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

Refer to NMFS No: WCRO-2022-03050

https://doi.org/10.25923/jxvp-qa93

August 18, 2023

Susan Poulsom
Manager, NPDES Permits Section
U.S. Environmental Protection Agency
1200 6th Avenue, Suite 155
Seattle, WA 98101

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the National Pollutant Discharge Elimination System permit for Dworshak Dam, U.S. Army Corps of Engineers, Permit No. ID0028568

Dear Ms. Poulsom:

Thank you for your letter dated January 11, 2023, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the National Pollutant Discharge Elimination System permit for Dworshak Dam (Permit No. IS0028568). We determined that your consultation package was complete and initiated consultation on February 12, 2023.

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson–Stevens Fishery Conservation and Management Act (16 U.S.C. 1855(b)) for this action. After reviewing the proposed action, we concluded that there are no adverse effects on EFH. Therefore, we are hereby concluding EFH consultation.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019 Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. On November 14, 2022, the Northern District of California issued an order granting the government's request for voluntary remand without vacating the 2019 regulations. The District Court issued a slightly amended order two days later on November 16, 2022. As a result, the 2019 regulations remain in effect, and we are applying the 2019 regulations here. For purposes of this consultation and in an abundance of caution, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

After reviewing the current status of the species, the environmental baseline, the effects of the proposed action, and the cumulative effects, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of ESA-listed Snake River (SR) fall-run Chinook salmon (*Oncorhynchus tshawytscha*) or Snake River basin steelhead (*O. mykiss*). We also concur with the EPA that the proposed action is not likely to adversely affect SR spring/summer Chinook salmon or designated critical habitat for SR fall-run Chinook salmon. We provide rationale for our conclusions in the attached opinion. This opinion is based on information provided in your biological evaluation, additional information we requested that was provided by the U.S. Environmental Protection Agency (EPA), U.S. Army Corps of Engineers (USACE), and other sources of information as cited in this opinion.

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

Please contact Lynne Krasnow, Columbia Hydropower Branch, Portland, OR, at (503) 347-7571, lynne.krasnow@noaa.gov, if you have any questions concerning this consultation or if you require additional information.

Sincerely,

Nancy L Munn

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

Enclosure

cc: Abigail Conner – EPA
Jenny Wu – EPA
John Palmer – EPA

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and NLAA Determination Concurrence

National Pollutant Discharge Elimination System Permit for Dworshak Dam

NMFS Consultation Number: WCRO-2022-03050

Action Agency: U.S. Environmental Protection Agency, Region 10

Affected Species and NMFS' Determinations:

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

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

Issued By: Nancy L Munn

Nancy L. Munn, Ph.D.
Acting Assistant Regional Administrator for Interior Columbia Basin Office

Date: August 18, 2023

TABLE OF CONTENTS

TABLE OF TABLES iii
TABLE OF FIGURES iii
ACRONYMS iv
1. Introduction 1
1.1. Background 1
1.2. Consultation History 1
1.3. Proposed Federal Action 3
1.3.1. Proposed Measures to Reduce the Likelihood of Permit Exceedances and the Toxicity of the Discharges 4
1.3.2. Minimizing Adverse Effects of Cooling Water Intake Structures 5
1.3.3. Clean Water Act Section 401 Certification 5
1.4. Other Activities Caused by the Proposed Action 5
2. Endangered Species Act: Biological Opinion And Incidental Take Statement 5
2.1. Analytical Approach 6
2.2. Rangewide Status of the Species and Critical Habitat 7
2.2.1. Status of the Species 7
2.2.1.1. Snake River Fall-run Chinook Salmon 8
2.2.2. Status of Critical Habitat 10
2.2.3. Climate Change Implications for ESA-listed Species and their Critical Habitat 12
2.3. Action Area 14
2.4. Environmental Baseline 14
2.4.1. Condition of Salmonid Habitat in the Action Area 15
2.4.2. Condition of Critical Habitat in the Action Area 17
2.5. Effects of the Action 17
2.5.1. Presence and Timing of SR Fall-run Chinook Salmon in the Action Area 18
2.5.2. Effects to Species 19
2.5.2.1. Oil and Grease Effluent Limits 20
2.5.2.2. Permitted pH Levels 23
2.5.2.3. Heat Discharges 23
2.5.2.4. Levels of Total Suspended Solids 24
2.5.2.5. Oxygen-demanding Materials 25
2.5.2.6. Discharge Prohibitions 26
2.5.2.7. Interactive and Synergistic Effects of Multiple Pollutants 28
2.5.2.8. Operation of the Cooling Water Intake System 28
2.5.2.9. Permit Conditions Added by the EPA under CWA Section 401 30

