity, and spatial structure.

Limiting factors. Limiting factors for this species include (NMFS 2009; NOAA Fisheries 2011):

- Degradation of floodplain connectivity and function, channel structure and complexity, riparian areas, fish passage, stream substrate, stream flow, and water quality.
- Mainstem Columbia River hydropower-related impacts.
- Degraded estuarine and nearshore marine habitat.
- Hatchery-related effects.
- Harvest-related effects.
- Effects of predation, competition, and disease.

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 2 and 3). 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). Rangewide, all habitat types are impaired to some degree, even though many of the watersheds comprising the fully designated area are ranked as providing high conservation value. The proposed action, however, affects only freshwater rearing and freshwater migration habitats.

Table 2. Physical and biological features of critical habitat designated for ESA-listed 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 emergence from gravel Fry/parr/smolt growth and development
Freshwater migration	Free of artificial obstruction Natural cover Water quality Water quantity	Adult sexual maturation Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Estuarine areas	Forage Free of artificial obstruction Natural cover Salinity Water quality Water quantity	Adult sexual maturation and "reverse smoltification" Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Nearshore marine areas	Forage Free of artificial obstruction Natural cover Water quantity Water quality	Adult growth and sexual maturation Adult spawning migration Nearshore juvenile rearing

Table 3. 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 temperature (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 (CHARTs) 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 CHARTs evaluated the quantity and quality of habitat features (e.g., spawning gravels, wood and water condition, 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).

Interior Columbia Recovery Domain

Critical habitat has been designated in the Interior Columbia recovery domain (ICRD), which includes the SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, UCR spring-run Chinook salmon, SR sockeye salmon, MCR steelhead, UCR steelhead, and SRB steelhead.

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 developments. Critical habitat throughout much of the ICRD has been degraded by intense agriculture, alteration of stream morphology (i.e., channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, livestock grazing, dredging, road construction and maintenance, logging, mining, and urbanization. Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems for critical habitat in developed areas.

Migratory habitat quality in this area 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 likely production areas in Oregon and Idaho, including the Burnt, Powder, Weiser, Payette, Malheur, Owyhee, and Boise river basins (Good et al. 2005), and Grand Coulee and Chief Joseph dams completely block anadromous fish passage on the upper mainstem Columbia River.

Hydroelectric development modified natural flow regimes, resulting in higher water temperatures, changes in fish community structure leading to increased rates of piscivorous and avian predation on juvenile salmon and steelhead, and delayed migration for both adults and juveniles. Physical features of dams such as turbines also kill migrating fish. In-river survival is inversely related to the number of hydropower projects encountered by emigrating juveniles. Similarly, development and operation of extensive irrigation systems and dams for water withdrawal and storage in tributaries have altered hydrological cycles.

A series of large regulating dams on the middle and upper Deschutes River affect flow and block access to upstream habitat, and have extirpated one or more populations from the Cascades Eastern Slope major population. Also, operation and maintenance of large water reclamation systems such as the Umatilla Basin and Yakima Projects have significantly modified flow regimes and degraded water quality and physical habitat in this domain.

Many stream reaches designated as critical habitat in the ICRD 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). Reduced tributary streamflow has been identified as a major limiting factor for all listed salmon and steelhead species in this recovery domain except SR fall-run Chinook salmon and SR sockeye salmon (NMFS 2007; NMFS 2011a).

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

The ICRD is a very large and diverse area. The CHARTs determined that few watersheds with PBFs for Chinook salmon or steelhead are in good to excellent condition with no potential for improvement. Overall, most ICRD watersheds are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some potential for improvement.

Despite these degraded habitat conditions, the HUCs 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. The Columbia River corridor is ranked as high conservation value. The CHARTs noted that this corridor connects every watershed and population for all listed ESUs/DPSs with the ocean, and is used by rearing and migrating juveniles, and migrating adults, of every component population.

A summary of the status of critical habitats considered in this opinion is provided in Table 4.

Table 4. Critical habitat, designation date, Federal Register citation, and status summary for critical habitat considered in this opinion.

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. However, most of these watersheds have some, or high, potential for improvement. We rated the conservation value of HUC5 watersheds as high for 10 watersheds, and medium for five watersheds. The conservation value of migration habitat in this area has been 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 (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.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
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. 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.
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 PCEs 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 the conservation value of HUC5 watersheds as high for 20 watersheds, medium for eight watersheds, and low for three watersheds.
Snake River Basin steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 25 subbasins in Oregon, Washington, and Idaho. 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.
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 the conservation value of occupied HUC5 watersheds as high for 80 watersheds, medium for 24 watersheds, and low for 9 watersheds.

HUC5=Fifth-field Hydrologic Code; ESU=Evolutionarily Significant unit; PBF= Physical or Biological Feature; PCE=Primary Constituent Element.

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 action area for the proposed action includes the area surrounding the in-water activity at the N&C pump station at RM 287.2 extending in a radius up to 2.47 miles (3,981 m) based on anticipated effects from hydroacoustic sound pressure generated during impact pile-driving related activities. The action area includes the in-water project site (sheet pile, manifold trench, intake pipes, and screen installation); the pump station and supporting facilities; the barges; equipment use and storage locations; stockpile locations; shoreline, riparian, and upland areas surrounding the N&C pump station; 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 project site is located in Oregon within the John Day Reservoir on the southern shoreline of the Columbia River, 4.5 miles downstream of McNary Dam. The location is in a rural area dominated by large-scale irrigated agriculture. Multiple other pump stations exist on the shoreline of Columbia River. The site includes the current pump station facilities that contain the existing pumps, intakes and screens, concrete pad structure, facility buildings and a gravel access road.

The action area includes the footprint of in-water construction at depths approximately up to 15 ft below the OHWM in the shallow waters, along the shoreline and upland areas of the mainstem Columbia River. The project site has been heavily impacted by anthropogenic alterations along the shoreline and upland areas. The Columbia River shoreline is composed of coarse sand, cobble size rock and depositional materials. The topography of the uplands is relatively flat and transitions to areas of steep, sloping banks down to the shoreline. There is no suitable spawning habitat and it is low quality for benthic prey production. There is minimal riparian vegetation composed of a narrow band of shrubs and willow species, and a few black cottonwoods. The site does not contain large woody material, pools or off-channel habitat or refugia.

Current conditions within much of the mainstem Columbia River are degraded relative to historical conditions, a reflection of a multitude of actions whose effects frame the environmental baseline in the action area. The hydropower system has greatly modified natural flow and altered the hydrograph of the Columbia River. Water impoundments have altered water quality resulting in higher water temperatures during some parts of the year and elevated background turbidity (Gilbreath et al. 2000), changed fish community structure leading to increased rates of piscivorous, predation on juvenile salmon and steelhead, and altered fish passage and delayed migration for both adults and juveniles. Shoreline development has reduced natural vegetation, disconnected floodplains, and reduced available off-channel refugia.

The mainstem dams and reservoirs, such as John Day Reservoir (where the project is located), continue to substantially alter the mainstem migration corridor habitat. The reservoirs have increased the cross-sectional area of the river, reducing water velocity, altering the food web, and creating habitat for native and non-native species that are predators, competitors, or food sources for migrating juvenile salmon and steelhead. Travel times of migrating smolts increase as they pass through the reservoirs (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 dams (turbines, bypass systems, spillbays, or surface passage routes) (NMFS 2019). However, overall passage conditions and resulting juvenile survival rates in this part of the migration corridor have improved substantially since the 1990s, when these species were listed. This is most likely the result of improved structures and operations and predator-management programs at the John Day project and other dams (24-hour volitional spill, surface passage routes, improved juvenile bypass systems, predator-management measures, etc.)

In addition, numerous anthropogenic features or activities near the project site and throughout the action area (e.g., dams, pump stations, marinas, 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. 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 Columbia River from historical floodplain areas. 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.

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. The Columbia River within the project area likely serves as juvenile rearing habitat and as a migration corridor for all ESUs/DPSs of spring- and fall-run Chinook salmon and steelhead and potentially sockeye salmon. Project activities will occur during winter, the recommended in-water work period, when adults do not typically occupy the project area. An occasional adult steelhead could be present year round in the mainstem Columbia River.

John Day Dam has created reservoir conditions in the project vicinity, with daily fluctuations in water level. John Day Reservoir is considered water quality limited by the ODEQ and it is on the Clean Water Act section 303(d) list for water temperature and pH (ODEQ 2006). 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. Turbidity in the reservoir is often elevated.

