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

Refer to NMFS No.: WCR-2018-11034

February 8, 2019

Thomas Montoya
Forest Supervisor
Wallowa-Whitman National Forest
1550 Dewey Avenue, Suite A
Baker City, Oregon 97814

Lt. Col. Christian N. Dietz
U.S. Army Corps of Engineers
Walla Walla District
201 North Third Avenue
Walla Walla, Washington 99362

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Hells Canyon Creek Boat Ramp Repair Project, Snake River-Butte Creek Subwatershed, HUC 170601010102, Wallowa County, Oregon

Dear Mr. Montoya and Lt. Col. Dietz:

Thank you for your letter dated October 29, 2018 requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Hells Canyon Creek Boat Ramp Repair Project. The enclosed document contains a biological opinion (Opinion) prepared by NMFS on the effects of your proposed project. In this Opinion, NMFS concludes that the action, as proposed, is not likely to jeopardize the continued existence of Snake River Basin steelhead, Snake River spring/summer Chinook salmon, and Snake River fall Chinook salmon, or result in the destruction or adverse modification of designated critical habitat for these species.

As required by section 7 of the ESA, NMFS provides an incidental take statement (ITS) with the Opinion. The ITS describes reasonable and prudent measures (RPMs) NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements that the Wallowa-Whitman National Forest (WWNF), U.S. Army Corps of Engineers, and/or any person who performs the action must comply with to carry out the RPMs. Incidental take from actions that meet these terms and conditions will be exempt from the ESA take prohibition.

This document also includes the results of our analysis of the action's effects on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and includes three Conservation Recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. These Conservation Recommendations are similar but not identical to the ESA Terms and Conditions. Section 305(b)(4)(B) of the MSA requires federal agencies provide a detailed written response to NMFS within 30 days after receiving these recommendations.

If the response is inconsistent with the EFH Conservation Recommendations, the action agencies must explain why the recommendations will not be followed, including the justification for any disagreements over the effects of the action and the recommendations. In response to increased oversight of overall 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, in your statutory reply to the EFH portion of this consultation, NMFS asks that you clearly identify the number of Conservation Recommendations accepted.

If you have questions regarding this consultation, please contact Mr. Brad DeFrees, Southern Snake Branch Office, at (208) 378-5698, or brad.defrees@noaa.gov.

Sincerely,

Michael P. Tehan
Assistant Regional Administrator
Interior Columbia Basin Office
NOAA Fisheries, West Coast Region

Enclosure

cc: J. Vacirca – WWNF
A. Miller – WWNF
G. Sausen – USFWS
A. Rogerson – NPT

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

Hells Canyon Creek Boat Ramp Repair Project, Wallowa County, Oregon
Snake River-Butte Creek Subwatershed, HUC 170601010102

NMFS Consultation Number: **WCR-2018-11034**

Action Agencies: U.S. Forest Service (Wallowa-Whitman National Forest), U.S. Army Corps of Engineers

Affected Species and Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
Snake River Basin steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	No
Snake River spring/summer Chinook salmon (*O. tshawytscha*)	Threatened	Yes	No	No
Snake River fall Chinook salmon (*O. tshawytscha)*	Threatened	Yes	No	No

Essential Fish Habitat (EFH):

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:

Michael P. Tehan
Assistant Regional Administrator

Date: February 8, 2019

TABLE OF CONTENTS

TABLES

FIGURES

ACRONYMS

ACRONYM	DEFINITION
AWA	Anti-Washout Admixture
BA	Biological Assessment
BMP	Best Management Practices
COE	U.S. Army Corps of Engineers
CWA	Clean Water Act
DPS	Distinct Population Segment
DQA	Data Quality Act
EFH	Essential Fish Habitat
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
HAPC	Habitat Areas of Particular Concern
HAZMAT	Hazardous Material
ITS	Incidental Take Statement
MPG	Major Population Groups
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NMFS	National Marine Fisheries Service
NPT	Nez Perce Tribe
NTU	Nephelometric Turbidity Units
Opinion	Biological Opinion
PBF	Physical and Biological Features
RPM	Reasonable and Prudent Measures
USFWS	U.S. Fish and Wildlife Service
VSP	Viable Salmonid Population

ACRONYM	**DEFINITION**
WSR	Wild and Scenic River
WWNF	Wallowa-Whitman National Forest

1. INTRODUCTION

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

1.1 Background

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

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 402.

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 through NMFS' Public Consultation Tracking System: https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts. A complete record of this consultation is on file at the NMFS office in Boise, Idaho.

1.2 Consultation History

The Wallowa-Whitman National Forest (WWNF) proposes to repair an existing public boat ramp at the Hells Canyon Creek Boat Launch and Visitor Center site.

On March 21, 2018, the WWNF submitted a description, diagrams, and maps for the project to NMFS for review and comment. After receiving feedback, the WWNF provided a draft biological assessment (BA) to NMFS on August 6, 2018, with a “may affect, likely to adversely affect” determination for Snake River Basin steelhead, Snake River spring/summer Chinook salmon, Snake River fall Chinook salmon, and their designated critical habitats. The BA also indicated that the proposed action may adversely affect Chinook salmon EFH. A phone conversation between the WWNF, the U.S. Fish and Wildlife Service (USFWS), and NMFS was held on August 21, 2018, to further discuss the project, particularly the addition of monitoring components, prior to initiating consultation. NMFS subsequently submitted written comments to the WWNF for the draft BA on August 29, 2018. The WWNF submitted a revised BA to NMFS on October 2, 2018. However, the revised BA contained “may affect, not likely to adversely affect” determinations for the designated critical habitat of each species, as well as a “will not adversely affect” determination for Chinook salmon EFH. NMFS responded indicating that it appeared that the determinations should remain the same as those in the original draft BA. The WWNF submitted a final BA to NMFS on October 23, 2018 with the revised determinations. Consultation was initiated on the same date that the final BA was received.

The U.S. Army Corps of Engineers (COE) may issue a Clean Water Act (CWA) section 404 permit for the project, and this consultation also addresses the COE's issuance of the permit.

Because this action has the potential to affect tribal trust resources, NMFS provided copies of the draft proposed action and terms and conditions for this Opinion to the Nez Perce Tribe (NPT) on December 12, 2018. The NPT did not respond.

1.3 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies (50 CFR 402.02). Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR 402.02). There are no interrelated or interdependent actions associated with this action.

The proposed action is the repair of an existing public boat ramp at the Hells Canyon Creek Boat Launch and Visitor Center site on the Snake River. The boat launch site is approximately 0.75 miles downstream from the Hells Canyon Dam, within the WWNF in Wallowa County, Oregon.

The concrete ramp and an associated concrete apron have been undermined due to repeated high river flows and boat traffic near the ramp. This activity has resulted in significant loss of fill underneath the ramp and lack of structural support. The boat ramp is approximately 14 feet wide and 80 feet long. The lower 36 feet of the ramp consist of 4-foot wide by 14 feet long precast concrete panels supported on steel beams and gravel fill. In addition, the concrete apron, which is directly adjacent to the upstream side of the boat ramp, is approximately 10 feet wide by 45 feet long. The apron provides additional area for loading and unloading boats. Scour gap measurements on the side of the structure range vertically from a few inches to 1.5 feet. Scour gap measurements underneath the boat ramp and apron range horizontally up to 5 feet. Original construction of the boat ramp was completed in 1993 by placing fill in the river at the launch location to provide a base for the ramp.

The proposed action is to:

1) Underpin the concrete apron and boat ramp to provide structural support and prevent structural settlement (Figure 1). Additionally, precast curbs will be installed at the end of the boat ramp to prevent users from backing trailers off the launch ramp; and,

2) Stabilize the in-water slope along the perimeter of the boat ramp and apron with riprap to prevent future undermining of the structure.

The following steps will be taken to repair the boat ramp structure:

1) Grout bags will be placed beneath the apron and boat ramp perimeter in areas that have been undermined. The grout bags will be filled with grout from the surface in shallow water, or by divers in deeper water. If necessary, a level pad will be constructed out of

eight inch or smaller quarry spalls for the grout bags to rest on. The grout mix will contain an anti-washout admixture (AWA). Once cured, the grout bags will support the perimeter of the structure. As the grout bags are filled they will adapt in shape to the variations in the river channel and the bottom of the boat ramp concrete panels. The top layer of grout bags will be installed 6 inches above the existing concrete to form a curb along the edge of the apron and boat ramp.

2) Prior to the complete installation of the grout bags, grout pump tubes will be installed around the perimeter of the apron and boat ramp. The tubes will later be utilized to pump grout into the voids beneath the boat ramp and apron concrete panels. Three-inch diameter holes will be cored in the existing boat ramp and apron concrete. These holes will be used as indicators to determine when grout pumped into the tubes has filled the voids to the elevation of the concrete ramp or apron.

3) Grout will be pumped through the grout tubes until visibly flush with the drilled holes. The grout mix used will also contain AWA.

4) Any remaining voids will be patched with an underwater patching compound, which will be pretreated with AWA.

In addition to the boat ramp repair, approximately 632 cubic yards of riprap will be installed adjacent to the boat ramp and apron to stabilize the in-water slopes and protect the structure from future undermining (Figure 2). The placed riprap will match the slope of the boat ramp and apron on the river-adjacent sides of the structure for approximately 15 feet, and will then maintain a 1-foot rise by 1.5-foot run slope downward until meeting the existing river bottom. Overall, the riprap will extend approximately 30 feet into the river channel from the boat ramp. Rock size will vary between 15-inch and 42-inch diameters. The large volume and variation in size of riprap will reduce the risk of localized scouring. Installation of the riprap will require in-channel equipment operation. A loader and rock truck will deliver riprap material from the stockpile to the boat ramp. The material will be dumped at the top of the placement area and pushed into place with a large excavator bucket. The excavator will be the only equipment operating within the channel, and will only operate from the top of the boat ramp and on paved areas along the shore.

The proposed action is expected to result in a reduced risk of future boat ramp scouring and associated damage. The construction window for this project is July 1, 2019, to October 15, 2019. The actual work period for this projected is estimated to be 1 to 2 weeks.