2.5.2.10. Summary—Effects of the Proposed Permit on the Species 30
2.5.3. Effects to Critical Habitat 30
2.5.3.1. Effects of Oil and Grease Effluent Limits on PBFs 30
2.5.3.2. Effects of Permitted pH Levels on PBFs 31
2.5.3.3. Effects of Heat Discharges on PBFs 31
2.5.3.4. Effects of Levels of Total Suspended Solids on PBFs 31
2.5.3.5. Effects of Levels of Oxygen-demanding Materials on PBFs 31
2.5.3.6. Effects of the Permit's Discharge Prohibitions on PBFs 31
2.5.3.7. Effects of Permitting the Operation of the Cooling Water Intake System on PBFs 32
2.5.3.8. Effects of Permit Conditions Added by the EPA Under CWA Section 401 on PBFs 32
2.5.3.9. Summary: Effects of the Proposed Permit on Critical Habitat 32
2.6. Cumulative Effects 32
2.7. Integration and Synthesis 33
2.7.1. Snake River Fall-run Chinook Salmon 33
2.8. Conclusion 35
2.9. Incidental Take Statement 35
2.9.1. Amount or Extent of Take 36
2.9.2. Effect of the Take 36
2.9.3. Reasonable and Prudent Measures 36
2.9.4. Terms and Conditions 36
2.10. Reinitiation of Consultation 37
2.11. "Not Likely to Adversely Affect" Determinations 37
2.11.1. Background and Action Agency's Effects Determinations 37
2.11.2. Snake River Spring/Summer Chinook Salmon 38
2.11.3. Snake River Basin Steelhead 38
3. Data Quality Act Documentation and Pre-Dissemination Review 38
3.1. Utility 39
3.2. Integrity 39
3.3. Objectivity 39
4. References 40

TABLE OF TABLES

Table 1. Listing status, status of critical habitat designations and protective regulations, and relevant Federal Register (FR) decision notices for Snake River fall-run Chinook salmon considered in this opinion.. 7

Table 2. Types of sites, essential physical and biological features (PBFs), and the life stage each PBF supports in designated critical habitat for Snake River fall-run Chinook salmon. The proposed action affects freshwater rearing and juvenile and adult migration habitats. 11

Table 3. Life stages and timing of Snake River fall-run Chinook salmon in the action area. 19

Table 4. Discharge rates, in gallons per minute (GPM) and millions of gallons per day (MGD), and frequencies of outfalls at Dworshak Dam. 20

Table 5. Calculated oil and grease concentrations in the effluent in milligrams per liter (mg/L), after dilution, within the action area. 22

Table 6. Maximum biological oxygen demand exposure concentrations in milligrams per liter (mg/L) below Dworshak Dam. 25

Table 7. Maximum chemical oxygen demand exposure concentrations in milligrams per liter (mg/L) below Dworshak Dam. 26

TABLE OF FIGURES

Figure 1. Location of Dworshak Dam on the North Fork Clearwater River, with the 500-meter downstream extent of the action area shown in white. 14

Figure 2. Ten-year average (2013–2022) daily outflow (kcfs) at Dworshak Dam. 16

Figure 3. Annual daily average influent temperatures (ºC), measured in the scroll case at Dworshak Dam, 2013–2022. 17

Figure 4. Snake River fall-run Chinook spawning area (yellow star), about one mile downstream of the action area (blue polygon) in the lower North Fork Clearwater River................ 19

ACRONYMS

BE	Biological Evaluation
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
CRS	Columbia River System
CWA	Clean Water Act
CWIS	Cooling Water Intake Structures
DPS	Distinct Population Segment
DQA	Data Quality Act
EAL	Environmentally Acceptable Lubricant
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
GPM	Gallons per Minute
Hg	Mercury
ICTRT	Interior Columbia Technical Recovery Team
ITS	Incidental Take Statement
kcfs	Thousand Cubic Feet per Second (rate of river water flow)
MeHg	Methylmercury
MGD	Million Gallons per Day
MPG	Major Population Group
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NPT	Nez Perce Tribe
Opinion	Biological Opinion
PBF	Physical or Biological Feature
PCB	Polychlorinated Biphenyls
PCE	Primary Constituent Element
PMP	PCB Management Plan
ppm	Parts per Million
RPM	Reasonable and Prudent Measure
SR	Snake River
SRB	Snake River Basin
TSS	Total Suspended Solids
USACE	U.S. Army Corps of Engineers
VSP	Viable Salmonid Population