On the mainstem Columbia River, hydropower projects, water storage projects and the withdrawal of water for irrigation and urban uses have significantly degraded salmon and steelhead habitats (NMFS 2013). The volume of water discharged by the Columbia River varies seasonally according to runoff, snowmelt, and hydrosystem demands. Mean annual discharge is estimated to be 265 kilo cubic feet per second (kcfs), but may range from lows of 71 to 106 kcfs to highs of 539 kcfs. Water management activities have reduced flows in the Columbia River, measured at Bonneville Dam, from April through July. Flow management for hydropower has increased flows measured at Bonneville Dam during winter months. Naturally occurring maximum flows on the Columbia River occur in May, June, and July as a result of snowmelt in headwater regions. Minimum flows occur from September to March, with periodic peaks due to winter rains. Interannual variability in stream flow is strongly correlated with two recurrent climate phenomena, the El Nino/Southern Oscillation and the Pacific Decadal Oscillation.

Irrigation water will continue to be withdrawn using the existing facilities. The existing water withdrawals are part of the environmental baseline for the action area. The proposed action does not include any change or an increase in the existing water withdrawals from the Columbia River.

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. 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 50 CFR 402.17(a) and (b).

The effects of the action includes effects caused by: in-water excavation; installation of the temporary sheet-piling surrounding the excavation area; vibratory and impact pile-driving; installation of the sheet-wall barrier and pilings, new intake pipe, manifold tee, and new screens; and placement of the substrate material back over the pipe. Effects to habitat in the action area will likely occur as a consequence of construction of the intake pipeline into the banks of the Columbia River. These effects will occur at the project site located along the shoreline of the Columbia River and within the John Day Reservoir. The species affected will include ESA-listed species that migrate through and occupy the John Day Reservoir during the in-water construction period, as well as additional effects to those salmon and steelhead anticipated to use the action area downstream of the project site for migration and rearing.

2.5.1 Fish Presence in the Action Area

Fish presence in the action area consists of different-sized species and age classes of salmon and steelhead that rear and migrate throughout the Columbia River. In general, juvenile salmon of different sizes often have different behavior, disposition to migrate, and distribution in reservoirs (Peven 1987), which will influence the degree to which effects of the project are experienced by individual fish. Some juvenile steelhead and salmon of all ESUs and DPSs in this opinion may migrate and overwinter in the John Day Reservoir (Table 5). A few adult steelhead of each DPS could be present year-round in the mainstem Columbia River. However, based on habitat quality and the number of adults in the John Day Reservoir, we anticipate that the number of adult steelhead of any DPS to be holding or migrating in the action area during the in-water construction work window (December 1 to March 31) will be small (a few fish). We anticipate a few individual adult Chinook salmon may migrate through the John Day Reservoir starting in mid-March towards the end of the in-water work window. However, it is highly unlikely adult Chinook will be present within the in-water construction area because they prefer deeper habitat. Adult sockeye salmon are not typically present during the winter months when in-water construction is planned. However, in a rare occurrence an individual adult sockeye salmon may be present and could be exposed to in-water work.

Table 5. Timing of Fish Presence at the Project Site.

<table>
<tr><th rowspan="2">Species</th><th></th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sept</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><th>Life Stage</th><td colspan="3">*IWWW</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>*IWWW</td></tr>
<tr><th rowspan="2">UCR Steelhead</th><td>Adult</td><td colspan="12">MIGRATION</td></tr>
<tr><td>Juvenile</td><td colspan="12">MIGRATION and REARING</td></tr>
<tr><th rowspan="2">MCR Steelhead</th><td>Adult</td><td colspan="12">MIGRATION</td></tr>
<tr><td>Juvenile</td><td colspan="12">MIGRATION and REARING</td></tr>
<tr><th rowspan="2">SRB Steelhead</th><td>Adult</td><td colspan="12">MIGRATION</td></tr>
<tr><td>Juvenile</td><td colspan="12">MIGRATION and REARING</td></tr>
<tr><th rowspan="2">UCR Spring-run Chinook salmon</th><td>Adult</td><td></td><td></td><td colspan="4">MIGRATION
(mid-March to mid-June)</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Juvenile</td><td colspan="12">MIGRATION and REARING</td></tr>
<tr><th rowspan="2">SR fall-run Chinook salmon</th><td>Adult</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">MIGRATION</td><td></td><td></td></tr>
<tr><td>Juvenile</td><td colspan="12">MIGRATION and REARING</td></tr>
<tr><th rowspan="2">SR Spring-Summer Chinook salmon</th><td>Adult</td><td></td><td></td><td colspan="8">MIGRATION
(mid-March to late October)</td><td></td><td></td></tr>
<tr><td>Juvenile</td><td colspan="12">MIGRATION and REARING</td></tr>
<tr><th rowspan="2">Sockeye Salmon</th><td>Adult</td><td></td><td></td><td></td><td></td><td colspan="7">MIGRATION
(mid-May to mid-November)</td><td></td></tr>
<tr><td>Juvenile</td><td colspan="12">MIGRATION and REARING</td></tr>
<tr><td colspan="14">*Oregon Department of Fish and Wildlife recommended in-water work window (IWWW) from December 1 to March 31 (ODFW 2008).</td></tr>
</table>

The proposed action includes in-water excavation from the shoreline banks of the Columbia River extending into the shallow waters up to 15 ft deep below the OHWM. In a study by Johnson et al. (2005), the vast majority of adult Chinook salmon migrated at a depth between 6 to 15 ft. below the surface in mainstem reservoirs, and individual fish frequently altered their depth in the water column. Johnson et al. (2008) also found adult steelhead migrating at depths greater than 6 ft. below water surface in reservoirs. In another study, Hughes (2004) noted that smaller fish swim closer to the stream bank than larger fish, and very few adult fish swim in the thalweg of the channel during upstream migration.

The majority of adult Chinook salmon migrate through the action area between April and October. Those passing John Day Dam from April 1 to June 5 are considered spring-run. Those passing June 6 to August 5 are considered summer-run, and those passing after August 6 are considered fall-run (Columbia Basin Research 2013). A small number of adult Chinook migrate at depths greater than 15 ft through John Day Reservoir towards the end of the in-water work window. Therefore, it is highly unlikely individual adult Chinook salmon may be present in the shallow waters of the project site during in-water work.

Adult steelhead migrate throughout the year and some overwinter in the John Day Reservoir in low numbers (Keefer 2008a). Project in-water construction activities will occur from December 1 to March 31, a period typically occupied by very few individual adults. The majority of adults migrate between June and October. Keefer et al. (2008a) found overwintering behaviors and distribution of adult steelhead in the Columbia River to be highly variable but found an estimated 12.4% of fish reaching spawning areas overwintered in the Columbia River. Daily counts at the Bonneville Dam have found few individual adult steelhead migrate during the winter months, with small increases in numbers of individual adults passing the dams in late February and March (Columbia River DART 2020). In addition to the steelhead being counted at the dams during the winter, some steelhead will hold in the reservoirs. Thus, we expect a few adult steelhead to be exposed to potential effects from construction activities.

During construction of this project, we do not expect adult SR fall-run Chinook or adult SR sockeye salmon to be present during the in-water work window as their migration timing and use of Columbia River habitat does not overlap with construction timing. We do not expect adult SR fall-run Chinook and SR sockeye salmon will be exposed to adverse effects of the proposed action. During late winter a few adult UCR spring-run Chinook salmon and SR spring/summer run Chinook salmon may be present in the project vicinity. Although adult UCR steelhead, MCR steelhead, and SRB steelhead are predicted to be most exposed to construction activities, only a very small number of adults of any individual population of each DPS are expected to be holding in the project site in the winter when construction activities occur.

Ocean-type salmon migrate downstream through the action area as subyearling juvenile fish, generally leaving natal areas within days to weeks following their emergence from the gravel. Subyearlings from the SR fall-run Chinook salmon ESU express two peak movements downriver, between April and June, and then from mid-June through August. Out-migrating juvenile SR sockeye salmon depart freshwater tributaries in the spring passing through the Columbia River during summer months prior to their ocean life-stage. Juvenile SR sockeye salmon do not typically overwinter in the mainstem Columbia River. A very few number of juvenile sockeye may rarely rear during the in-water window. Some juvenile Chinook salmonids remain in freshwater for extended periods until reaching a larger size (more than 75 millimeters) (Levings et al. 1986; Levy and Northcote 1982; MacDonald et al. 1988); consequently, juvenile salmon and steelhead may be in the action area near construction activities during the in-water window.

Subyearling Chinook salmon generally remain close to the water surface, favoring habitat less than 6 ft. deep and where currents do not exceed 0.1 ft./sec. They seek lower energy areas where waves and currents do not require them to expend considerable energy to remain in position while they consume invertebrates that live on or near the substrate. These areas typically have fine-grain substrates supporting benthic prey production.