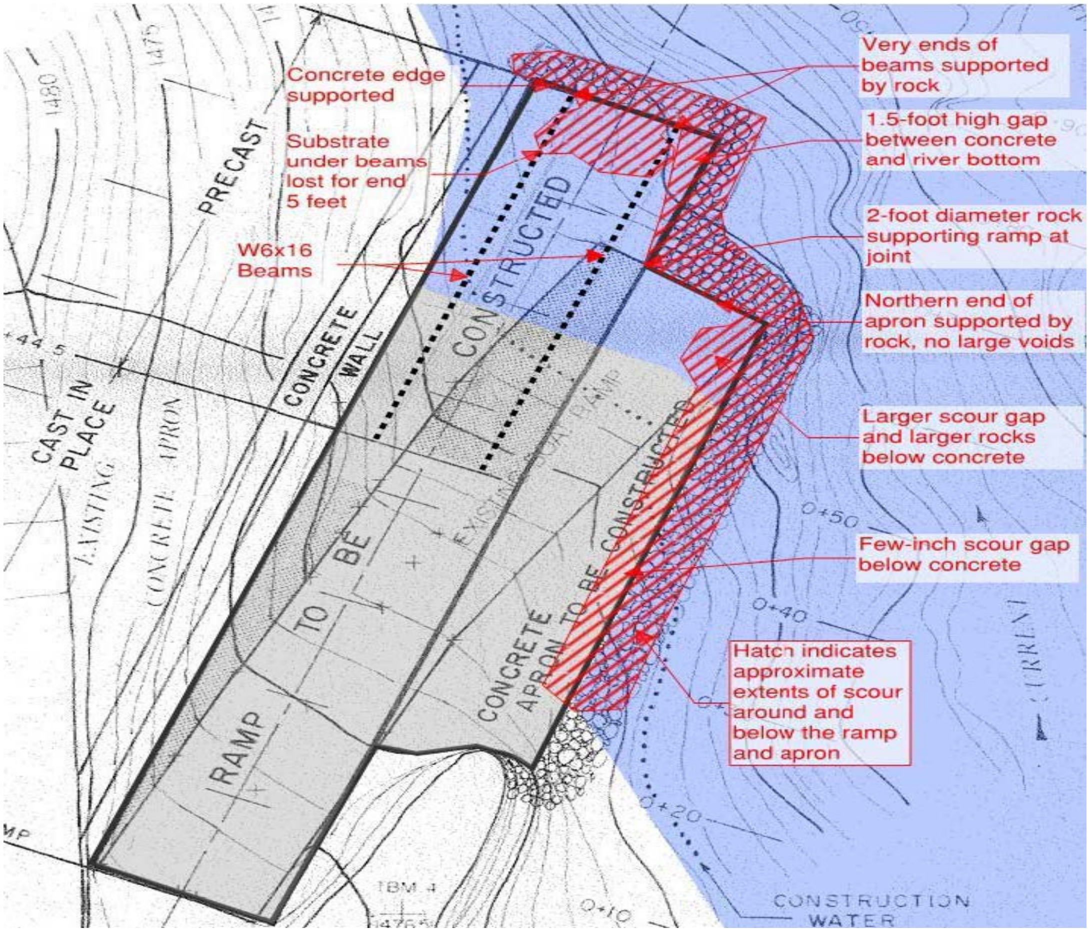

Figure 1. Boat Ramp Scour Areas (WWNF 2018).

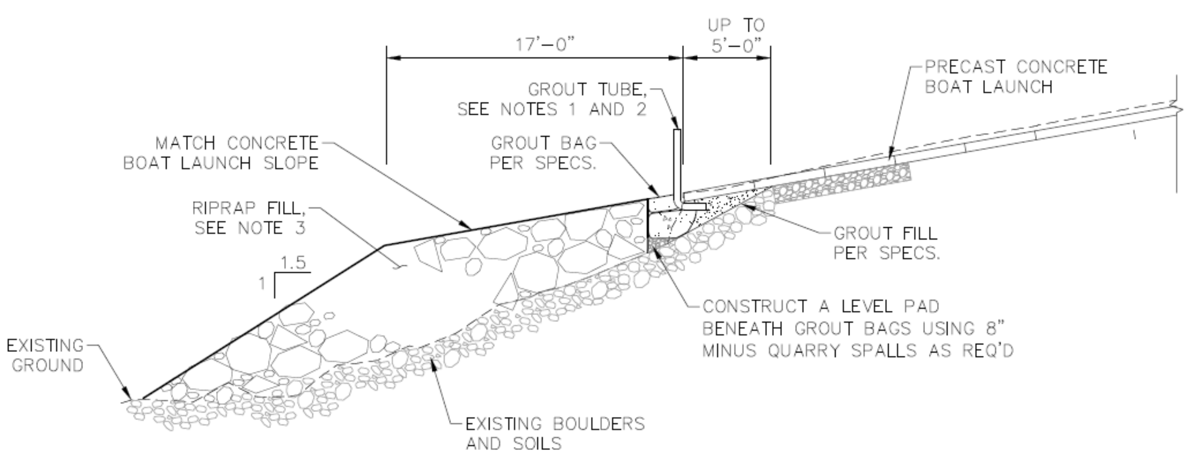

Figure 2. Cross Section of Boat Ramp with Riprap Placement (WWNF 2018).

1.3.1 Conservation Measures

The WWNF proposes the following conservation measures to minimize the impacts of the proposed action on ESA-listed fish and their habitat:

Table 1. Conservation Measures.

Category	Specific Measures
Sediment and Stormwater Control	• A site-specific erosion control plan will be developed to minimize the risk and scale of erosion/sediment from the site. o The plan will include practices to minimize erosion and sedimentation associated with all aspects of the project, including staging areas, stockpiling of materials, and grading of materials. • During construction, erosion controls will be monitored and maintained daily to ensure proper functioning. • If erosion controls are improperly functioning, work will stop immediately. Repairs, replacements, or the installation of additional erosion control measures will be completed before work resumes. o Proper maintenance includes removal of sediment and debris from erosion controls such as silt fences or hay bales once it has reached one third of the exposed height of the control. • Riprap material will be stockpiled in a location away from the Snake River, such as the visitor center parking lot.
Equipment Spill and Leak Prevention	• A site-specific pollution control plan will be developed to minimize the risk and scale of pollution from equipment or from the site. o The plan will include practices to prevent construction debris from entering any stream or waterbody. The plan will also include practices to prevent and control hazardous material spills. • All fuel storage and refueling will occur outside of the banks of the Snake River and in designated sites away from water sources. • Spill prevention and containment kits will be required to be onsite during all periods of construction activity. • All spills will be mitigated and reported in accordance with the WWNF hazardous material (HAZMAT) plan. • All vehicles and other heavy equipment will be used as follows: o Stored, fueled, and maintained in a vehicle staging area placed 150 feet or more from any waterbody, or in an isolated hard zone such as a paved parking lot. o Inspected daily for fluid leaks before leaving the vehicle staging area for operation within 50 feet of any waterbody. o Steam-cleaned before operation below ordinary high water mark, and as often as necessary during operation to remain free of all external oil, grease, mud, seeds, organisms and other visible contaminants. o Generators, cranes, and any other stationary equipment operated within 150 feet of any waterbody will be maintained and protected as necessary to prevent leaks and spills from entering the water.
Instream Work	• All work within the active channel will be completed in accordance with the Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife resources (ODFW 2008, or the most recent version). • The WWNF will work with Idaho Power Company, the operator of Hells Canyon Dam, to maintain stable flows during the repair project. • All heavy equipment will be operated from land and/or the boat ramp. • Heavy equipment will be selected and operated as necessary to minimize adverse effects on the environment. For example, equipment will be minimally-sized, will utilize low

Category	Specific Measures
	pressure tires, maintain minimal hard turn paths for tracked vehicles, and utilize temporary mats or plates within wet areas or sensitive soils. • The grout pumping rate will be limited to less than eight cubic yards per hour to prevent pH values within the channel from exceeding 9.0. • Equipment will be washed prior to arrival at the site in order to prevent the spread of noxious weeds. • All work within the active channel will be completed in accordance with the Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources.
Monitoring	• WWNF personnel will monitor operations during the grouting phase of the project to ensure that significant seepage of grout from the grout bags or voids does not occur. In the event of significant seepage the grouting operation will be shut down, evaluated, and methods will be revised prior to the continuation of grouting. • WWNF personnel will monitor pH values in the Snake River during the grouting operation. The monitoring site will be located approximately 100 feet downstream from the boat ramp in a slower moving eddy. If pH values exceed 9.0 the grouting operation will be shut down, evaluated, and methods will be revised prior to the continuation of grouting. • After construction is complete, WWNF personnel will inspect the boat ramp following high flow events to determine if new scour of the riprap or boat ramp structure is occurring. If significant scour is found, a maintenance plan will be developed in consultation with NMFS and the USFWS.

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

2.1 Rangewide Status of the Species and Critical Habitat

This Opinion considers the status of three species: Snake River Basin steelhead, Snake River spring/summer Chinook salmon, and Snake River fall Chinook salmon. Each of these evolutionarily significant units (ESU) or distinct population segments (DPS) is composed of multiple populations which spawn and rear in different watersheds across the Snake River basin. Having multiple viable populations makes an ESU or DPS less likely to become extinct from a single catastrophic event (ICBTRT 2010). NMFS expresses the status of an ESU or DPS in terms of the status and extinction risk of its individual populations, relying on McElhaney et al.'s (2000) description of a viable salmonid population (VSP). The four parameters of a VSP are abundance, productivity, spatial structure, and diversity. The recovery plan for Snake River spring/summer Chinook salmon and Snake River Basin steelhead (NMFS 2017a), and the recovery plan for Snake River fall Chinook salmon (NMFS 2017b) describes these four parameters in detail and the parameter values needed for persistence of individual populations and for recovery of the ESU or DPS.