1. INTRODUCTION

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

1.1. Background

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 U.S.C. 1531 et seq.), as amended, 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 within 2 weeks at the NOAA Library Institutional Repository at https://repository.library.noaa.gov/welcome. A complete record of this consultation is on file at NMFS' office in Portland, Oregon.

1.2. Consultation History

The U.S. Environmental Protection Agency (EPA) proposes to finalize and issue a National Pollutant Discharge Elimination System (NPDES) permit to the U.S. Army Corps of Engineers (USACE) for discharges from Dworshak Dam to waters of the Nez Perce Tribe (NPT).

In July, 2020, NMFS completed consultation on the operation of the Columbia River System (CRS) with the USACE, U.S. Bureau of Reclamation, and U.S. Department of Energy–Bonneville Power Administration, collectively referred to as the CRS Action Agencies, and issued a biological opinion (opinion) for the Continued Operation and Maintenance of the Columbia River System (CRS opinion), which includes Dworshak Dam (NMFS 2020). The EPA was not an action agency for the 2020 consultation for activities they authorize or permit, associated with these Federal facilities. Thus, the EPA has requested to consult with NMFS on its proposed issuance of the NPDES permit for discharges at this project.

The Clean Water Act (CWA) prohibits any entity from discharging "pollutants" through a "point source" into a "water of the United States" unless it has an NPDES permit. The NPDES permit contains limits on what can be discharged, includes monitoring and reporting requirements, and has other provisions to ensure that the discharge does not harm water quality or human health.

Pre-consultation discussions with the EPA began in September, 2021, when the EPA requested information to include in its biological evaluation (BE) for the draft NPDES permit for this project. NMFS and the EPA continued pre-consultation discussions through early February, 2023. In these exchanges, NMFS provided technical information to the EPA on the spatial and temporal distribution and the biological requirements of ESA-listed species, and on essential fish habitat (EFH) requirements for Chinook and coho salmon. The EPA sent NMFS a draft BE on December 5, 2022, and NMFS provided feedback to the EPA, and written comments, December 19, 2022.

On January 13, 2023, the EPA provided a final BE for the proposed permit (EPA 2023a) and requested NMFS' concurrence with its determinations that issuance of the proposed permit was not likely to adversely affect Snake River (SR) spring/summer-run Chinook salmon (*Oncorhynchus tshawytscha*), SR fall-run Chinook salmon (*O. tshawytscha*), and Snake River basin (SRB) steelhead (*O. mykiss*), or critical habitat designated for SR fall-run Chinook salmon under Section 7(a)(2) of the ESA. The EPA also determined that finalizing the proposed permit would not adversely affect Essential Fish Habitat designated for Pacific Coast Salmon under Section 305(b) of the Magnuson–Stevens Fishery Conservation and Management Act. After reviewing the BE, we were unable to concur with the EPA's determinations for SR fall-run Chinook salmon or SRB steelhead and explained our reasoning in an email on February 16, 2023. The EPA sent us an email the same day, expressing interest in proceeding with formal consultation, which we initiated on that date. However, after further reviewing the BE and other available information, we concurred with the EPA that the proposed permit was not likely to adversely affect SRB steelhead.[1] Thus SR fall-run Chinook salmon are addressed in the biological opinion section of this document, and SR spring/summer-run and SRB steelhead are addressed in the "not likely to adversely affect" section of this document.

On December 15, 2022, NMFS sent letters to the Confederated Tribes of the Colville Reservation, the Spokane Tribe of Indians, the NPT, the Coeur d'Alene Tribe, the Kootenai Tribe, the Shoshone–Bannock Tribes, the Kalispel Tribe of Indians, the Cowlitz Indian Tribe, the Confederated Tribes of Warm Springs, the Confederated Tribes of Grand Ronde, the Confederated Tribes of the Umatilla Indian Reservation, and the Confederated Tribes and Bands of the Yakama Nation to gauge their interest in this project as well as our consultation on the EPA's separate NPDES permit for Chief Joseph Dam. We also sent a letter to the Confederated Tribes of the Siletz Indians of Oregon on December 21, 2022. We had not received responses to these inquiries at the time we completed this biological opinion.