Older juvenile salmon and steelhead (+1 age class) use a variety of habitats including nearshore, off-channel, mid-channel, and deep-water habitats. Dauble et al. (1989) found that spring-run Chinook salmon smolts were often abundant just after sunset in shallow nearshore areas (less than 30 cm deep) of low current velocity. Beeman and Maule (2006) observed a difference in daytime swim depth between yearling steelhead and yearling Chinook salmon, with steelhead migrating at a mean depth of 6 ft and Chinook salmon migrating at a mean depth of 10 ft. A study by Timko et al. (2011) recorded juvenile steelhead migrating in the top 5 to 15 ft. of the water column in the Priest Rapids Project (which is located upstream of the project area). Bradford and Taylor (1997) reported similar results with subyearlings dispersing downstream from natal tributaries to mainstem habitats. This mostly occurred during the night with fish moving to the stream margins and nearshore areas during the day. Thus, we expect spring-run juvenile Chinook salmon and steelhead to be present at the project site during the in-water construction.

Subyearling and juvenile Chinook salmon from upriver populations (UCR spring-run Chinook SR spring/summer-run Chinook salmon and SR fall-run Chinook salmon) and rearing or migrating juvenile steelhead of all DPSs are the most likely ESUs/DPSs to be exposed during in-water construction at the project site.

2.5.2. Effects to Species

We anticipate short-term effects to exposed species and life stages during project construction, and long-term effects as a consequence of potential impingement on intake screens. The short-term effects include the potential for behavior modification, injury and death, as well as injury and harm from reduced habitat quality and temporary altered fish passage and migration. These effects are described below.

Harm, Mechanical Injury or Death during In-water Construction
The proposed action includes 1,920 ft^2 of in-water excavation in depths up to 15 ft.; and use of heavy equipment to install sheet-wall barrier, steel piles, the manifold, the new intake pipeline and screens. It is likely that some individual fish will flee or avoid the in-water activities. Adults and older juveniles are generally better at avoiding this kind of disturbance. Some fish are less likely to successfully flee, and they may be injured or killed. In-water activities will take up to 8 weeks, and will occur between December 1 and March 31. Based on this timing and the shallow site characteristics, only adult steelhead (SRB, MCR and UCR) and juveniles from any of the ESUs/DPSs are likely to be present. Since adults and larger juveniles are better able to avoid disturbance, juvenile steelhead and subyearling Chinook salmon are the most vulnerable to exposure to in-water equipment during construction.

Adult fish fleeing the work site are unlikely to be harmed. Generally, they are migrating upstream and avoidance of the work activities is not likely to impair their ability to migrate or hold. Juvenile fish fleeing the work site are also unlikely to be harmed because the site provides low quality feeding opportunities and this quality of feeding is present nearby.

Any juvenile fish present within the project footprint, or within the sheet-wall barrier during the in-water work will likely be injured or killed from interactions with equipment. It is unlikely that more than a few fish would be killed or injured because few fish are present during the work window and the footprint is small. Any fish injured or killed will likely be distributed among any of the populations that could be present.

Water Quality

The proposed project includes in-water construction below the OHWM involving excavation within the trench (1,920 ft^2), installation of the sheet-wall barrier, pilings, manifold, the new intake pipe and screens, and replacing the bottom sediment over the new pipe. Heavy machinery and equipment working from the barges during in-water work will suspend sediment and create a turbidity plume downstream of the work site.

Effects to salmonids are reasonably likely to occur from substrate disturbance though in-water excavation activities. These activities will temporarily increase delivery of fine sediments, increase turbidity in the water column and degrade water quality. The greater the flow of water over the disturbed area and the larger the disturbed area, the greater the movement of sediments.

All in-water excavation, construction, pipeline and screen installation is anticipated to occur for up to 8 weeks. The proposed action will increase turbidity each day excavation occurs. Because the contractor will install the sheet-wall around the excavation area, we expect most of the elevated turbidity for those 8 weeks will remain within the sheet-wall area. The sheet-pile wall will be a partial barrier and remain open along the northern end of the in-water site open parallel to the Columbia River flowing downstream. We expect the majority of sediment and turbidity generated within the sheet-wall barrier will be contained behind the sheet-pile walls. Currents are not likely to result in sediment and turbidity being carried by perpendicular flows moving out into the deeper channel of the Columbia River, and downstream around the sheet-walls. Turbidity levels will be high within the in-water site each day (approximately 1,920 ft^2) and will likely settle out overnight, but rise again in the morning when in-water work resumes. Outside of the sheet-wall barrier, we expect the turbidity levels to be near or slightly above background (see below for discussion of background levels in the reservoir in winter). The installation and removal of the sheet-wall will increase turbidity and suspended sediment concentrations downstream of the in-water work area. Because background levels are naturally high and mix rapidly in the large river, we expect turbidity plumes following sediment curtain installation and removal to not exceed 10% above background levels at 500 ft. downstream from the construction area. This pulse of suspended sediment will last minutes to a few hours.

The John Day Reservoir tends to be relatively homogenous with regard to physical, chemical, and biological attributes, largely a result of low water-retention times within the reservoir (Gilbreath et al. 2000). Background turbidity in the winter in John Day River is relatively high with Secchi disc readings generally less than 1 meter. Phytoplankton concentrations contribute to elevated turbidity, and can be high in the winter as well. However, most of the elevated turbidity is a consequence of high suspended sediment loads.

The effects of suspended sediment and turbidity on fish range from beneficial to detrimental. Elevated total suspended solids (TSS) have been reported to enhance cover conditions, reduce piscivorous fish/bird predation rates, and improve survival, but elevated TSS has also been reported to cause physiological stress, reduce feeding and growth, and adversely affect survival. Although fish that remain in turbid waters may experience a reduction in predation from piscivorous fish and birds (Gregory and Levings 1998) chronic exposure can cause physiological stress responses that can increase maintenance energy and reduce feeding and growth (Lloyd et al. 1987; Redding et al. 1987; Servizi and Martens 1991). Salmonid gill-flaring and behavioral modifications including feeding changes have been observed in response to pulses of suspended sediment (Berg and Northcote 1985) and turbidity plume avoidance has been observed in salmonids and other fish (Sigler et al. 1984, Lloyd et al. 1987, Servizi and Martens 1991).

During in-water work, any juvenile salmonid or steelhead present within the sheet-walls are most likely to experience one or more of these physical or behavioral effects from the reduction in water quality. They are likely to exhibit reduced feeding and reduced fitness. Outside the sheet-wall barrier during in-water construction, turbidity levels will be close to background, and we do not expect juvenile or adult fish to respond to the small water quality changes. During sheet-wall removal and the short-term elevated suspended sediment downstream, adults will move out of the area with higher turbidity. Smaller juveniles that are less likely to flee may exhibit reduced feeding for a few hours. This is not expected to reduce their fitness over the long-term. We anticipate excess fine sediments will dissipate and settle into the channel substrate relatively quickly or be carried downstream.

Chemical contamination. As with all construction activities involving the use of mechanized equipment, accidental release of fuel, oil, and other contaminants may occur. If enough of the fuel or contaminant is spilled, it could injure or kill aquatic organisms. The project will include the use of heavy equipment (an excavator and a crane) deployed on either the river bank or a floating barge in the Columbia River. There is the potential for accidental spills of petroleum products or other hazardous materials into the river from this equipment. Petroleum-based contaminants, such as fuel, oil, and some hydraulic fluids, contain polycyclic aromatic hydrocarbons (PAHs), which can kill salmon at high concentrations, and can cause sublethal, adverse effects at lower concentrations (Meador et al. 2006).

Any contaminant and pollutant spills that make their way into the Columbia River could harm fish. However, NMFS anticipates PAH releases of only very small quantities (ounces) are likely with each accidental release or spill. Conservation measures (staging areas, biodegradable lubricants, fuel containment system and spill containment booms) will be implemented to minimize the use of toxic substances and prevent or contain any spill that may occur.

The project will include complying with ODEQ water quality requirements, daily inspection of equipment for work below the OHWM, and multiple conservation measures to maintain and protect water quality. The project will limit in-water work to the winter season, when the densities of ESA-listed fish are low in the Columbia River. There is ample habitat in the immediate vicinity of the action area for fish to move to, if needed. For these reasons, it is unlikely that effects of chemical contamination from the proposed action will injure or harm any juvenile or adult fish.

Substrate quality. N&C will excavate approximately 1,920 ft^2 of benthic habitat, place the new pipe, and then return the native substrate over the new pipe. Excavation will occur within the sheet-wall, where access and feeding will already be reduced (adults are expected to swim away from the disturbance and smaller juveniles will have reduced ability to feed because of elevated turbidity). Once the sheet-wall is removed, the substrate is expected to recolonize with benthic invertebrates within a few days, although reestablishment of a more stable benthic community is likely to take up to several months after the work is completed. Drifting invertebrates from upstream are expected to recolonize the affected areas once the proposed project is completed. These changes are expected to recover the diversity of invertebrates over time, as the area is recolonized. The prey base will be reduced for up to a few months and spring migrating juvenile of any DPS or ESU salmon and steelhead considered in this opinion that would occupy the action area would experience the temporary effects of this loss. However, during this recovery period, juvenile salmonids can feed nearby in similar habitats, and thus the effects to feeding will be small to negligible.