The status of each species is determined by the level of extinction risk that the listed species faces, based on parameters considered in documents such as the recovery plan, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The condition of critical habitat throughout the designated area is determined by the current function of the essential physical and biological features (PBFs)[1] that help to form that conservation value.

Table 2 summarizes the status and available information on the Snake River Basin steelhead DPS, the Snake River spring/summer Chinook salmon ESU, and the Snake River fall Chinook salmon ESU, based on the detailed information on the status of individual populations, and the species as a whole provided by the *ESA Recovery Plan for Snake River Spring/Summer Chinook Salmon & Snake River Basin Steelhead* (NMFS 2017a), *ESA Recovery Plan for Snake River Fall Chinook Salmon* (NMFS 2017b), and *Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest* (NWFSC 2015). These three documents are incorporated by reference here. All species remain threatened with extinction since the time of their listing (2006, 1992, and 1992, respectively) due to many individual populations not meeting recovery plan abundance and/or productivity targets.

Table 2. Most recent listing classification and date, status summary (including recovery plan reference and most recent status review), and limiting factors for species considered in this Opinion.

Species	Listing Status	Status Summary	Limiting Factors
Snake River Spring/summer Chinook Salmon	Threatened 6/28/05	This ESU comprises 28 extant and four extirpated populations, organized into five major population groups (MPGs), none of which are meeting the viability goals laid out in the recovery plan (NMFS 2017a). All except one extant population (Chamberlin Creek) are at high risk of extinction (NWFSC 2015). Most populations will need to see increases in abundance and productivity in order for the ESU to recover. Several populations have a high proportion of hatchery-origin spawners—particularly in the Grande Ronde, Lower Snake, and South Fork Salmon MPGs—and diversity risk will also need to be lowered in multiple populations in order for the ESU to recover (ICBTRT 2010; NWFSC 2015).	• Adverse effects related to the mainstem Columbia and Snake River hydropower system and modifications to the species' migration corridor. • Degraded freshwater habitat, including altered streamflows and degraded water quality. • Harvest-related effects. • Predation in the migration corridor. • Potential effects from high proportion of hatchery fish on natural spawning grounds.
Snake River Fall Chinook Salmon	Threatened 6/28/05	This ESU comprises one extant population of fish spawning in the mainstem of the Snake River and the lower reaches of the associated major tributaries including the Tucannon, Grande Ronde, Clearwater, Salmon, and Imnaha Rivers. Historically, a single extirpated population spawned and reared able	• Adverse effects related to the mainstem Columbia and Snake River hydropower system and modifications to the species' migration corridor.

[1] We use the term PBF to mean primary constituent element; the shift in terminology does not change the approach used (81 FR 7414).

Species	Listing Status	Status Summary	Limiting Factors
		the Hells Canyon Dam. The ESU also includes four artificial propagation programs (NMFS 2017b). Therefore the population has a high proportion of hatchery-origin spawners. The population is considered viable, but will need to see an increase in productivity combined with a reduction in diversity risk for the ESU to recover (ICBTRT 2010; NWFSC 2015).	• Harvest-related effects. • Potential effects from high proportion of hatchery fish on natural spawning grounds.
Snake River Basin Steelhead	Threatened 1/5/06	This DPS comprises 24 populations organized into five MPGs. Currently, five populations are tentatively rated at high risk of extinction, 17 populations are rated at moderate risk of extinction, one population is viable, and one population is highly viable. Although abundance has increased since the time of listing, four out of the five MPGs are not meeting the population viability goals laid out in the recovery plan (NMFS 2017a). In order for the species to recover, more populations will need to reach viable status through increases in abundance and productivity. Additionally, the relative proportion of hatchery fish spawning in natural spawning areas near major hatchery release sites remains uncertain and may need to be reduced (NWFSC 2015, most recent species status review).	• Adverse effects related to the mainstem Columbia and Snake River hydropower system and modifications to the species' migration corridor. • Genetic diversity effects from out-of-population hatchery releases. Potential effects from high proportion of hatchery fish on natural spawning grounds. • Degraded fresh water habitat. • Harvest-related effects, particularly B-run steelhead. • Predation in the migration corridor.

The proposed action will occur in the Hells Canyon watershed in the Snake River. For steelhead, this section of the Snake River was historically occupied by the Hells Canyon Tributaries steelhead population of the Hells Canyon MPG. This population is considered extirpated, and the Hells Canyon MPG is not expected to contribute to DPS recovery (NMFS 2017a). Tributaries available to steelhead below the Hells Canyon Dam are not considered large enough to support an independent population. The Hells Canyon reach of the Snake River does not currently support an independent population, although steelhead do occur in the action area. Although we suspect that the majority of steelhead occurring in the action area are likely hatchery fish, adult, wild steelhead protected under the ESA are regularly caught at the Hells Canyon Dam trap facility. Because ESA-listed steelhead have access to the action area and could be present, effects on Snake River Basin steelhead are evaluated in this Opinion.

Habitat analyses and historical records indicate historical and current presence of Snake River spring/summer Chinook in the action area. The area above Hells Canyon Dam once supported several anadromous populations of spring/summer Chinook (NMFS 2017a). Although the Hells Canyon reach of the Snake River does not currently support an independent population, spring/summer Chinook salmon do currently occur in the action area. While we suspect that the majority of spring/summer Chinook salmon occurring in the action area are most likely hatchery fish, adult, wild spring/summer Chinook protected under the ESA are occasionally caught at the Hells Canyon Dam trap facility. Because ESA-listed spring/summer Chinook salmon have access to the action area and could be present, effects on Snake River Spring/summer Chinook salmon are also evaluated in this Opinion.

For fall Chinook, this section of the Snake River is occupied by the Lower Snake River population, which is the single extant population for the ESU. This population includes fish spawning in the mainstem of the Snake River and lower reaches of several associated tributaries (NMFS 2017b). The population is currently rated at low risk for abundance/productivity, moderate risk for spatial structure, moderate risk for diversity, and is likely achieving maintained status for an overall viability rating (NMFS 2017b). The Snake River fall Chinook ESU as a whole is not meeting the recovery goals described in the recovery plan for the species, which require the single population to be "highly viable with high certainty" (NWFSC 2015).

Table 3 summarizes designated critical habitat for Snake River Basin steelhead, Snake River spring/summer Chinook salmon, and Snake River fall Chinook salmon, based on the detailed information on the status of critical habitat throughout the designation area provided in the recovery plan for each species (NMFS 2017a; NMFS 2017b), which is incorporated by reference here. NMFS describes critical habitat in terms of essential PBFs of that habitat to support one or more life stages (e.g., sites with conditions that support spawning, rearing, migration, and foraging). For Snake River Basin steelhead, PBFs include water quality, water quantity, spawning substrate, floodplain connectivity, forage, natural cover, and passage free of artificial obstructions. For Snake River spring/summer Chinook salmon, PBFs include spawning gravel, water quality, water quantity, food, riparian vegetation, water temperature, substrate, water velocity, cover/shelter, space, and safe passage. For Snake River fall Chinook salmon, PBFs are the same as for spring/summer Chinook salmon, but also include access. Across the designations, the current ability of PBFs to support the species varies from excellent in wilderness areas to poor in areas of intensive human land use.

Table 3. 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
Snake River Spring/summer 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 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 (NMFS 2017a). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Snake River Fall Chinook Salmon	12/28/93 58 FR 68543	Critical habitat consists of all Columbia River estuarine areas, as well as river reaches upstream to the confluence of the Columbia and Snake Rivers, and all Snake River reaches from the confluence of the Columbia River upstream to Hells Canyon Dam. It also includes lower portions of the Palouse. Clearwater, and North Fork Clearwater Rivers. Habitat quality in all reaches is influenced by various land uses, especially irrigated agriculture, in terms of heavy sediment and nutrient loading from irrigation returns (NMFS 2017b).
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 (NMFS 2017a). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems.

The construction and operation of water storage and hydropower projects in the Columbia River basin have altered biological and physical attributes of the mainstem migration corridor for all three ESA-listed species addressed in this Opinion. These alterations have affected juvenile migrants to a much larger extent than adult migrants. However, changing temperature patterns have created passage challenges for summer migrating adults in recent years, requiring new structural and operational solutions (i.e., cold water pumps and exit “showers” for ladders at Lower Granite and Lower Monumental Dams). Actions taken since 1995 that have reduced negative effects of the hydrosystem on juvenile and adult migrants include: (1) Minimizing winter drafts to increase flows during peak spring passage; (2) releasing water from storage to increase summer flows; (3) releasing water from Dworshak Dam to reduce peak summer temperatures in the lower Snake River; (4) constructing juvenile bypass systems to divert smolts, steelhead kelts, and adults that fall back over the projects away from turbine units; (5) providing spill at each of the mainstem dams for smolts, steelhead kelts, and adults that fall back over the projects; (6) constructing “surface passage” structures to improve passage for smolts, steelhead kelts, and adults falling back over the projects; and, (7) maintaining and improving adult fishway facilities to improve migration passage for adult salmon and steelhead.

2.1.1 Climate Change Implications for ESA-listed Species and their Critical Habitat

One factor affecting the ESA-listed species and critical habitat is climate change. Likely changes in temperature, precipitation, wind patterns, and sea-level height have implications for survival of Snake River Basin steelhead, Snake River spring/summer Chinook salmon, and Snake River fall Chinook salmon in both their freshwater and marine habitats. As the climate changes, air temperatures in the Pacific Northwest are expected to increase 2°C to 8°C by the 2080s (Mantua et al. 2009). While total precipitation changes are uncertain, increasing air temperature will result in more precipitation falling as rain rather than snow in watersheds across the basin (NMFS 2017a). In general, these changes in air temperatures, river temperatures, and river flows are expected to cause changes in salmon and steelhead distribution, behavior, growth, and survival, although the magnitude of these changes remains unclear.

Climate change could affect Snake River Basin steelhead, Snake River spring/summer Chinook salmon in the following ways: (a) Winter flooding in transient and rainfall-dominated watersheds may reduce overwintering habitat for juveniles; (b) reduced summer and fall flows may reduce the quality and quantity of juvenile rearing habitat, strand fish, or make fish more susceptible to predation and disease; (c) timing of smolt migration may change due to a modified timing of the spring freshet; and (d) lethal water temperatures may occur in the mainstem river migration corridor or in holding tributaries resulting in higher mortality rates (NMFS 2017a).