The BE provides a description of the proposed permit and an analysis of its effects on anadromous fish species, designated critical habitat, and essential fish habitat in the North Fork Clearwater River. The present opinion is based on information provided in the BE, the draft NPDES permit, the technical fact sheet (EPA 2022a, 2022b, 2023a), and existing analyses in the CRS opinion (NMFS 2020). This consultation is not a reinitiation of the CRS opinion, and this new opinion does not replace the CRS opinion. We incorporate by reference relevant portions of the CRS opinion, provide information and additional analysis specific to the EPA's proposed issuance of this NPDES permit, and specify reasonable and prudent measures (RPMs) and Terms and Conditions that are applicable to the EPA and the permit applicant, the USACE.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019 Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. On November 14, 2022, the Northern District of California issued an order granting the government's request for voluntary remand without vacating the 2019 regulations. The District Court issued a slightly amended order two days later on November 16, 2022. As a result, the 2019 regulations remain in effect, and we are applying the

[1] We did not designate critical habitat for Snake River basin steelhead within the action area for this consultation.

2019 regulations here. For purposes of this consultation and in an abundance of caution, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

1.3. Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02).

The EPA Region 10 is proposing to issue an NPDES permit for the discharge of pollutants to waters of the NPT from Dworshak Dam, a Federal facility operated by the USACE on the North Fork Clearwater River. This would be the first individual NPDES permit issued by the EPA for this facility and would be effective for 5 years. The permit would authorize the following types of discharges: cooling water discharges (Outfalls 001–003), equipment drainage and floor drain discharges (Outfalls 004 and 005), equipment and facility maintenance-related water discharges (Outfall 005), sump and dam leakage flows (Outfalls 004–006), and lubricants (all outfalls).

We adopt by reference the EPA's description of the proposed permit contained in Section 2 of the BE (EPA 2023a). The proposed permit does not regulate waters that flow over the spillway or pass through the turbines and does not authorize oil spills. It contains the following requirements and stipulations that have the potential to affect SR fall-run Chinook salmon or its designated critical habitat:

- Numerical effluent limits on discharges for oil and grease and pH.
- Narrative effluent limits stating "the permittee is prohibited from discharging toxic substances and deleterious materials in concentrations that impair the beneficial uses of the receiving water."
- Narrative effluent limits stating "waters shall be free from hazardous, toxic, deleterious, radioactive, floating, suspended, or submerged matter that would impair designated uses."
- The use of environmentally acceptable lubricants (EALs), unless technically infeasible.
- Technologies and operations that minimize the impingement and entrainment of fish in cooling water intake structures (CWIS).
- Monitoring requirements for flow, oil and grease, pH, and temperature.
- A detailed best management practices (BMP) plan and BMP annual report to prevent and minimize oil releases, including oil accountability tracking.
- An EAL annual report to inventory equipment where EALs may be used, and to report when and where EALs have been implemented.

- A CWIS study and annual report on the implementation of technologies to meet CWIS permit conditions.

- A Polychlorinated Biphenyls (PCB) Management Plan and PCB Annual Report to inventory past actions to reduce/remove PCBs, identify potential current sources, and describe actions to reduce those sources.

1.3.1. Proposed Measures to Reduce the Likelihood of Permit Exceedances and the Toxicity of the Discharges

The proposed permit includes several measures designed to reduce the likelihood that the permit limits are exceeded, to reduce the toxicity of oil and grease released at the project, and to reduce the likelihood of negative effects: (1) the use of EALs for all equipment where oil and grease can interface with water, unless technically infeasible; (2) monitoring and annual reporting; and (3) the development and implementation of a Best Management Practices Plan.

- The EPA's 2011 Environmentally Acceptable Lubricants report defines EALs as "lubricants that have been demonstrated to meet standards for biodegradability, toxicity, and bioaccumulation potential that minimize their likely adverse consequences in the aquatic environment, compared to conventional lubricants." The USACE has been pursuing conversion to EALs at Dworshak Dam for several years and at this point, all substitutions have been made that are feasible (EPA 2023c). We therefore do not expect further reductions in the toxicity of polycyclic aromatic hydrocarbon discharges from the project under the proposed permit.