Upland habitat quality. The existing uplands at the N&C pump station location is highly altered from its natural riverbank characteristics at the project site. The site contains minimal riparian vegetation or trees along the riverbank, and the uplands areas contain existing structural facilities and gravel areas. The installation of the new pipeline into the riverbank and the portion of the new pipeline above the OHWM will likely continue and extend the existence of the upland facilities and structures for the foreseeable future, although the water right remains, with or without the structures. The site contains low-quality riparian habitat features and these new structures will not further reduce the low quality of the habitat. Minimal vegetation will be removed and after project implementation all disturbed uplands areas will be restored to pre-site conditions. Silt fencing along the riverbank, spill prevention and hazardous containment measures will be used to limit erosion and contamination discharge into the Columbia River. The upland facilities and pipeline will not be in waters containing ESA-listed salmonids or critical habitat. NMFS does not anticipate the construction above the OHWM will have effects on listed salmonids.

Ambient light/shading and predation. The reduction of ambient light (e.g., light attenuation and shading) is one of the primary mechanisms by which overwater (barges, moored vessels) and in-water structures (intake, screens, manifold, and pilings,) adversely affect salmon and steelhead. Light levels are a determining factor that 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). Overwater structures can substantially reduce light levels necessary for these behaviors. Studies have documented use, and sometimes selection, of in- and overwater structures by predators such as smallmouth bass and northern pikeminnow (Pribyl et al. 2004; Celedonia et al. 2008).

N&C proposes to use two barges (crane and excavator/materials) in the Columbia River to excavate the trench and install the sheet-wall pilings, steel piles, manifold, new intake pipe and screens. To accomplish this, the barges would be in the water for up to 8 weeks, and would likely move along the sheet-wall, pipe length and vicinity to best access the work area. A stationary barge moored in shallow water can act much like a dock in blocking light and providing a haven for predatory fish such as smallmouth bass and northern pikeminnow, which prey on juvenile salmonids in the Columbia River system (Vigg et al. 1991; Tabor et al. 2004; Zimmerman and Ward 1999; Fritts and Pearsons 2004). The shaded area 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). The shade will only occur during construction, which will last for up to 2 months. During this time, juvenile fish of any DPSs/ESUs may be present; however, predators are less active. Thus, we expect a few individual juvenile salmon or steelhead will experience behavior modifications (reduced feeding success, altered migration, avoidance) that may reduce fitness; and a few individuals may experience injury or death from predation. The duration of this effect from the barges presence is up to 8 weeks.

In addition, the proposed action will install the new intake, six steel piles, the manifold, and screens that will create new permanent in-water structures in the Columbia River. The new in-water structures will permanently increase the amount of in-water structures in the Columbia River by 225 ft^2. The new screens, intake and manifold will be constructed approximately up to 160 ft from shore in water depths approximately up to 15 ft. below the OHWM. These structures may also attract small mouth bass and northern pikeminnow. Pilings placed in flowing water create low velocity microhabitats that allow predators such as smallmouth bass and northern pikeminnow to conserve energy by holding in these areas and catching prey as it passes (Petersen et al. 1993).

The extent of these effects on fish is difficult to quantify in terms of the number of affected fish without elaborate and expensive studies. We anticipate the altered lighting regime and presence of the new in-water structures will increase predation of juvenile salmon and steelhead for the duration of the existence and use of the N&C pump station.

Intake entrainment/impingement during project operation. The project includes installing a new 42-inch-diameter intake pipe into an excavated trench and two 72-inches-wide and 202-inches-long half-barrel fish screens approximately 160 ft from shore. The fish screens (total area 202 ft^2) will be secured and supported by the manifold "tee" connected to the intake pipeline leading to the upland pump station. The new screens will be designed to meet NMFS fish passage criteria, and designs will be reviewed for final approval by NMFS' hydraulic engineer prior to any construction being initiated. The existing intake structure was initially installed in 1968. NMFS is not aware when the existing screens were installed. However, we anticipate they have been in operation for many years or decades, and used during the irrigation season. We anticipate the existing screens are no longer functioning properly and may no longer prevent entrainment or impingement of juvenile salmon or steelhead. Potential injury or mortality of fish at the existing screens during the irrigation season is likely part of the environmental baseline. The new intake pipe and fish screens meeting NMFS fish passage criteria will minimize injury or mortality of listed salmonids. We expect the new screens' designs will reduce the current risk of potential entrainment and impingement to listed juvenile salmon and steelhead compared to the current existing screens. However, it will not completely eliminate the potential risk of any present juvenile salmon or steelhead from injury, or being killed if present in front of the fish screens and intake during pumping operations.

Adult salmonids and most juvenile salmonids in the vicinity of the intakes and screens will likely volitionally swim away from the area and avoid injury or death from entrainment and impingement at the intake screens and pumps. Subyearling Chinook salmon and juvenile steelhead are the most likely to be exposed to effects during rearing or migrating in the shallow waters near the project site. Smaller juvenile fish or smolts present at the immediate front of the intake and screen are more vulnerable to the effects of potential entrainment or impingement at the fish screen and may be injured or killed. We anticipate a few individual juvenile salmon and steelhead of any of the ESUs and DPSs may encounter injury or be killed if they are unable to flee from in front of the intake structures. We do not expect the number of fish killed to be a significant amount to affect the abundance of any population of ESA-listed salmon or steelhead considered in this opinion.

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. Pile-driving increases SPLs and noise during construction. The project entails the placement of 320 ft. of sheet-pile wall as a barrier to surround the work area, and six 12-inch-diameter steel piles. Installation will occur primarily with a vibratory pile-driver. However, an impact pile-driver will be used, if necessary, to hard drive to refusal and set the sheet-walls and piles if substrates prevent all installation by the vibratory driver. Based on the additional information[4] provided by Campbell LLC, the cumulative duration of peak underwater noise from pile-driving is anticipated to be up to 35 hrs from vibratory driver installation, and if necessary up to a maximum of 1,500 strikes (approximately 100 strikes daily) by an impact driver. All pile-driving installation is expected to take approximately up to 2 weeks within the in-work window. Pile-driving operations will only be completed during the day.

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. 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. We anticipate fish will experience behavioral modifications from sounds generated through vibratory driving as fish flee the vicinity. The sharp sound pressure waves associated with impact drivers cause a rapid change in water pressure level. In general, injury and mortality effects from underwater noise are caused by these rapid pressure changes. Impact pile-driving can produce underwater sound pressure waves that can have effects on fish, varying upon the variables of: type and intensity of sounds, size of the piles, firmness of the substrate, water depth, and the type and size of the pile-driver. Larger piles and firmer substrate require greater energy to drive the

[4] Email between Eric Campbell (Campbell LLC) to Rebecca Viray (NMFS) on June 25, 2020, containing additional information of total vibratory and impact driving details for removal and installation of sheet-walls and steel piles.

pile resulting in higher SPLs. This is a relationship between driven energy and its transformation into overcoming friction or resonance. Hollow steel piles produce higher SPLs than similarly-sized wood or concrete piles (Hastings and Popper 2005). Sound attenuates more rapidly in shallow water than in deep waters (Rogers and Cox 1988). However, fish with swim bladders and smaller fish, which tend to be in shallower water, have been shown to be more vulnerable to injury (Hanson et al. 2003).

A multi-agency work group determined that to protect listed species, sound pressure waves should be below the threshold of 206 decibels (dB) and, for cumulative strikes, either 187 dB sound exposure level (SEL) where fish are larger than 2 grams or 183 dB SEL where fish are smaller than 2 grams. In addition, a "harassment" threshold below SPLs of 150 dB is applied for behavioral effects to individual listed fish (Popper et al. 2006; FHWG 2008).

Sheet piles. Some rearing juvenile salmon and steelhead may experience the effects of these SPLs. Based on estimates using NMFS hydroacoustic calculator, we anticipate that behavioral effects [(150 dB root mean square (RMS)] will occur in a semicircle out to 3,981 meters (2.47 miles) from each sheet pile installed in-water by an impact pile-driver. However, there are a multitude of possible behavioral responses that may occur; from no change, to a mild awareness, a startle response, small temporary movements, or larger movements that displace the fish from their normal location. The result of exposure could be a temporary threshold shift in hearing due to a temporary fatiguing of the auditory system that can reduce the survival, growth, and reproduction of the affected fish by increasing the risk of predation and reducing foraging or spawning success (Stadler and Woodbury 2009).