Climate change could affect Snake River fall Chinook salmon in the following ways: (a) Higher water temperatures during adult migration may lead to increased mortality or reduced spawning success; (b) if water temperatures accelerate the rate of egg development, it could lead to earlier fry emergence and dispersal, which could be either beneficial or detrimental, depending upon location and prey availability; (c) warmer temperatures will increase metabolism, which may increase or decrease juvenile growth rates and survival, depending upon availability of food; (d) increases in water temperatures in Snake and Columbia River reservoirs could increase consumption rates and growth rates of predators and, hence, predation-related mortality on subyearling fall Chinook salmon; and (e) reduced flow in late spring and summer may lead to delayed migration of juvenile fall Chinook salmon and higher mortality passing dams (NMFS 2017b).

Climate factors will likely reduce suitable rearing areas and limit run timing under warmer future conditions, and thereby make it more challenging to increase abundance and recover these species.

2.2 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 includes the project work site in and around the Snake River, as well as the Snake River from 100 feet upstream of the boat ramp repair (the likely extent of potential noise/disturbance), extending downstream 1,000 feet from the boat ramp repair (the likely extent of potential downstream sediment effects). The Snake River through Hells Canyon acts as the border between the states of Idaho and Oregon. The boat ramp is located on the Oregon side of the Snake River.

2.3 Environmental Baseline

The environmental baseline is defined at 50 CFR 402.02.

The project site is located approximately 0.75 miles downstream from Hells Canyon Dam on the Oregon side of the Snake River. The action area is located on U.S. Forest Service land administered by the WWNF. The Snake River through the Hells Canyon is a stable stream channel that is deeply entrenched. The area has minimal floodplain development. The channel banks and stream bed within Hells Canyon are dominantly comprised of boulders. Tributary streams within Hells Canyon are steep, deeply entrenched channels. The majority of the Hells Canyon reach of the Snake River is bounded on both sides by the Hells Canyon Wilderness Area, which was established in 1975. Management activities within the Wilderness are limited primarily to dispersed recreation and fire suppression activities. Since the creation of the Hells Canyon Wilderness Area, there has been a steady decline in grazing activities in the canyon on National Forest land.

The following further detail baseline conditions:

- The Snake River from the Hells Canyon Dam to Sheep Creek has a "Not Supporting" status for the beneficial use of Cold Water Aquatic Life in the Idaho Department of Environmental Quality 2014 Integrated Report due to presence of mercury, inadequate water temperatures, and dissolved gas supersaturation (IDEQ 2017).

- The Hells Canyon reach of the Snake River has been designated as a Wild and Scenic River (WSR) from Hells Canyon Dam to the Oregon-Washington border. The WSR corridor extends 0.25 miles on either side of the river. Activities within the WSR corridor are primarily recreation related.

- The Hells Canyon Creek Boat Launch and Visitor Center site is located on the alluvial fan of Hells Canyon Creek. The mouth of Hells Canyon Creek is approximately 75 feet downstream from the boat ramp. The alluvial fan has been extensively modified for the construction of a visitor center, parking areas, boat dock, and boat ramp. Additionally, the site may have received fill material from work associated with the construction of the Hells Canyon Dam. The facilities at this site were constructed in 1992.

- The Snake River is approximately 174 feet wide and 35 feet deep at the project site during normal summer flows.

- Snake River streamflow in the action area is primarily regulated by release rates from the Hells Canyon Dam, which is located approximately 0.75 miles upstream from the boat ramp.

Snake River Basin steelhead use the Snake River within the action area for both migration and rearing. Hells Canyon Creek provides limited spawning and rearing habitat for steelhead. Numerous other tributaries to the Hells Canyon reach of the Snake River also provide spawning and rearing habitat (WWNF 2018). Adult wild steelhead are regularly captured at the Hells Canyon Dam trap facility, which is located just below Hells Canyon Dam (J. Chandler, personal communication, 2018).

Snake River spring/summer Chinook salmon use the Snake River within the action area as migration habitat. Snake River spring/summer Chinook salmon do not spawn in the mainstem of the Snake River, although some spawning may occur in lower portions of larger tributaries to the Snake River (WWNF 2018). These potential spawning areas are not within the action area. As previously mentioned, the majority of Snake River spring/summer Chinook salmon that are present in the action area are highly likely to be hatchery fish from the Idaho Power hatchery program (J. Chandler, personal communication, 2018), although adult wild Snake River spring/summer Chinook salmon are occasionally caught at the Hells Canyon Dam trap facility (J. Chandler, personal communication, 2018).

Snake River fall Chinook salmon use the Snake River within the action area as holding habitat for adult fish and rearing habitat for juvenile fish (WWNF 2018). The nearest known spawning areas are located at the mouth of Deep Creek, approximately 0.65 miles upstream from the boat ramp, and within the Snake River approximately 0.75 miles downstream from the boat ramp (J. Chandler, personal communication, 2018). Juvenile rearing habitat is located in the action area. Juvenile Snake River fall Chinook salmon utilize shoreline areas as rearing habitat (WWNF 2018). Spawning habitat for fall Chinook salmon in the Snake River is considered to be good condition (Davidson et al. 2004).

2.4 Effects of the Action

"Effects of the action" is defined at 50 CFR 402.02.

2.4.1 Effects to Species

The in-water portion of the proposed action will take place between July 1 and October 15. All work within the active channel will be completed in accordance with the Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources (ODFW 2008). WWNF estimates that the actual work period will be 1 to 2 weeks. Table 4 summarizes potential salmonid species and life stage presence in the Hells Canyon reach of the Snake River during the project work window.

Table 4. Periodicity of species and life stages of salmonids in the Hells Canyon reach of the Snake River (including canyon tributaries) during the project work window (WWNF 2018).

Life Stage/Activity/Species	Jul		Aug		Sep		Oct	
Upstream Adult Migration								
Summer steelhead								
Spring/summer Chinook salmon								
Fall Chinook salmon								
Adult Holding/Overwintering								
Summer steelhead								
Spring/summer Chinook salmon								
Fall Chinook salmon								
Adult Spawning								
Summer steelhead								
Spring/summer Chinook salmon		T	T	T	T			
Fall Chinook salmon								
Egg Incubation through Fry Emergence								
Summer steelhead								
Spring/summer Chinook salmon				T	T	T	T	T
Fall Chinook salmon								
Juvenile Rearing								
Summer steelhead								
Spring/summer Chinook salmon	T	T	T	T	T			

Life Stage/Activity/Species	Jul		Aug		Sep		Oct	
Fall Chinook salmon								
Downstream Juvenile Migration								
Summer steelhead								
Spring/summer Chinook salmon								
Fall Chinook salmon								

Notes: T = Canyon Tributaries. Darker shading indicates primary period for the activity.

Salmonids present in the action area during the project implementation period could experience the following adverse effects from the proposed action:

- Exposure to changes in pH value due to grouting activity;
- Risk of injury or death due to mobilized riprap;
- Exposure to short-term turbidity plumes downstream of the project site;
- Increased sediment deposition along the banks of the river;
- Exposure to construction noise and disturbance; and,
- Exposure to chemical contamination.

The proposed action includes best management practices (BMPs) to help avoid and/or minimize adverse effects to salmonids. The likelihood of exposure and the magnitude of response to these effects of the action are discussed below.

2.4.1.1 Elevated pH Values

Repairing the boat ramp and apron requires the underwater application of cement-based grout. Grout will be pumped into grout bags for placement below the perimeter of the structure, and will also be pumped into voids beneath the structure. An underwater cement-based patching compound may also be used to seal any remaining voids. The primary water quality parameter affected by placing grout underwater is pH (Fitch 2003). In-water grout application can cause pH values to exceed 11.0 in certain conditions (Fitch 2003). Aquatic organisms generally prefer pH between 6.5 and 8.0 (Addy et al. 2004). Changes in pH value due to grouting can be harmful, and potentially lethal, to salmonids depending on the degree of change and duration of exposure (McLeay 1983). A study by Witschi and Ziebell (1979) found that juvenile salmonids display sluggish behavior or loss of equilibrium when exposed to pH 9.0 water. Additionally, exposure to pH 9.0 water for 30 minutes or longer may cause elevated oxygen consumption rate and a greater rate of coughing among juvenile salmonids, in comparison to salmonids in water with ordinary pH values (Hargis 1976). Water with a pH value of 10.0 or greater is likely to be rapidly lethal to salmonids, regardless of life stage (McLeay 1983).

Grout placement field monitoring was conducted for similar scour damage repair projects in the State of Virginia. Data from the monitoring shows that elevated pH values may persist between 4 to 6 hours depending on the volume of streamflow entering the site. pH values peaked as high as 10.9 at some sites, with pH increases typically occurring within several minutes of the commencement of grout pumping (Fitch 2003). However, at sites where water was not isolated (i.e., no turbidity curtain was used) and a high volume of water was moving through the site, pH returned to normal values through dilution at a faster rate and spikes in pH values were less severe (Fitch 2003). In instances where grout bags were used without a turbidity curtain, elevated pH values generally dissipated rapidly toward baseline values in less than 30 minutes after grout pumping occurred (Fitch 2003). Additionally, grout bag installation sites with the use of AWA had a lower maximum pH (8.9) and lower maximum amount of time for pH values to return to baseline (2.5 hours) (Fitch 2003). Most sites with pH values exceeding 9.0 were attributed to grout pumping rates exceeding 13 cubic yards per hour (Fitch 2003). Fitch (2003) concluded that instream pH values can be kept under the state water quality level by use of proper placement technique, AWA, high streamflow volume, and slower grout pumping rates. The states of Idaho and Oregon both have an upper limit of 9.0 for pH water quality standards.