- The proposed permit requires the USACE to monitor effluent samples for oil and grease at all six outfalls at the project. Initial sampling frequency is once per week, but if none of the samples tested in the first year exceed the numerical effluent limit (5 mg/L as a daily maximum), the USACE can reduce sampling frequency to once per month. If the 5 mg/L limit is exceeded, a violation of the permit is entered into the EPA's NPDES compliance and enforcement database for potential future enforcement action (EPA 2023a).

- Oil spills and visible sheens are not covered by the permit and any occurrence "that triggers an emergency action or notification under the facility's Spill Prevention Control and Countermeasure plan" must be reported to the EPA within 24 hours (EPA 2023a). A log of the event must be retained and made available to the EPA and the Nez Perce Tribe. The USACE's compliance responsibilities are described in Section IV of the proposed permit (EPA 2023a) and are designed to ensure that the USACE takes the measures needed to comply with the limit for oil and grease.

The required BMP Plan will include: oil accountability tracking; site-specific measures to prevent the escape of grease and heavy oils used for lubrication and hydraulics; identification of site-specific vulnerabilities, ways to address these vulnerabilities, and contingency planning for potential oil releases from these vulnerabilities; and measures to reduce the need for lubricants for all facility equipment that comes in contact with river water.

1.3.2. Minimizing Adverse Effects of Cooling Water Intake Structures

The proposed permit also addresses Section 316(b) of the CWA, which seeks to minimize adverse effects from CWISs on fish. The EPA applies this authority to existing facilities with an NPDES permit (EPA 2023b). The statute requires the permit writer to use best professional judgment to determine the best technology available to ensure that adverse effects are minimized to reduce impingement and entrainment of aquatic organisms at existing power generating and manufacturing facilities. Impingement occurs when fish become entrapped on the outer part of intake screens and entrainment occurs when fish pass through the screens and into the cooling water system. The proposed permit would authorize the operation of the two CWISs in the tailrace of Dworshak Dam.

1.3.3. Clean Water Act Section 401 Certification

Section 401 of the CWA states that a Federal agency may not issue a permit to discharge to waters of the United States unless a Section 401 water quality certification is issued or waived. Because this facility discharges to waters of the NPT, which the EPA has not approved for Treatment as a State, the EPA is the certifying authority. The EPA recognizes that the 401 certifications are consequences of the proposed permit and need to be considered as part of the analysis of effects.

Section 401 of the CWA requires that the certification conditions must be at least as stringent as NPT's water quality standards, so that they would add more protections to threatened and endangered species, critical habitat, or essential fish habitat. One of the draft 401 certification conditions for Dworshak Dam requires monitoring of mercury (Hg) and methylmercury (MeHg) at each outfall two times per year. This condition is included in the draft 401 certification at the request of the NPT in accordance with Nez Perce Tribal Code. Its purpose is to gather information regarding potential Hg and MeHg discharges. Biogeochemical conditions in some large reservoirs promote the conversion of deposited Hg into MeHg in studies at other dam sites (e.g., the Hells Canyon Complex), and this monitoring requirement will provide information on the risk of potential effects of MeHg from Dworshak Reservoir reaching the action area via the permitted discharges.

1.4. Other Activities Caused by the Proposed Action

We considered, under the ESA, whether or not the proposed permit would cause any other activities and determined that it would not. We had previously considered the effects of operating Dworshak Dam in NMFS (2020).

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

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

The EPA determined the proposed permit is not likely to adversely affect SR spring/summer Chinook salmon, SR fall-run Chinook salmon, and SRB steelhead or designated critical habitat for SR fall-run Chinook salmon. We concurred with all of these except for the EPA's determinations for SR fall-run Chinook salmon and its critical habitat, which are addressed in this biological opinion. Our concurrence for SR spring/summer Chinook salmon and SRB steelhead is documented in the "Not Likely to Adversely Affect" determinations section (Section 2.11).

2.1. Analytical Approach

This opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

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

The designation of critical habitat for SR fall-run Chinook salmon uses the term primary constituent element (PCE) or essential features. The 2016 final rule (81 FR 7414; February 11, 2016) that revised the critical habitat regulations (50 CFR 424.12) for some species replaced these terms with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

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

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

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.

- Evaluate the environmental baseline of the species and critical habitat.