Pilings. For this project, NMFS completed calculations to determine distances individual fish may encounter effects from impact pile-driving based on information provided in the submitted BA. We used the baseline single strike levels of 207 dB peak, 173 dB SEL, and 189 dB RMS for a 12-inch-diameter steel piling measured at 10 meters and a default transmission loss constant of 15 meters. The project anticipates at the maximum, if all work requires pile installation by impact driver, there will be an estimated 100 pile strikes daily (project total 1,500 strikes over a 2-week duration). Based on these calculations, the onset of physical injury would occur up to at a maximum distance of 82 ft (25 meters) from the pile for fish greater than 2 grams (juvenile salmonids present in the action area will be greater than 2 grams). However, NMFS hydroacoustic calculator is conservative to determine maximum distance of direct injury or behavioral modifications to listed species. Our calculation assumes 100 impact pile strikes would occur within a single day with an overnight break before resuming impact driving the next day. It is likely most pile-driving will be installed by a vibratory hammer. This will reduce potential direct injury or death to individual listed fish present within the radius where SPLs will extend. The applicants will use a bubble curtain during any impact driving installation. The proper use of a sound attenuating device (confined bubble curtain) can also result in reductions in SPLs depending on the type of impact driver and site specific conditions, potentially reducing effects to listed species during pile-driving (Wursig et al. 2000; CalTrans 2015).

It is difficult for NMFS to determine the type of response an individual fish will make or what type of effect that response has to a population. However, vibratory pile driving is reasonably certain to alter individual salmon and steelhead rearing and migration behavior. In general, it is reasonable to assume some fish will exhibit a behavioral response over the duration of pile-driving activity and will likely flee the immediate area. NMFS anticipates the majority of fish will respond by adjusting their behavior.

The use of a vibratory driver on the sheet wall or piles, with no hard driving to refusal, will greatly reduce the level of noise associated with the work, if feasible. Also, the noise and disturbance of driving pile is ephemeral, and timing restrictions will minimize the number of fish that will be exposed. NMFS expects some fish will be harassed by the action and flee the area. NMFS does not believe that this response to vibratory driving will result in immediate direct injury or death to juvenile salmon or steelhead. However, we anticipate some individual fish may experience behavioral modifications including reduced feeding success, altered migration, altered reaction time, and increased exposure risk to predators from avoiding elevated SPLs during vibratory pile-driving (CalTrans 2015). These behavioral modifications may reduce the fitness of a few juvenile salmon or adult or juvenile steelhead to a point where a few fish may be injured or increase exposure to death.

We anticipate a few individual juvenile salmon and steelhead of any of the ESUs and DPSs may encounter hydroacoustic SPLs during impact pile driving that will injure or kill them. We anticipate any individual salmon and steelhead greater than 2 grams and present with 82 ft. from the site of impact driving will be injured or killed. We anticipate a small number of adult steelhead will overwinter in the mainstem Columbia River. A very few individual adult Chinook migrate through the John Day Reservoir starting mid-March. We do not expect SR-fall Chinook present during the winter in-water work window. The fish injured or killed will likely be distributed among the remaining populations of each ESU and DPS that could be present. We do not expect the number of fish killed to be a significant amount to affect the abundance of any population of ESA-listed salmon or steelhead considered in this opinion.

Reduced access and passage. The installation of the new permanent in-water structures (steel-pilings, intake, manifold and screens) and sheet-wall pilings will create both long-term and short-term barriers limiting access and reducing passage to a small footprint within the action area for any juvenile or adult salmon or steelhead into the in-water work area or along the shoreline of the Columbia River. The reduced in-water work area is a small size and portion relative to the available migratory and rearing habitat within the John Day Reservoir. The project will result in a permanent increase of 225 ft^2 new in-water structures in the Columbia River. The presence of these structures may prevent some juvenile salmon or steelhead from access and use of the immediate habitat at the intake site. The action area contains ample space and migratory access around the site location and we expect adult and juvenile salmonids and steelhead will navigate around the in-water work area. We expect a few individual juvenile salmon or steelhead will experience behavior modifications (reduced feeding success, altered migration, avoidance) but we do not anticipate this will alter the fitness of juvenile salmon or adult or juvenile steelhead.

Relevance of Effects on Individual Fish to Salmonid Population Viability

To determine whether the effects to individual fish are meaningful, we analyze the effect of the proposed action on VSP characteristics [abundance, population growth rate (productivity), spatial structure, and diversity] at the scale of the population. While these characteristics are described as unique components of population dynamics, each characteristic exerts significant influence on the others. For example, declining abundance can reduce spatial structure of a population, and when habitats are less varied, then life history diversity within a population can decline.

Abundance. Due to the small footprint of the excavation and the use of the in-water work period when few individuals are present, very small numbers of juveniles of salmon and steelhead of any of the DPSs and ESUs in this opinion will be injured or killed during pile-driving, in-water construction activities, excavation or backfilling of the trench. Juvenile steelhead and subyearling Chinook salmon are the most likely to be present during this season. The action will result in a short-term small, localized reduction in prey availability. We expect these benthic invertebrate organisms to recolonize quickly so that there will be little effect on prey by the time juvenile salmonids are present and little effect on fish condition or survival. The installation of the new intake and screens will minimize risk of entrainment and impingement while pumping during the irrigation season. NMFS-approved fish screens will reduce the ongoing loss of fish compared to the current intake and screens. However, it will not eliminate all potential of injury or death of individual fish. We expect a few juvenile salmonids and steelhead will be injured or killed each irrigation season over the long-term pumping of irrigation water from the intake and screens. The new in-water structures will provide a small increase in cover for predators. We anticipate there will be a long-term small increase in piscivorous predation of a small number of juvenile steelhead and salmonids for the existence of the in-water structures. Other effects of the action (short-term reduction to available passage and migration, and increases in fine sediments and turbidity) will modify the behavior of individuals in the action area, but are not likely to affect survival. The loss of a few juvenile fish in any population will not meaningfully change its abundance.

Productivity. A few adult steelhead may be displaced during in-water construction, but no adults are expected to be killed or harmed. A few individual juvenile fish from spring-migrating populations of Chinook and steelhead may be injured or killed during in-water work. A few individual juvenile salmon or steelhead from any DPSs and ESUs may be injured or killed when the intake pumps and screens are operated during the irrigation season. A few juvenile salmon and steelhead may be injured or killed due to an increased risk of piscivorous predation from the additional new in-water structures providing cover for predators. We expect this loss of a few fish will occur for the long term for the duration of the operation and existence of the intakes and in-water structures. No more than a few juveniles of any population is expected to be injured or killed. These effects will not alter the productivity of any of the populations.

Spatial structure. NMFS does not expect the proposed project to affect the spatial structure of any of the affected populations because the proposed action will not affect the distribution of any populations nor block access to habitat.

Diversity. The project's related activities are not likely to affect more than a few individuals of any population or DPSs and ESUs due to the use of the in-water work window when very few individuals of any population will be present in the action area. Any individual juveniles in the vicinity that encounter effects would be a very small proportion of each of the species' populations that will be exposed to project-related activities or long-term operations (e.g., entrainment or impingement on the screens).

2.5.3. Effects on Critical Habitat

The critical habitat PBFs most likely to be affected are substrate, water quality, forage, and safe passage.

Substrate
Approximately 1,920 ft^2 of near-shore, shallow-water benthic habitat will be disrupted by trench excavation (up to 12 ft. deep), pile driving, and intake pipe and screen installation during in-water construction. Approximately 630 cu yd of native substrate and material will be removed and used as fill to cover the installed intake pipe, returning the natural contours of the streambed of the Columbia River. Pile driving to install sheet-wall and six steel piles will disrupt established substrate. The installation of the six new 12-inch-diameter steel piles will permanently remove approximate 5 ft^2 of channel substrate, a very small portion of the available habitat in the John Day Reservoir. Increased turbidity from project activities will result in sediment deposition downstream of the in-water work area, which has the potential to adversely affect primary and secondary productivity (Spence et al. 1996) for a short time period during and immediately following in-water work. Excess fine sediment in the action area is expected to occur over a small area and is likely to be transient, as daily and seasonal increases in water velocity associated with dam operations remobilize and redeposit these sediments in slower moving portions of the reservoir. The scale of impact will be minimal relative to the rearing habitat in the action area, and will not meaningfully change the conservation value of substrate within the John Day Reservoir.