For the boat ramp repair project, we make the following assumptions about pH values during grouting activities:

- Based on field data, a 60:1 water to concrete ratio with the use of grout bags will keep instream pH values below 9.0 for streams with a baseline pH of 8.0 or less (Fitch 2003). It is anticipated that Snake River pH values will be close to neutral during the work window.

- The mean monthly flows for the Snake River at the project site during the work window (July 1 through October 15) are greater than 10,000 cubic feet per second (cfs) (WWNF 2018).

- Grout bags will be used for initial grout placement in the perimeter of the structure. Subsequent grout pumping will occur behind the perimeter and will cease immediately if grout seepage occurs. The grout pumping rate will be limited to 8 cubic yards per hour. AWA will be used in all phases of grout application.

- Thus, water pH values in the vicinity of the boat ramp should remain less than 9.0 for flows greater than 4,000 cfs.

- It will not be feasible to monitor the number of fish injured or killed as a result of elevated pH values.

Because of high streamflow volume at the site and water remaining un-isolated, NMFS assumes elevated pH values will dilute rapidly, affect a small area, and affect only a portion of the width of the river channel. Therefore, fish located immediately downstream from the boat ramp are the primary concern for elevated pH. The WWNF will monitor pH values approximately 100 feet downstream from the boat ramp during all grouting activities. The monitoring site is located in an eddy that holds slower moving water and is adjacent to the boat ramp. Thus, monitoring at this location is expected to reflect the maximum extent of pH value elevation within the action area during grouting activities. The eddy is approximately 45 feet wide, which is 25 percent of the width of the river channel in the project area (174 feet wide in during normal summer flows).

Elevated pH values have the potential to cause harm to salmonids present within the eddy due to slower dilution rates and proximity to the project site. If pH values exceed 9.0 during monitoring efforts, the grouting operation will be shut down, evaluated, and methods will be revised prior to the continuation of grouting. This, in addition to the other BMPs associated with the grouting activities, will effectively minimize this risk to ESA-listed salmonids in the action area.

2.4.1.2 Mobilized Riprap

The placement of riprap is known to cause adverse effects to stream morphology, fish habitat, and fish populations (Schmetterling et al. 2001; Garland et al. 2002; USFWS 2000). As reported by Washington Department of Fish and Wildlife (WDFW et al. 2002), juvenile life stages of salmonids are especially affected by bank stabilization projects. In low flows, juveniles depend on cover provided by undercut banks and overhanging vegetation to provide locations for resting, feeding, and protection from predation. During periods of high streamflow, juveniles often seek refuge in low velocity microhabitats, including undercut banks and off-channel habitat. Riprap may preclude the future development of new off-channel rearing habitats by fixing the channel in its current location.

In-water placement of riprap also has the potential to injure or kill fish located at the project site or immediately downstream from the site. Approximately 632 cubic yards of riprap will be used to stabilize the instream slope adjacent to and below the boat ramp structure. Rock size will vary between 15-inch and 42-inch diameters. Some material could be mobilized downstream from the project site due to high flow velocity at the boat ramp structure during placement. NMFS expects this mobilized material will settle within 300 feet downstream from the project site due to gravity and slower moving water in an adjacent eddy. Fish within the pathway of mobilized riprap are expected to relocate out of the affected area into nearby suitable habitats during construction. However, a small number of individuals could be crushed or injured during the initial phase of riprap placement activities. Additionally, if a pause in work occurs during riprap placement activities, fish are expected to repopulate the affected area within several hours. Thus, fish could be repeatedly exposed to mobilized riprap.

The project will utilize approximately 632 cubic yards of riprap, which will occupy 525 square feet of the river channel cross section. Riprap will be placed up to 30 feet into the channel from the bank, affecting 17 percent of the total channel width (174 feet wide in during normal summer flows). Since riprap placement and potential mobilized riprap will only affect a small portion of the river channel, fish will be able to relocate to nearby suitable habitat. It will not be feasible to monitor the number of fish injured or killed as a result of riprap placement.

Riprap to be placed as part of the proposed action will occur around the ramp itself, placed in areas that were previously riprapped or disturbed for the existing ramp. Consequently, there are no undercut banks and there is no overhanging vegetation that will be affected by placement of this riprap. Riprap could increase habitat for smallmouth bass, which are a predator for juvenile salmonids. However, due to pre-existing riprap in the area, NMFS does not expect a change in predator habitat. Because placement of rock will occur in a previously riprapped/disturbed location the proposed action is expected to maintain the existing adverse effects to ESA-listed fish species and negative channel morphology impacts associated with riprapping.

2.4.1.3 Turbidity

The effects of increased suspended sediment on salmonids vary based on exposure time and concentration. These effects were reviewed by Newcombe and Jensen (1996) and range from avoidance response, to minor physiological stress from increased rate of coughing, to injury from abrasion of gill tissue, to death. Salmonids are relatively tolerant of low to moderate levels of suspended sediment (Gregory and Northcote 1993). Salmon and steelhead tend to avoid suspended sediment above certain concentrations (Servizi and Martens 1992; McLeay et al. 1987). Avoidance behavior can mitigate adverse effects when fish are capable of moving to an area with lower concentrations of suspended sediment. Researchers have reported thresholds for salmonid avoidance behavior at turbidities ranging from 30 to 70 nephelometric turbidity units (NTU) (Lloyd 1987; Servizi and Martens 1992; Berg and Northcote 1985).

The proposed action will utilize approximately 632 cubic yards of riprap to stabilize the in-stream slope adjacent to and below the boat ramp structure. Placement of riprap within the wetted channel will create temporary minor increases in turbidity within the action area due to riprap fines and the mobilization of pre-existing sediment on the riverbank and riverbed. However, the riverbank and riverbed of the Hells Canyon reach of the Snake River are composed primarily of boulders. Additionally, high flow volume in the project area likely maintains a low baseline volume of sediment. The excavator will work from paved area on the riverbank or from the boat ramp to install riprap. No ground excavation work will occur during the project. Additional BMPs per a site-specific erosion control plan will also be employed in the project site. For these reasons, overall sediment delivery and turbidity due to the action are expected to be minor. Visible turbidity in some cases can extend as far as 2,500 feet downstream (Foltz et al. 2013). However, for this project, with limited baseline sediment, low amounts of in-water work, and high flow volumes, we expect project-associated turbidity will be undetectable beyond 1,000 feet downstream from the project site. The turbidity plume will likely extend downstream from the boat ramp in an eddy adjacent to the ramp. The turbidity plume will likely dissipate at a rapid rate as a result of mixing with high volume streamflow from the river.

Turbidity plumes will be at highest concentrations when in close proximity of the boat ramp and are unlikely to span the channel width at this location. Channel width at the edge of the boat ramp during normal summer flows is approximately 174 feet. Maximum channel depth at the boat ramp is approximately 35 feet. As a plume moves downstream from the boat ramp, it will be quickly diluted due to high flow volume. Fish exposed to higher concentrated turbidity plumes near the boat ramp could temporarily relocate to nearby suitable habitat. Therefore, the duration and extent of the turbidity increases resulting from riprap placement are expected to be short-term and localized, with minimal impact to ESA-listed fish.

2.4.1.4 Sediment Deposition

Turbidity plumes from riprap placement will deposit a small amount of sediment in the Snake River downstream from the project site. The majority of mobilized sediment is likely to be dispersed by high flows during the work window. Some mobilized sediment is expected to be deposited near river banks up to 1,000 feet downstream of the project site, which would likely be dispersed during the following spring. Effects to individual fish could include reduction of available cover. Since the channel banks and stream bed of Hells Canyon reach of the Snake River is dominantly comprised of boulders, changes to primary and secondary productivity are unlikely to affect food supply for the fish.

Fine sediment deposition in spawning gravel reduces interstitial water flow, leading to depressed dissolved oxygen concentrations, and it can physically trap emerging fry in the gravel (Koski 1966; Everest et al. 1987; Meehan and Swanston 1977). Fish eggs deposited in gravel with a high percentage of fine sediments have a reduced rate of survival. Egg survival and fish abundance decrease rapidly when fine sediment exceeds a threshold of approximately 30 percent fines by volume (Everest et al. 1987; Spence et al. 1996). The most concentrated sediment deposits caused by the proposed action are likely to occur on the banks of the river and in the eddy adjacent to the boat ramp, an area where juvenile salmonids could be rearing but spawning does not occur. The nearest known spawning area for salmonids is approximately 0.75 miles downstream from the boat ramp, below the extent of sediment deposition caused from the proposed action. The areas of localized deposition could persist for several months through fall and winter. High-flow events are likely to disperse any project-generated sediment deposits in spring, causing only slight increases in the amount of fine sediment deposition in rearing areas. As described above in Section 2.4.1.3, only a small amount of sediment is expected to be mobilized, thus, there will only be a small amount of sediment available for deposition. Because of the expected effectiveness of the proposed sediment control BMPs as well as proper project design characteristics, NMFS does not expect that enough sediment deposition will take place to alter salmonid use of the habitat.

2.4.1.5 Noise and Disturbance

Construction noise or visual stimulus may disturb nearby salmonids, causing them to move away from the project site. If fish move, they are expected to move only short distances to an area where they feel more secure, and only for a few hours in any given day (Grant and Noakes 1987; Ries 1995; Olson 1996; SNF 2009). Because the stream habitat near the project site is relatively uniform, we expect that if fish are displaced temporarily into nearby areas they are unlikely to be adversely affected by those changes in location. Noise from heavy construction equipment will not likely rise to the decibel level known to physically harm fish (FHWA 2008; Wysocki et al. 2007).

2.4.1.6 Chemical Contamination

Use of construction equipment and heavy machinery adjacent to and within stream channels poses the risk of an accidental spill or leakage of fuel, lubricants, hydraulic fluid, antifreeze, or similar contaminants into the riparian zone, or directly into the water. If these contaminants enter the water, the substances could adversely affect habitat, injure or kill aquatic food organisms, or directly impact ESA-listed species (e.g., Neff 1985; Staples et al. 2001). The proposed action includes multiple conservation measures aimed at minimizing the risk of fuel, oil, or similar contaminant leakage into the stream. For example, equipment will be cleaned of external oil and checked for leaks prior to arrival at the project site. Equipment will be inspected daily for leaks or accumulations of grease. Any identified problems will be corrected immediately. All fuel, oil, and other hazardous materials will be stored away from the river channel. Equipment refueling will also occur away from the river channel. Based on the past success of these types of conservation measures in other projects, negative impacts to ESA-listed fish and fish habitat from fuel spills or leaks are unlikely.