- Evaluate the effects of the proposed action on species and their critical habitat using an exposure–response approach.

- Evaluate cumulative effects.

- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species; or (2) directly or indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.

- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2. Rangewide Status of the Species and Critical Habitat

In this section, we examine the status of SR fall-run Chinook salmon that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" for the jeopardy analysis. We also examine the condition of critical habitat throughout the designated area, evaluate the conservation value of the various watersheds that make up the designated area, and discuss the function of the PBFs that are essential for the conservation of the species. The Federal Register notices and notice dates for the species and critical habitat listings that we consider in this opinion are included in Table 1.

Table 1. Listing status, status of critical habitat designations and protective regulations, and relevant Federal Register (FR) decision notices for Snake River fall-run Chinook salmon considered in this opinion.

Species	Listing Status	Critical Habitat	Protective Regulations
Chinook salmon (*Oncorhynchus tshawytscha*)			
Snake River fall-run	T 4/22/92; 57 FR 14653	12/28/93; 58 FR 68543	6/28/05; 70 FR 37160

Note: Listing status 'T' means listed as threatened under the ESA.

2.2.1. Status of the Species

In this section we describe the present condition of the SR fall-run Chinook salmon evolutionarily significant unit (ESU). NMFS expresses the status of a salmonid ESU in terms of likelihood of persistence over 100 years (or risk of extinction over 100 years). NMFS uses the description in McElhany et al. (2000) of a viable salmonid population (VSP) that defines "viable" as less than a 5 percent risk of extinction within 100 years and "highly viable" as less than a 1 percent risk of extinction within 100 years. A third category, "maintained," represents a less than 25 percent risk within 100 years (moderate risk of extinction). To be considered viable, an ESU should have multiple viable populations so that a single catastrophic event is less likely to cause the ESU to become extinct, and so that it may function as a metapopulation that can sustain population-level extinction and recolonization processes (ICTRT 2007). The risk level of the ESU is built up from the aggregate risk levels of the individual populations and major population groups (MPGs) that make up the ESU.

Attributes associated with a VSP are: (1) abundance, the number of naturally produced adults in natural production areas; (2) productivity, the number of naturally spawning adults produced per parent; (3) spatial structure, the spatial distributions of both the individuals in the population and the processes that generate that distribution; and (4) diversity, the distribution of traits within and among populations, ranging in scale from DNA sequence variation in single genes to complex life history traits. A VSP needs sufficient levels of these four attributes in order to: safeguard the genetic diversity of the listed ESU or distinct population segment (DPS); enhance its capacity to adapt to various environmental conditions; and allow it to become self-sustaining in the natural environment (ICTRT 2007). These viability attributes are influenced by survival, behavior, and experiences throughout the entire salmonid life cycle, characteristics that are influenced in turn by habitat and other environmental and anthropogenic conditions. The present risk faced by the ESU informs NMFS' determination of whether additional risk will appreciably reduce the likelihood that the ESU will survive or recover in the wild.

The following sections summarize the status and available information considered in this opinion based on the *ESA Recovery Plan for Snake River Fall-run Chinook Salmon* (NMFS 2017); *Biological Viability Assessment Update for Pacific Salmon and Steelhead Listed Under the Endangered Species Act: Pacific Northwest* (Ford 2022); and *2022 5-Year Review: Summary & Evaluation of Snake River Fall-Run Chinook Salmon* (NMFS 2022a). These three documents are incorporated by reference here.

2.2.1.1. Snake River Fall-run Chinook Salmon

The SR fall-run Chinook salmon ESU was listed as threatened on April 22, 1992 (57 FR 14653). On August 18, 2022, in the agency's 5-year review for SR fall-run Chinook salmon, NMFS concluded that the species should remain listed as threatened (NMFS 2022a).

The ESU includes one fall-run Chinook salmon population that spawn in the mainstem of the Snake River and lower reaches of its major tributaries. The ESU also includes four artificial propagation programs: the Lyons Ferry Hatchery, Fall-run Chinook Acclimation Ponds, Nez Perce Tribal Hatchery, and Idaho Power programs (85 FR 81822). Historically, this ESU included one large additional population spawning in the mainstem of the Snake River upstream of the Hells Canyon Dam complex (Ford 2022). Snake River fall-run Chinook salmon have substantially declined in abundance from historical levels, primarily due to the loss of primary spawning and rearing areas upstream of the Hells Canyon Dam complex (57 FR 14653). Additional concerns for the species have been the high percentage of hatchery fish returning to natural spawning grounds and the relatively high aggregate harvest impacts by ocean and in-river fisheries (Good et al. 2005). Despite improvements in status over the last 5 years, threats associated with hydropower, habitat degradation and access, hatcheries, harvest, and predation continue to challenge ESU recovery (NMFS 2022a).