Water Quality
The proposed action will have a short-term (up to 2 months) negative effect on water quality by increasing suspended sediment and turbidity during construction; this will occur during the installation of the sheet-pile barrier and excavation within the sheet-pile barrier. Additionally, an area up to 500 ft downstream of the in-water work area will have increased suspended sediment for minutes to hours after the sheet-wall barrier is removed. The size and velocity and naturally high turbidity of the river in the John Day Reservoir results in relatively homogenous physical, chemical and biological characteristics. Thus, the turbidity pulse following sheet-wall barrier removal will quickly become mixed with the river and be indistinguishable from background levels. In addition to the sheet-pile barriers, N&C proposes to use erosion and sediment measures to reduce excess turbidity and suspended fine sediments. NMFS anticipates any excess turbidity will dilute and disperse with the river current and not be distinguishable from background levels 500 ft downstream of the proposed action.

The use of heavy equipment may result in very small amounts of pollutants entering waterways as discussed above. However, the project will use conservation measures (storage and fueling or lubricants, fuels in designated areas, hazardous and spill containment booms) to minimize and limit effects of chemical contamination reducing water quality. Through the use of these measures, it is unlikely chemical contamination will have more than a minimal effect to water quality.

Given the BMPs, erosion control methods, a PCP plan, and the use of the in-water work window, NMFS believes that the effects to water quality will not meaningfully decrease the function of this PBF in the action area.

Forage
The proposed action will have a short-term negative effect on benthic macroinvertebrates by crushing, covering, or displacing them during excavation and installation of the intake pipe in an area approximately 1,920 ft^2. We expect nearby benthic macroinvertebrates will begin to recolonize within several days to weeks, and will fully recolonize the area within a few months after project completion. The alteration of this amount of habitat could have some localized effects to forage for out-migrating and rearing juvenile salmonids and steelhead that use this nearshore area during construction, and for up to several months after project completion. However, we do not anticipate the localized reduction in available forage will have long-term impact to the quality of habitat. Given the size of the reservoir, the amount of available local nearshore habitat, and the short-term nature of the effect, NMFS does not anticipate that this project will change the conservation value of forage in the John Day Reservoir.

Safe Passage
The proposed action will create short-term and long-term alteration of PBFs for passage. Short-term safe passage will be reduced during the 8-week in-water construction period when the sheet-wall barrier and barges are present. This construction will occur at a time when very few fish of any species will be migrating either upstream or downstream. The installation of 225 ft^2 of new in-water structures will reduce a small amount of habitat available for safe passage as long as the pump station exists.

We expect NMFS-approved fish screens, in place of the old existing screens, will improve condition and beneficial effects regarding safe passage, reducing risk of entrainment and impingement in front of the intakes.

Bass and northern pikeminnow are predators on juvenile salmonids. To the extent that the temporary over-water and permanent in-water structures increase bass and pikeminnow predation success, the proposed action could minimally reduce juvenile salmon and steelhead passage success.

We expect both the short-term and long-term alteration of passage will occupy only a small footprint, around which migration in either direction will be unimpeded. We expect this alteration of the PBFs for safe passage due to the new in-water structures will be permanent.

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 vs. cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 2.4).

During this consultation, NMFS searched for information on future state, tribal, local, or private actions that were reasonably certain to occur in the action area. Resource-based activities such as timber harvest, agriculture (including substantial irrigation withdrawals affecting both tributary and mainstem Columbia River flows), mining, shipping, and energy development are likely to continue to exert an influence on the quality of freshwater habitat in the action area. Irrigation of farmlands contributes to large amounts of in-stream water withdrawals throughout the basin. Applications of pesticides and chemicals for agricultural production contribute to pollutant inputs and accumulate to degrade water quality. Additional effects to the Middle Columbia River are anticipated with population growth, urban development, and increases in recreational use of the Columbia River. The population of Umatilla County, Oregon, grew 2.7%[5] from 2010 to 2019. NMFS assumes the population for Umatilla County will continue to grow for the foreseeable future. As the human population in the action area grows, demand for agricultural, commercial and residential development, and recreation is likely to increase as well. Industrial and commercial development often contribute to increases in shoreline riprap, altered landscapes and increases in impermeable surfaces. The effects of new development are likely to reduce the conservation value of the habitat within the action area. However, the magnitude of the effect is difficult to predict and is dependent on many social and economic factors. 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.

Although these are ongoing and likely to continue in 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). 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 also be reviewed by NMFS. 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 habitats.

2.7. Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we 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 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

[5] U.S. Census Bureau. Available at: https://www.census.gov/quickfacts/morrowcountyoregon.

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 environmental baseline is characterized by degraded floodplain and channel structure, altered sediment routing, altered hydrology, and altered water quality. Within the action area, the major sources of impacts to salmon and steelhead are hydropower dam systems as well as the continued development and maintenance of the shoreline including marinas, docks, roads, railroads, and riprap. Dams and reservoirs within the migratory corridor have altered the river environment and affected fish passage. Water impoundment and dam operations 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. 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 Columbia River 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. The cumulative effects of state and private actions within the action area are anticipated to continue to have negative effects on ESA-listed salmonids.

Climate change is likely to affect the abundance and distribution of the ESA-listed species considered in the opinion. The exact effects of climate change are both uncertain, and unlikely to be spatially homogeneous, and the ability of listed-species to adapt is uncertain. Most of the effects of the action are short term, and thus will not exacerbate the effects on species and habitat caused by climate change. The long-term effects of impingement at the new screens is likely to continue. The installation of new screens will reduce impingement as long as the screens are maintained, and this effect will not be altered by climate change. The current withdrawals of irrigation water are considered in the baseline flows.

The action area is used by UCR spring-run Chinook salmon, UCR steelhead, MCR steelhead, SRB steelhead, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, and SR sockeye salmon. Upper Columbia River spring-run Chinook salmon and SR sockeye are listed as endangered. All three UCR spring-run Chinook salmon populations, and the single extant SR sockeye salmon population, have an overall viability rating of high risk. The other five species are listed as threatened, and while some populations are viable, most populations within these ESU/DPSs remain at moderate or high risk of extinction.

NMFS anticipates the proposed action will affect juvenile UCR spring-run Chinook salmon, UCR steelhead, MCR steelhead, SRB steelhead, SR spring/summer-run Chinook salmon, and SR fall-run Chinook salmon within the active in-water work area during the winter months. We do not expect juvenile SR sockeye salmon to be present in the action area during the in-water work window. However, an individual juvenile sockeye may on occasion be rearing in the John Day Reservoir. Smaller juvenile fish that are less likely to flee may experience passage alteration if delayed within the sheet-wall barrier and are likely to die or be injured by equipment, pile-driving or high levels of turbidity. The work area is a small area and will affect only a few individuals of any population of each species. Adult UCR, MCR and SRB steelhead are the most likely to be in the John Day Reservoir in the winter work window, and they are highly likely to avoid the disturbance caused by the construction. Adult steelhead are migrating or holding in the reservoir in the winter, and the avoidance behaviors are not expected to reduce their fitness because there is other similar habitat in the vicinity. A few individual adult UCR spring-run Chinook and SR spring/summer Chinook salmon may migrate through the action area beginning mid-March. We do not anticipate adult SR fall-sun Chinook or adult SR sockeye salmon will be present during the in-water work window.

In addition to direct injury or death, juvenile salmonids may be harmed during and in the few months following construction because of the following:

- Temporary reduction in available forage may disrupt established macroinvertebrate communities.
- Temporary sheet-wall pilings and new in-water structures may slightly disrupt normal passage or migration activities, and juveniles will likely swim around the barrier and structures during passage.
- Vibratory pile-driving may create behavioral modifications as juveniles flee the area.
- Barges and new in-water structures may provide cover for predatory fish, which may kill or injure juveniles.
- Increased turbidity may disrupt normal feeding activities of juveniles and displace them to other areas of the reservoir.

These effects will be minor, temporary (days to a maximum of 2 months), and will affect all populations of juvenile salmonids that are present in the John Day Reservoir during the winter work window.

In addition to these short-term effects, there are likely to be long-term consequences of the proposed action. The screens on the new intake pipe will comply with NMFS's screening criteria to minimize entrainment of juveniles into the pipes. However, even with proper maintenance a small number of juveniles may become impinged or scrape along the screen resulting in injury or death. The additional new in-water structures may result in an increase of exposure risk to predation for juveniles of all the species over the long-term existence of the structure.

Considering the effects of the action in conjunction with the existing condition of the environmental baseline and the small level of potential cumulative effects, NMFS has determined that the loss of a very small number of juvenile salmon and steelhead that may be caused by the proposed action will not be substantial enough to negatively influence VSP criteria at the population scale and will not appreciably reduce the likelihood of any population maintaining its current status. Because the effects will not be substantial enough to negatively influence VSP criteria at the population scale, the viability of MPGs, ESUs, and DPSs are also not expected to be reduced. The effects of the proposed action are not likely to appreciably reduce survival of any of the seven species considered in this opinion at the species level, nor is the action likely to reduce the likelihood of recovery of these species.