2.4.2 Effects to Critical Habitat

Implementation of the proposed project is likely to affect freshwater rearing and migration habitat for ESA-listed salmonids. The PBFs that could be adversely affected by the proposed action are water quality, substrate, natural cover, forage, fish passage, and water velocity. Each of these effects are described in more detail below.

2.4.2.1 Water Quality

The proposed action could negatively affect water quality through temporary increases in pH value, chemical contamination, or short-term increases in turbidity. As described in Section 2.4.1.1, we expect that the grout-to-water ratio, grout pumping rate, and use of AWA will result in a short-term, localized, and low magnitude rise in pH values within the Snake River, which will rapidly dissipate from contact with high flow volumes. These factors will also reduce the risk of pH values rising above 9.0, the state water quality standards for Idaho and Oregon. If pH does exceed 9.0 during monitoring efforts, operations will cease, then be evaluated, and the methods for implementing the action will be revised prior to the continuation of work. As described in Section 2.4.1.6, we expect that proposed BMPs will reduce the risk of leaks or spills from machinery from entering the Snake River. We expect adverse effects from increases in turbidity (below 50 NTU) upon riprap placement to last for a few hours and extend no more than 1,000 feet downstream from the project site. These increases in turbidity will cover a small area, will be of low magnitude (sublethal to fish occupying the habitat), and will be short term. Project effects on the water quality PBF will be small and temporary for pH value increases; very small, if even detectable, for chemical contamination; and small and temporary for turbidity. None of the effects are expected to change the function of the water quality PBF.

2.4.2.2 Substrate

Turbidity plumes from riprap placement activities will deposit a small amount of sediment along the banks of the Snake River. Because of the expected effectiveness of the proposed sediment control BMPs, NMFS expects that any occurring sediment deposition will be of small amounts, localized, and temporary. Habitat quality will likely recover as fine sediments are flushed downstream during high flows in spring after project completion, and will not reduce the function of the substrate PBF.

2.4.2.3 Natural Cover

Natural cover could be slightly negatively affected due to the installation of riprap adjacent to the boat ramp. Natural cover could also be slightly negatively affected due to the installation of fill in the voids underneath the boat ramp and apron, which could be acting as an artificial undercut bank for fish. Approximately 632 cubic yards of riprap will be installed, decreasing the channel area by approximately 525 square feet. The riprap will be large coarse rock, ranging from approximately 15 inches to 42 inches in diameter. The proposed riprap will be similar in volume and area to the original fill that the boat ramp was constructed on. However, the installed riprap will be larger diameter than the original fill used in order to protect the boat ramp structure from future high flow events. The decrease in channel area is expected to have minor negative effects on natural cover, while the increase in rock size in comparison to the original fill could partially offset this effect by providing a small amount of natural cover. Since the boat ramp did not have voids upon original installation, filling of the voids will restore the structure and site to reduced natural cover. Because of these project design characteristics, the project is not likely to change the function of the natural cover PBF in the long term.

2.4.2.4 Forage

Installation of riprap could cause short-term increases in turbidity and sediment deposition, which may temporarily reduce macroinvertebrate communities immediately adjacent to and downstream of (<1,000 feet) the project site. However, increases in turbidity and sediment deposition are expected to only affect a small area and will likely be flushed out during high flow events in the spring or during high flow releases from the Hells Canyon Dam following project implementation. High streamflow volume of the Snake River in the action area is expected to minimize both the magnitude and duration of effects on salmonid food sources. For these reasons, the proposed action is unlikely to result in appreciable effect on, or reduction in function of the forage PBF.

2.4.2.5 Fish Passage and Water Velocity

Upstream and downstream passage within the project site may be temporarily impaired during riprap placement activities. Additionally, upstream and downstream passage may be slightly altered in the long-term due to riprap decreasing the overall channel area adjacent to the boat ramp. Placing approximately 632 yards of riprap along the in-water slope adjacent to the boat ramp will decrease the overall channel area by 525 square feet. The current cross sectional channel area is approximately 4,650 square feet at high flow (WWNF 2018). This restriction may cause slight increases in flow velocity of the channel at the project site. The restriction may also cause a slight rise in water surface of the channel at the project site and upstream from the site. However, diurnal water surface changes due to water discharge from the Hells Canyon Dam may exceed the effects of this change on a regular basis. Thus, the effects to flow velocity and water surface rise will be minimal compared to existing operational changes. The riprap will be similar in volume and area to the original fill when the boat ramp was initially installed. Therefore, addition of riprap to the river channel as a result of the boat ramp repair will likely result in minor impact to the function of the passage PBF.

2.5 Cumulative Effects

"Cumulative effects" is defined at 50 CFR 402.02.

The action area is entirely federal land. All land-based activities occurring there are authorized or managed by the WWNF. The Hells Canyon Dam, which is operated by Idaho Power, is located approximately 0.75 miles upstream from the action area. Discharge rates from the Hells

Canyon Dam are adjusted on a regular basis. Changes in discharge rates will continue to affect streamflow volume and stream velocity of the Snake River within the action area.

Additionally, the thermal regime in the Hells Canyon reach of the Snake River is likely more productive for fall Chinook salmon today than it was historically due to the influence of the Hells Canyon Dam. However, other issues associated with the operation of the Hells Canyon Dam limit Snake River fall Chinook salmon viability in this reach (NMFS 2017b).

2.6 Integration and Synthesis

In this section, we add the effects of the action (Section 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5), taking into account the status of the species and critical habitat (Section 2.1), 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 by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat for the conservation of the species.

Species. Many individual populations of Snake River Basin steelhead and Snake River spring/summer Chinook salmon are not meeting recovery plan abundance and productivity targets. The Hells Canyon reach of the Snake River is not included within the population boundaries of any Snake River Basin steelhead or Snake River spring/summer Chinook populations. The fish in this reach, however, are listed fish under the ESA.

The Lower Snake River Population will need an increase in productivity combined with a reduction in diversity risk in order to recover. Therefore, each species remains threatened with extinction. Furthermore, climate factors could make it more challenging to increase productivity, decrease diversity risk, and recover the listed species (NMFS 2017b). River habitat in the action area exhibits a "Not Supporting" status for the beneficial use of Cold Water Aquatic Life (IDEQ 2017).

Salmonids in the action area could potentially be affected by turbidity, sediment deposition, noise, and chemicals; however, these effects are expected to be minor because of the proposed BMPs and the ability of fish to move out of the affected area into similar nearby habitats during construction. The following adverse effects are expected:

- Salmonids located directly downstream from the boat ramp structure could be exposed to sublethal elevated pH values as a result of grouting activities;
- Salmonids located directly downstream from the boat ramp structure could be injured or killed due to mobilized riprap in the channel during riprap placement activities.

The exposure of sublethal short-term elevated pH values to a small number of salmonids immediately downstream from the project site would not likely reduce the abundance and productivity of the fall Chinook population. Due to avoidance behavior, the likelihood of injury or death to salmonids from mobilized riprap is small. If injury or death occurs, it is likely to only

impact a few individuals. Thus, the abundance and productivity of ESA-listed fish species would likely not be affected. Because we do not anticipate a change in the viability of the Lower Snake River fall Chinook salmon population, the proposed action will not likely affect the survival of the ESU. In addition, the probability of recovery for the species will not likely be affected. The number of steelhead or spring/summer Chinook that might be affected by the proposed action are too few to affect the abundance or productivity of nearby populations or the DPS or ESU as a whole. For this reason, the action is unlikely to reduce the survival or recovery of either of these species.
Critical habitat. Critical habitat for Snake River Basin steelhead, Snake River spring/summer Chinook salmon, and Snake River fall Chinook salmon is present in the action area. The proposed action will cause either small or short-term effects to water quality, substrate, natural cover, forage, fish passage, and water velocity PBFs. However, due to the small or short-lived nature of these effects, the conservation value of critical habitat for the conservation of each species would not likely be affected.

2.7 Conclusion

After reviewing the current status of the listed species and their designated critical habitat, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS' Opinion that the proposed action is not likely to jeopardize the continued existence of Snake River Basin steelhead, Snake River spring/summer Chinook salmon, and Snake River fall Chinook salmon, or destroy or adversely modify their associated designated critical habitats.

2.8 Incidental Take Statement

Section 7(b)(4) and section 7(o)(2) of the ESA 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.

2.8.1 Amount or Extent of Take

In the Opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

- **Short-term water quality impacts from elevated pH values**. Due to the large width and depth of the river channel in the action area, it is not possible to observe the number of fish actually exposed to elevated pH values. That being the case, NMFS will use the extent and duration of the elevated pH values as a surrogate for take. This is a rational surrogate for take because the bigger the size and the longer the duration of elevated pH values, the greater the amount of take that would occur. NMFS will consider the extent of take exceeded if pH values measured 100 feet downstream from the project site exceed 9.0 for more than 1-hour, or if pH values measured at the same location exceed 10.0 instantaneously.

- **Injury or death from mobilized riprap**. Due to the depth of the river channel in the action area, it is not possible to observe the number of fish injured or killed from mobilized riprap during project construction. That being the case, NMFS will use the volume of riprap placed within the river channel as a surrogate for take. This is a rational surrogate for take because the greater volume of riprap used, the greater amount of take that would occur. Although this surrogate could be considered coextensive with the proposed action, monitoring and reporting requirements will provide opportunities to check throughout the course of the proposed action whether the surrogate is exceeded. For this reason, the surrogate functions as an effective reinitiation trigger. NMFS will consider the extent of take exceeded if more than 750 cubic yards of riprap is placed within the river channel.

2.8.2 Effect of the Take

In the 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 of the species.