2.7.2. Critical Habitat

The proposed action has the potential to affect numerous PBFs within the action area. Those PBFs include water quality (sediment, turbidity, and chemical contamination), substrate, safe passage, and forage. The primary effects of the action will be short-term construction-related effects, and the long-term alteration of safe passage from additional in-water structures in the Columbia River. NMFS expects adverse effects to the above PBFs from the reduced water quality, temporary disturbance of the substrate and shallow-water benthic habitat which will cause a temporary change to prey availability in the disturbed area. Increases in TSS and turbidity during project construction are expected to be high within the sheet-wall area. Once the sheet-wall barrier is removed, water quality will be impaired by a turbidity plume that may extend as far as 500 ft downstream of the excavation area, and last for up to a few hours. Background levels of turbidity in the John Day Reservoir are quite high, and this temporary increase in turbidity in a small area of the river will not change water quality at the scale of the critical habitat designation.

Benthic disturbance in the excavation area will reduce prey availability. The prey invertebrates will start to recolonize as soon as construction is done. Recolonization will occur over a couple of months. The disturbed area is a small fraction of similar quality, shallow habitat area available for use in the John Day Reservoir.

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 cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of the seven species considered in this opinion, or destroy or adversely modify their designated critical habitat.

2.9. Incidental Take Statement

Section 9 of the ESA and federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the federal agency or applicant (50 CFR 402.02). 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 the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows: (1) behavioral changes due to increased turbidity and in-water disturbance; (2) increased injury or death from predation; (3) mechanical injury or death from in-water work equipment; (4) injury or death from entrainment or impingement at intakes or screens; and (5) behavioral changes, injury or death from hydroacoustic disturbance generated from vibratory or impact pile-driving activities. NMFS is reasonably certain the incidental take described here will occur because: (1) recent and historical surveys indicate 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 steelhead and salmon.

We anticipate the proposed action may result in harm, harassment, injury or death to juvenile salmon or steelhead from any of the DPSs and ESUs within the active in-water construction area. Subyearling Chinook salmon and juvenile steelhead are the most vulnerable and likely to be exposed to injury or death while rearing in shallow water habitat during the in-water work window. Although juvenile SR sockeye salmon are least likely to be present during the in-water construction, an individual fish may occasionally rear in the winter. Based on the timing and shallow water depths adult steelhead (SRB, MCR and UCR) are more vulnerable and a small number of fish are likely to be present during the in-water work. A small number of adult Chinook may be migrating through the action area during the end of the in-water work window. Adult UCR spring-run and SR spring/summer Chinook salmon are least vulnerable to effects from construction. Adult sockeye salmon and SR fall-run Chinook salmon are not anticipated to be in the project area during in-water construction.

Incidental Take from Increased Turbidity and Disturbance
NMFS expects salmon and steelhead to be temporarily displaced and may have reduced feeding (harm) due to elevated turbidity levels resulting from in-water work associated with the installation and removal for the sheet-wall barrier, and excavation and installation for the intake pipeline and screens. Because it is not feasible to observe fish harmed, NMFS will use the extent and duration of the turbidity plumes as a surrogate for take resulting from degraded water quality. These indicators are causally linked to incidental take from channel excavation, sheet-wall installation and removal, and intake screen assembly installation in waters containing the seven species covered in this opinion, because the amount of take increases as turbidity associated with the in-water work increases in extent and duration. Therefore, NMFS will consider the extent of take exceeded if a turbidity plume exceeds 10% of background measurements during project construction (as measured 500 ft. downstream from in-water work) or extends further than 500 ft. downstream of the in-water work area for more than two consecutive monitoring intervals.

Incidental Take from Increased Predation
NMFS expects the proposed action will result in harm, harassment, injury or death to juvenile salmon and steelhead by increases in exposure to piscine predators. Salmon and steelhead fleeing from predators may experience behavior modifications (harm) through reduced feeding success, altered migration from avoiding predators (harassment). The modifications may result in reduced fitness and survival to any juvenile steelhead or salmon present. We expect injury or death of juvenile salmon and steelhead from increased predators due to the temporary reduction in ambient light and shade from the presence of the temporary barges and from the additional increase in permanent in-water structures. We expect some juvenile salmon and steelhead will experience direct injury or be killed from increased interactions with predators.

Estimating the specific number of animals injured or killed by increased predation is not possible because of the range of responses that individual fish will have, and because the numbers of fish present is highly variable. While this uncertainty makes it impossible to quantify take in terms of numbers of animals injured or killed, the duration of the temporary habitat change coupled with the permanent change in habitat to which fish will be exposed is readily discernible and presents a reliable measure of the extent of take that can be monitored and tracked.

The increased predation associated with the presence of the barges is best quantified by the duration of the barge presence during in-water construction. The increased predation associated with the new additional in-water structures (225 ft^2) will likely occur as long as the pump station exists. Therefore, the increased predation from the additional permanent in-water structures is best represented by the size of the footprint the new structures will occupy. The proposed surrogate is linked to anticipated take because it describes both the duration and amount of area of changes in habitat conditions that will cause take due to increases in predator habitat. Also, this clearly quantifiable measure can easily be measured to determine if take might be exceeded. Specifically, NMFS will consider the extent of take exceeded if the presence of the temporary barge at the project in-water work site exceeds 60 days, or if the overall increased amount of the area of the new in-water structures (intake, manifold and screens) exceeds the 225 ft^2. Therefore, the duration of the temporary habitat modified by the presence of the barge during in-water work and the area of the new in-water structures represents the extent of take exempted from increased predation in this ITS.

Incidental Take from Mechanical Injury or Death
NMFS anticipates the proposed action will result in injury or death as a result of in-water excavation and fill. Estimating the specific number of animals injured or killed by interactions with heavy equipment is not possible because of the range of responses that individual fish will have, and because the numbers of fish present at any time is highly variable. While this uncertainty makes it impossible to quantify take in terms of numbers of animals injured or killed, the extent of habitat altered by excavation and installation of the in-water pipeline is readily discernible and presents a reliable measure of the extent of take that can be monitored and tracked. Therefore, the estimated extent of habitat encompassed by trench excavation and filling represents the extent of take associated with mechanical injury and death. The proposed surrogate is causally linked to anticipated take because it describes conditions that will cause take due to in-water work. Specifically, NMFS will consider the extent of take exceeded if the limits of excavation and filling exceed 2,000 ft^2.

Incidental Take from Entrainment and Impingement
NMFS anticipates the proposed action will result in injury or death as a result of entrainment and impingement at screens at the intake pump station. Estimating the specific number of animals injured or killed at intake screens is not possible because of the range of responses that individual fish will have, and because the numbers of fish present at any time is highly variable. While this uncertainty makes it impossible to quantify take in terms of numbers of animals injured or killed, the rate of water withdrawal at the intake screens is readily discernible and presents a reliable measure of the extent of take that can be monitored and tracked. The intake will have fish screens designed and installed appropriate for the authorized water right pumping rate to minimize entrainment or impingement of individual fish. The fish screens will be approved to meet NMFS fish passage criteria to minimize injury or death. Therefore, the estimated rate of the water withdrawal while pumping at the intakes represents the extent of take associated with entrainment or impingement. The proposed surrogate is linked to anticipated take because it described conditions that will cause take due to fish experiencing entrainment or impingement at the intake pump and screen. Specifically, NMFS will consider the extent of take exceeded if the withdrawal pumping rate exceeds 10,000 gpm at each intake screen, or exceed above 19,210 gpm from both intake screens.

Incidental Take from Hydroacoustic Sound Pressure Levels during Pile-Driving
NMFS expects the proposed action will result in harm, harassment, injury or death to salmon and steelhead by exposure to hydroacoustic SPLs during vibratory and impact pile-driving activities. Salmon and steelhead experience behavior modifications (harm) through reduced feeding success and altered migration from avoiding elevated SPLs during vibratory pile driving. The modifications may result in reduced fitness and survival to any juvenile steelhead or salmon present. Any fish present in the vicinity out to 82 ft. from the sheet-wall barrier or steel pile installation by impact pile driving can result in injury or death to listed species.