2.8.3 Reasonable and Prudent Measures

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

The WWNF and COE (for those measures relevant to the CWA section 404 permit) shall:

1. Minimize incidental take from construction activities and implement all of the proposed conservation measures.

2. Ensure completion of a monitoring and reporting program to confirm that the terms and conditions in this ITS were effective in avoiding and minimizing incidental take from permitted activities and that the amount and extent of take was not exceeded.

2.8.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the WWNF must comply with them in order to implement the reasonable and prudent measures (RPMs) (50 CFR 402.14). The WWNF 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. To implement RPM 1 (minimize take from construction activities), the WWNF and COE (for those measures relevant to the CWA section 404 permit) shall ensure the following:

   a. The construction contractor's equipment is cleaned of external oil and grease prior to arrival at the project site. The construction contractor's equipment is inspected daily for leaks and accumulation of grease, and any identified problems are corrected prior to equipment contact with water.

b. The construction contractor does not end-dump riprap, placing it slowly and incrementally into the river channel to minimize: a sudden increase in turbidity, potential for riprap mobilization, and risk of injury or death to fish.

c. The construction contractor stabilizes all disturbed areas within 12 hours of any break in work unless construction will resume within 7 days.

d. In-water work is confined to the work window of July 1 through October 15.

e. That any terms applied to the CWA 404 permit are consistent with the project description, conservation measures, and terms and conditions in the BA and this Opinion.

2. To implement RPM 2 (monitoring and reporting), the WWNF shall:

   a. Ensure that the construction contractor or WWNF personnel monitor pH value changes created by the action. The construction contractor will immediately cease work if pH values exceed Oregon and Idaho state standards (pH 9.0) at 100 feet downstream from the project site. Monitoring shall continue though the cessation period to record the magnitude and duration of exceedance. Any evidence of stress to salmonids, or other aquatic organisms, shall be recorded. The construction contractor shall implement and document BMPs, including reduction of pumping rate or adjustment to placement technique, to reduce the magnitude and duration of elevated pH values before continuing work. Work shall not resume until pH values are within acceptable limits by state standards. Stop work, and notify NMFS immediately (extent of take) if pH values exceed 9.0 for more than 1-hour, or if pH values exceed 10.0 instantaneously.

   b. Ensure that the construction contractor or WWNF personnel visually monitor boat ramp repair efforts during grouting activities for significant seepage of grout from grout bags or voids. In the event of significant seepage, the grouting activity will immediately cease and pH values will be monitored. Grout application methods will be revised prior to continuation of grouting. Any significant seepage with correlation to elevated pH values should be recorded.

   c. Notify NMFS immediately (extent of take) if more than 750 cubic yards of riprap is placed within the river channel. Ensure that the construction contractor ceases activities and contact NMFS if more than 750 cubic yards of riprap is placed within the river channel.

   d. Submit a monitoring report (with information on elevated pH value and riprap volume) by April 15 of the year following project completion to the Snake Basin Office email: nmfswcr.srbo@noaa.gov.

2.9 Conservation Recommendations

Conservation recommendations are defined at 50 CFR 402.02, and, for this consultation, are as follows:

1. The construction contractor should contour the placed riprap in a manner that conforms to natural channel processes in the project site and further reduces potential for future streambank cutting.

2. If possible, the construction contractor should place the riprap in the least amount of stages as possible (i.e., few work breaks between placements) to reduce the possibility of fish returning to areas affected by mobilized riprap after initial relocation.

3. The construction contractor should ensure that no fish are present in the voids underneath the boat ramp or apron prior to grouting activities. To ensure no fish presence, the construction contractor should sweep each void in order to relocate any fish from the area.

4. The construction contractor should clean all riprap (i.e. remove sediment fines) prior to placement in the river channel.

2.10 Reinitiation of Consultation

This concludes formal consultation for the Hells Canyon Creek Boat Ramp Repair Project.

As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the 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 agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat that was not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

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. The MSA (Section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. This analysis is based, in part, on the EFH assessment provided by the WWNF and descriptions of EFH for Pacific Coast salmon (PFMC 2014) contained in the fishery management plans developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The proposed action (Section 1.3) and action area (Section 2.2) for this consultation are described earlier in this Opinion. The action area includes areas designated as EFH for rearing and migration life-history stages of Chinook salmon. Environmental effects of the proposed action may adversely affect EFH. The affected EFH possesses areas containing the features and habitat function consistent with habitat areas of particular concern (HAPC). Identifying HAPCs helps focus conservation efforts on particular habitats that are of high ecological importance. The HAPC for Pacific coast salmon potentially affected by the proposed action is complex channels and floodplain habitats.

3.2 Adverse Effects on Essential Fish Habitat

The proposed project "may adversely affect" EFH for Chinook salmon as a result of boat ramp repair activities within the Hells Canyon watershed. However, the impact avoidance and BMPs described in Section 1.3.1 are expected to effectively minimize the effects. Effects to critical habitat were discussed in Section 2.4.2, and are incorporated as reference for the effects to EFH. Temporary increases in noise/disturbance during construction activities should have minor and short-lived effects on EFH. Additionally, the following adverse effects to EFH may occur:

1. Temporary increases in pH value could result from grouting activities associated with the boat ramp repair. As described in Section 2.4.1.5, we expect that the grout-to-water ratio, grout pumping rate, and use of AWA will result in a short-term, localized, and low magnitude rise in pH values within the Snake River, which will rapidly dissipate from contact with high flow volumes. These factors will also reduce the chance of pH values rising above 9.0, the state water quality standards for Idaho and Oregon. pH values measured 100 feet downstream from the project site are not expected to exceed 9.0 for more than 1-hour, nor to exceed 10.0 instantaneously.

2. Placement of riprap could result in temporary minor increases in turbidity and a small amount of sediment deposition. Additionally, minimal negative impacts to natural cover, forage, fish passage, and water velocity are expected. As described in Section 2.4.2.1, increases in turbidity (below 50 NTU) upon riprap placement are expected to last for a few hours and extend no more than 1,000 feet downstream from the project site. These increases in turbidity will cover a small area, will be of low magnitude, and will be short term. As described in Section 2.4.2.2, expected effectiveness of the proposed sediment control BMPs, sediment deposition is expected to be of small amounts, localized, and temporary. Habitat quality will likely recover as fine sediments are flushed downstream during high flows in spring after project completion, and will not reduce the function of

the substrate. As described in Section 2.4.2.3, a decrease in channel area as a result of riprap placement is expected to have minor negative effects on natural cover, while the increase in rock size in comparison to the original fill could partially offset this effect by providing a small amount of natural cover. As described in Section 2.4.2.4, installation of riprap could cause short-term increases in turbidity and sediment deposition, which may temporarily reduce macroinvertebrate communities immediately adjacent to and downstream of (<1,000 feet) the project site. However, increases in turbidity and sediment deposition are expected to only affect a small area and will likely be flushed out during high flow events in the spring or during high flow releases from the Hells Canyon Dam following project implementation. Therefore, effects to forage are expected to be minimal. As described in Section 2.4.2.5, upstream and downstream passage within the project site may be temporarily impaired during riprap placement activities. Additionally, upstream and downstream passage may be slightly altered in the long term due to riprap decreasing the overall channel area adjacent to the boat ramp. This restriction may cause slight increases in flow velocity of the channel at the project site. The restriction may also cause a slight rise in water surface of the channel at the project site and upstream from the site. However, diurnal water surface changes due to water discharge from the Hells Canyon Dam may exceed the effects of this change on a regular basis. Thus, the effects to flow velocity and water surface rise will be minimal compared to existing operational changes.

3.3 Essential Fish Habitat Conservation Recommendations

1. To minimize effects to Chinook salmon EFH, the WWNF and COE (for those measures relevant to the CWA section 404 permit) should impose the following permitting conditions to ensure:

    a. The construction contractor's equipment should be cleaned of external oil and grease prior to arrival at the project site. The construction contractor's equipment should be inspected daily for leaks and accumulation of grease, and any identified problems should be corrected prior to equipment contact with water.

    b. The construction contractor should not end-dump riprap, slowly and incrementally placing it into the river channel to minimize: a sudden increase in turbidity, potential for riprap mobilization, and risk of injury or death to fish.

    c. The construction contractor should stabilize all disturbed areas within 12 hours of any break in work unless construction will resume within 7 days.

    d. That any terms applied to the CWA 404 permit should be consistent with the project description, conservation measures, and terms and conditions in the BA and this Opinion.

    e. The construction contractor or WWNF personnel should monitor pH value changes created by the action. The construction contractor should immediately cease work if pH values exceed Oregon and Idaho state standards (pH 9.0) at

100 feet downstream from the project site. Monitoring should continue though the cessation period to record the magnitude and duration of exceedance. The construction contractor should implement and document BMPs, including reduction of pumping rate or adjustment to placement technique, to reduce the magnitude and duration of elevated pH values before continuing work. Work should not resume until pH values are within acceptable limits by state standards.

   f. The construction contractor or WWNF personnel should visually monitor boat ramp repair efforts during grouting activities for significant seepage of grout from grout bags or voids. In the event of significant seepage, the grouting activity should immediately cease and pH values should be monitored. Grout application methods should be revised prior to continuation of grouting. Any significant seepage with correlation to elevated pH values should be recorded.

2. The construction contractor should contour the placed riprap in a manner that conforms to natural channel processes in the project site and further reduces potential for future streambank cutting.

3. The construction contractor should clean all riprap (i.e. remove sediment fines) prior to placement in the river channel.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the WWNF and COE 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 timeframes for the federal agency response. The response must include a description of 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 WWNF and COE 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

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity.

4.1 Utility

"Utility" principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users.

This ESA consultation concludes that the proposed action will not jeopardize the affected listed species and will not destroy or adversely modify designated critical habitat for the listed species. Therefore, the WWNF can fund and permit, and the COE can issue a CWA 404 permit for the proposed action. The intended users of this Opinion are the WWNF, the COE, and any of their cooperators, contractors, or permittees. A copy of this Opinion was provided to the WWNF and the COE. This consultation will be posted on NMFS West Coast Region website (http://www.westcoast.fisheries.noaa.gov). The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan.