Estimating the specific number of animals injured or killed by pile driving is not possible because of the range of responses that individual fish will have, and because the numbers of fish present, is highly variable. While this uncertainty makes it impossible to quantify take in terms of numbers of animals injured or killed, the duration of the pile-driving activities to which fish will be exposed is readily discernible and presents a reliable measure of the extent of take that can be monitored and tracked. Therefore, the duration of vibratory pile-driving (excess of 35 hrs) or the number of strikes (150 daily[6]) by an impact pile driver represents the extent of take associated with hydroacoustic SPLs during impact pile-driving activities. The proposed surrogate is linked to anticipated take because it described conditions that will cause take due to fish experiencing behavioral modifications during either vibratory pile driving, or injury or death from impact pile driving during the in-water pile installation activities. Specifically, NMFS will consider the extent of take exceeded if construction includes above 35 hrs. of vibratory pile driving, or exceeds 150 strikes per day by an impact pile-driver.

[6] The proposed action estimated up to a maximum of 100 strikes daily by an impact driver if necessary. Our Extent of Take (150 strikes) includes a margin above the estimated strike number. We anticipate this additional number of daily strikes would not alter our anticipated effects analysis for the project.

The surrogates described above are measurable, and thus can be monitored and reported. For this reason, the surrogates function as effective reinitiation triggers.

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 the species or destruction or adverse modification of critical habitat.

2.9.3. Reasonable and Prudent Measures

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

1. Avoid or minimize take from habitat disturbance and mechanical injury.
2. Avoid or minimize take from reduced water quality.
3. Avoid or minimize take from increased predation.
4. Avoid or minimize take from injury or death from entrainment or impingement.
5. Avoid or minimize take from injury or death from pile-driving activities.
6. Conduct sufficient monitoring to ensure that the project is implemented as proposed, and the extent of take is not exceeded.

NMFS believes that full application of conservation measures included as part of the proposed action, together with use of the RPMs and terms and conditions described below, are necessary and appropriate to minimize the likelihood of incidental take of listed species due to completion of the proposed action.

2.9.4. Terms and Conditions

The terms and conditions described below are non-discretionary, and the Corps or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). 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 RPM 1:
    a. Conduct all work below the OHWM within as short a period as possible between December 1 and March 31.
    b. Confine excavation to the minimum area necessary to achieve project goals, no larger than 2,000 ft^2.
    c. Implement all proposed impact minimization measures and BMPs as described in the Proposed Action section of this opinion and in the BA dated June 2020.

2. The following terms and conditions implement RPM 2:
    a. Conduct turbidity monitoring as follows:

i. All in-water construction shall be conducted following the proposed sediment control measures and follow state and federal water quality requirements to minimize sedimentation and turbidity in the Columbia River.
ii. Monitoring will be conducted daily, every 4 hrs during daylight hours, when in-water work is conducted.
iii. Observations shall occur daily before, during, and after commencement of construction activities and compared to observable baseline turbidity measurements upstream of the action area.
iv. Background measurements will be measured or observed at an undisturbed site within the flow channel approximately 100 ft. upstream of the project area.
v. Compliance measures will be measured or observed in the flowing channel approximately 500 ft. downstream from the project area. If visible plume is observed at 500 ft. downstream, turbidity measurements should not exceed above 10% of the background measurements. If turbidity is exceeded, BMPs will be modified and additional sediment control measures will be installed to minimize downstream increase of turbidity and fine sediments. Properly sized curtains will be used to ensure that the curtains remain in constant contact with the substrate, and span the entire water column. Monitoring will be continued every 4 hrs. If plume is observed to exceed 10% of background measurements (after 8 hrs.), work shall be stopped until the turbidity level returns to baseline conditions.

3. The following terms and conditions implement RPM 3:

a. The Corps (or applicant) shall remove the barges from the action area as soon as in-water construction is complete.

4. The following terms and conditions implement RPM 4:

a. All intakes shall have fish screens to avoid juvenile fish entrainment and impingement and will be operated in accordance with NMFS' current fish screen criteria (NMFS 2011).

5. The following terms and conditions implement RPM 5:

a. Use a vibratory driver to drive piles, provided substrate conditions are appropriate. If substrate conditions are not appropriate, an impact driver may be used and an attenuating sound reduction method or bubble curtain will be required.
b. Drive each piling as follows to minimize the use of force and resulting sound pressure:
i. Use the smallest driver and the minimum force necessary to complete the job.
ii. Use a drop driver or a hydraulic impact driver whenever feasible, and set the drop height to the minimum necessary to drive the piling.
iii. When possible, place a block of wood or other sound dampening material between the driver and the piling being driven.

iv. If water velocity is 1.6 fps or less, surround the piling being driven by a confined or an unconfined bubble curtain that will distribute small air bubbles around 100% of the piling perimeter for the full depth of the water column.
v. If water velocity is greater than 1.6 fps, surround the piling being driven by a confined bubble curtain (e.g., a bubble ring surrounded by a fabric or metal sleeve) that will distribute air bubbles around 100% of the piling perimeter for the full depth of the water column.

c. Require 12 hrs. of non-pile-driving time overnight prior to each day's impact pile-driving activities to minimize cumulative effects.

6. The following terms and conditions implement RPM 5:

a. Track and monitor construction activities (as described below) 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. Details of total footprint of disturbed area during in-water excavation and installation of pipeline to ensure meeting the extent of take requirements.
   iii. Summary and details of turbidity monitoring including:
      a. Any daily observed turbidity plume from the in-channel work area to 500 ft downstream during the in-water construction period. Observations shall occur daily before, during and after commencement of construction activities and compared to observable turbidity.
      b. Description of the visually monitored downstream extent of turbidity plumes resulting from in-water construction and excavation activities, including removal of the sheet-pile wall barrier.
      c. A summary of turbidity monitoring results, including results of implementing required BMPs, and including a description of any erosion control failure, excess turbidity release, and efforts to correct such incidence.
   iv. Photos of habitat conditions (open water including sediment control measures, shoreline, banks, vegetation, etc.) at the in-water work site before, during, and after project completion. General views and close-ups showing details of the project and project area, including pre- and post-construction. Label each photo with date, time, project name, photographer's name, and the subject.
   v. Number and species of any observed injured or dead listed salmon or steelhead found at the in-water work site.

c. All reports will be sent to:

   National Marine Fisheries Service
   Columbia Basin Branch
   304 South Water Street, Suite 201
   Ellensburg, Washington 98926

   i. Reference to NMFS consultation number WCRO-2020-01190.

d. If the amount or extent of take is exceeded, stop project activities and notify NMFS immediately.

2.10. Conservation Recommendations

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

The following conservation recommendations are discretionary measures that NMFS believes are consistent with this obligation and therefore should be carried out by the federal action agency:

1. Work with N&C and other water users in the Columbia River Basin including landowners on long-term plans and designs to improve water use and efficiency that result in more water remaining in the stream or river for fish, and to upgrade and modify other existing pump stations and intakes to prevent injury to fish and aquatic resources.

2.11. Reinitiation of Consultation

This concludes formal consultation for the N&C Irrigation Improvement Replacement Project.

As 50 CFR 402.16 states, reinitiation of consultation is required and shall be requested by the federal agency or by NMFS where discretionary federal agency involvement or control over the action has been retained or is authorized by law and if (1) the amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the 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 (4) a new species is listed or critical habitat designated that may be affected by the action.

3. MAGNUSON–STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT 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 (PFMC) 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 BA 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 habitat connectivity.

The proposed project includes adding temporary barges, excavation of channel substrate, pile-driving and installation of the new intake pipe beneath the substrate of the Columbia River, and then covering the new pipe with substrate material removed during excavation. This will alter approximately 2,000 ft^2 of river bottom, altering benthic habitat and macroinvertebrate production. This action will result in short-term effects to water quality and feeding habitat.

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

1. The temporary alteration of the near-shore environment by excavation and placement of structures beneath the channel substrate which will temporarily (during construction) affect juvenile rearing and the quality of habitat in the migration corridor.
2. Temporary reduction in prey availability from removal and disturbance of the macroinvertebrate community and as a result of increased fine sediment in stream substrates due to instream work.
3. Short-term elevation of turbidity and sedimentation within and immediately downstream from the construction area from construction activities.
4. Habitat disturbance due to vibratory and possibly impact pile-driving (hydroacoustic impacts). The sound associated with pile-driving alters the physical properties of the habitat, temporarily reducing the quality of the habitat in the action area.

3.3. Essential Fish Habitat Conservation Recommendations

We provide the following conservation recommendation:

1. Implement RPM 1, RPM 2 and RPM 5, and their terms and conditions described in the ITS in the ESA portion of this document, to minimize adverse effects to EFH due to pile-driving, operation of heavy equipment, and sediment disturbance.
2. Implement RPM 6, 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 these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in Section 3.2 above, EFH 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 Data Quality Act specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1. Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the Corps. Other interested users could include N&C, IRZ, Campbell LLC, and the citizens of Umatilla County. Individual copies of this opinion were provided to the Corps. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adheres to conventional standards for style.

4.2. Integrity

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

4.3. Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

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

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

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

5. REFERENCES

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