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

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

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

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

5. REFERENCES

Addy, K., Green, L., and Herron, E. 2004. pH and Alkalinity. URI Watershed Watch. 4 p.

Berg, L. and T. G. Northcote. 1985. Changes in territorial, gill-flaring, and feeding behavior in juvenile coho salmon (*Oncorhynchus kisutch*) following short-term pulses of suspended sediment. Canadian Journal of Fisheries and Aquatic Science 42: 1410-1417.

Chandler, J. 2018. Personal communication by email from Idaho Power, April 16, 2018.

Davidson, A., T. Cichosz, A. Sondenaa, D. and Saul. 2004. Snake Hells Canyon Subbasin Assessment. Prepared for the Northwest Power and Conservation Council. 323 p.

Everest, F. H., G. H. Reeves, J. R. Sedell, D. B. Hohler and T. Cain. 1987. The effects of habitat enhancement on steelhead trout and coho salmon smolt production, habitat utilization, and habitat availability in Fish Creek, Oregon, 1983-86. 1986 Annual Report. Bonneville Power Administration, Division of Fish and Wildlife Project 84-11. Portland, Oregon.

Federal Highway Administration (FHWA). 2008. Effective Noise Control During Nighttime Construction, updated July 15, 2008. http://ops.fhwa.dot.gov/wz/workshops/accessible/Schexnayder_paper.htm

Fitch, G. M. 2003. Minimizing the Impact on Water Quality of Placing Grout Underwater to Repair Bridge Scour Damage. Virginia Transportation Research Council. 31 p.

Foltz, R. B., B. Westfall, and B. Kopyscianski. 2013. Turbidity changes during culvert to bridge upgrades at Carmen Creek, Idaho. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 12 p.

Garland, R. D., K. F. Tiffan, D. W. Rondorf, and L. O. Clark. 2002. Comparison of subyearling fall Chinook salmon's use of riprap revetments and unaltered habitats in Lake Wallula of the Columbia River. North American Journal of Fisheries Management. 22 (4): 1283-1289.

Grant, J. W. A. and D. L. G. Noakes. 1987. Movers and stayers: Foraging tactics of young-of-the-year brook charr, Salvelinus fontinalis. Journal of Animal Ecology 56: 1001–1013.

Gregory, R. S. and T. S. Northcote. 1993. Surface, planktonic, and benthic foraging by juvenile chinook salmon (*Oncorhynchus tshawytscha*) in turbid laboratory conditions. Canadian Journal of Fisheries and Aquatic Sciences 50: 223-240.

Hargis, J. R. 1976. Ventilation and metabolic rate of young rainbow trout (Salmo gairdneri) exposed to sublethal environmental pH. Journal of Experimental Zoology. 196: 39-44.

Idaho Department of Environmental Quality (IDEQ). 2017. Final Assessment Unit Status Report for Snake River, Hells Canyon Subbasin, Idaho.

Interior Columbia Basin Technical Recovery Team (ICBTRT). 2010. Current Status Reviews: Interior Columbia River Basin Salmon ESUs and Steelhead DPSs. Volume I: Snake River Basin ESUs/DPS. Snake River spring/summer Chinook salmon ESU, Snake River steelhead DPS Snake River fall Chinook salmon ESU, Snake River sockeye salmon ESU. Interior Columbia Basin Technical Recovery Team: Portland, Oregon. 261 p. https://www.nwfsc.noaa.gov/research/divisions/cb/genetics/trt/col/trt_current_status_assessments.cfm

Koski, K. V. 1966. The survival of coho salmon (Oncorhynchus kisutch) from egg deposition to emergence in three Oregon coastal streams. Master's thesis. Oregon State University. Corvallis, Oregon.

Lloyd, D. 1987. Turbidity as a Water Quality Standard for Salmonid Habitats in Alaska. North American Journal of Fisheries management 7:34-45.

Mantua, N., I. Tohver, and A. Hamlet. 2009. Impacts of climate change on key aspects of freshwater salmon habitat in Washington State. Climate Impacts Group, University of Washington, Seattle, Washington.

McElhany, P., M. H. Ruckelshaus, M. J., T. C. Wainwright, and E. P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-42, Seattle, Washington, 156 p.

McLeay, D. J. 1983. Toxicity of Portland Cement to Salmonid Fish. Prepared for Water Quality Unit, Habitat Management Division, Fisheries and Oceans Canada. 10 p.

McLeay, D. J., I. K. Birtwell, G. F. Hartman, and G. L. Ennis. 1987. Responses of Arctic Grayling (Thymallus arcticus) to acute and prolonged expose to Yukon Placer Mining Sediment. Can. J. Fish. Aquat. Sci. 44: 658-673.

Meehan, W. R. and D. N. Swanston. 1977. Effects of gravel morphology on fine sediment accumulation and survival on incubating salmon eggs. Research Paper PNW-220. U.S. Forest Service.

National Marine Fisheries Service. 2017. (NMFS 2017a). ESA Recovery Plan for Snake River Spring/Summer Chinook Salmon (Oncorhynchus tshawytscha) & Snake River Basin Steelhead (Oncorhynchus mykiss) November 2017. Prepared by National Marine Fisheries Service West Coast Region. 284 p. http://www.westcoast.fisheries.noaa.gov/publications/recovery_planning/salmon_steelhead/domains/interior_columbia/snake/Final%20Snake%20Recovery%20Plan%20Docs/final_snake_river_spring-summer_chinook_salmon_and_snake_river_basin_steelhead_recovery_plan.pdf

National Marine Fisheries Service. 2017. (NMFS 2017b). [ESA Recovery Plan for Snake River Fall Chinook Salmon (Oncorhynchus tshawytscha)](https://www.westcoast.fisheries.noaa.gov/publications/recovery_planning/salmon_steelhead/domains/interior_columbia/snake/Final%20Snake%20Recovery%20Plan%20Docs/final_snake_river_fall_chinook_salmon_recovery_plan.pdf) November 2017. Prepared by National Marine Fisheries Service West Coast Region. 366 p. https://www.westcoast.fisheries.noaa.gov/publications/recovery_planning/salmon_steelhead/domains/interior_columbia/snake/Final%20Snake%20Recovery%20Plan%20Docs/final_snake_river_fall_chinook_salmon_recovery_plan.pdf

Neff, J. M. 1985. Polycyclic aromatic hydrocarbons. *In*: Fundamentals of aquatic toxicology, G.M. Rand, and S.R. Petrocelli (eds.), pp. 416-454. Hemisphere Publishing, Washington, D.C.

Newcombe, C. and J. Jensen. 1996. Cannel Suspended Sediment and Fisheries: A Synthesis for Quantitative Assessment of Risk and Impact. North American Journal of Fisheries Management 16: 693-727.

Northwest Fisheries Science Center (NWFSC). 2015. Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest. 356 p.

Oregon Department of Fish and Wildlife (ODFW). 2008. Oregon Guidelines for Timing of In-water Work to Protect Fish and Wildlife Resources. 12 p.

Olson, D. 1996. Monitoring Report Associated with the Implementation of the Incidental Take Statement for Snake River Spring/summer Chinook Salmon (Oncorhynchus tshawytscha) for the 1995 Recreational Floating on the main Salmon River. USDA Forest Service, Sawtooth National Forest, SNRA, Custer County, Idaho.

Pacific Fishery Management Council (PFMC). 2014. Appendix A to the Pacific Coast Salmon Fishery Management Plan, as modified by Amendment 18. Identification and description of essential fish habitat, adverse impacts, and recommended conservation measures for salmon.

Ries, P. 1995. May 23, 1995 letter to National Marine Fisheries Service documenting: Field notes collected during the 1992 floatboating season on the Sawtooth National Recreation Area. USDA Forest Service, Sawtooth National Forest, SNRA, Custer County, Idaho.

Sawtooth National Forest (SNF). 2009. Calendar Year 2008 monitoring report for Sawtooth National Recreation Area Permitted Commercial Floatboating and Walk/Wade Angling and Non-Outfitted Floatboating and Walk/Wade Angling on the Upper Main Salmon River. USDA Forest Service Sawtooth National Forest Sawtooth National Recreation Area Custer County, Idaho. January 30, 2009.

Schmetterling, D. A., C. G. Clancy, and T. M. Brandt. 2001. Effects of riprap bank reinforcement on stream salmonids in the western United States. Fisheries 26(7): 6-13.

Servizi, J. A. and D. W. Martens. 1992. Sublethal responses of coho salmon (*Oncorhynchus kisutch*) to suspended sediments. Canadian Journal of Fisheries and Aquatic Sciences 49: 1389-1395.

Spence, B. C, G. A. Lomnicky, R. M. Hughes, and R. P. Novitzki. 1996. An Ecosystem Approach to Salmonid Conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp., Corvallis, Oregon.

Staples C. A, J. B. Williams, G. R. Craig, and K. M. Roberts. 2001. Fate, effects and potential environmental risks of ethylene glycol: a review. Chemosphere. 43(3): 377-383.

U.S. Fish and Wildlife Service (USFWS). 2000. Impacts of riprapping to ecosystem functioning, Lower Sacramento River, California. Fish and Wildlife Coordination Act Report. June. 40 p.

Wallowa-Whitman National Forest (WWNF). 2018. Hells Canyon Creek Boat Ramp Repair Project. 37 p.

Washington Department of Fish and Wildlife (WDFW), Washington State Department of Transportation, and Washington Department of Ecology. 2002. Washington State Aquatic Habitat Guidelines Program: Integrated Streambank Protection Guidelines 2003.

Witschi, W. A. and C.D Ziebell. 1979. Evaluation of pH shock on hatchery-reared rainbow trout. The Progressive Fish-Culturist. 41: 3-5.

Wysocki, L. E., J. W. Davidson III, M. E. Smith, S. S. Frankel, W. T. Ellison, P. M. Mazik, A. N. Popper, and J. Bebak. 2007. Effects of aquaculture production noise on hearing, growth, and disease resistance of rainbow trout Oncorhynchus mykiss. Aquaculture 272: 687-697.