Life History. After spending two to five years in the ocean, adult SR fall-run Chinook salmon enter the Columbia River in July and August, and migrate past the lower Snake River mainstem dams from August through November. Fish spawning takes place from October through early December in the mainstem of the Snake River, primarily between Asotin Creek and Hells Canyon Dam, and in the lower reaches of the Tucannon, Grande Ronde, Clearwater, Salmon, and Imnaha Rivers (Connor and Burge 2003; Ford 2011). Juveniles emerge from the gravels in March and April of the following year.

Most SR fall-run Chinook salmon migrate to the Pacific Ocean during their first year of life, normally within three months of emergence from the spawning substrate as age-0 smolts, to spend their first winter in the ocean. Chinook salmon juveniles tend to display a "rear as they go" strategy, in which they continually move downstream through shallow shoreline habitats during their first summer and fall, continually growing until they reach the ocean by winter (Connor and Burge 2003; Coutant and Whitney 2006). Tiffan and Connor (2012) showed that subyearling fish favor water less than 6 feet deep, and Tiffan et al. (2014) found that riverine reaches were likely better rearing habitat than reservoir reaches.

Spatial Structure and Diversity. The SR fall-run Chinook salmon ESU includes one extant population of fish that currently spawns in all five of its historical major spawning areas. Fall-run Chinook salmon also occasionally spawn in the mainstem Snake River downstream from Lower Granite Dam (Dauble et al. 1999). The spatial structure risk for this population is therefore low and is not precluding recovery of the species (Ford 2022).

There are several diversity concerns for SR fall-run Chinook salmon, leading to a moderate diversity risk rating for the extant Lower Snake population. One concern is the relatively high proportion of hatchery spawners (70 percent) in all major spawning areas within the population (Ford 2022; NMFS 2017). The fraction of natural-origin fish on the spawning grounds has remained relatively stable, with 5-year means of 31 percent (2010–2014) and 33 percent (2015–2019) (Ford 2022). The diversity risk will need to be reduced to low in order for this population to be considered highly viable. Because there is only one extant population, it must achieve highly viable status in order for the ESU to recover.

Abundance and Productivity. Historical abundance of SR fall-run Chinook salmon is estimated to have been 416,000 to 650,000 adults (NMFS 2006), but numbers declined drastically over the 20th century, with only 78 natural-origin fish (WDFW and ODFW 2021) and 306 hatchery-origin fish passing Lower Granite Dam in 1990. After 1990, abundance increased dramatically, and exceeded 10,000 natural-origin returns each year from 2012–2015. However, the 5-year geometric means of natural-origin spawners has declined by 36 percent between the 2010–2014 (11,254) and 2015–2019 (7,252) time periods. Although there have been recent declines in natural-origin returns, the 10-year geometric mean for the years 2010–2019 (9,034 natural-origin adults) exceeds the recovery plan abundance metric (i.e., greater than 4,200 natural-origin spawners) (Ford 2022; NMFS 2017; NMFS 2022a). Productivity, as seen in brood year returns-per-spawner, has been below replacement in recent years, and a longer-term, 20-year geometric mean raw productivity is 0.63, far below the recovery plan metric of 1.7. While below-replacement returns are concerning, the long-term (15-year) abundance trend is stable and the population remains well above the minimum abundance threshold set by the Interior Columbia Technical Recovery Team (ICTRT).

Recovery. NMFS completed a recovery plan for SR fall-run Chinook salmon in 2017 (NMFS 2017). The most likely pathway to recovery is achieving a substantial amount of natural production in one or two of the five major spawning areas. The natural production emphasis areas would be managed to have a low percentage of hatchery-origin spawners (NMFS 2022a). In order to maintain and improve the status of this ESU, NMFS (2022a) recently recommended implementing a number of actions, including but not limited to: (1) Idaho Power Company's SR fall-run Chinook salmon spawning program; (2) implementation of the CRS biological opinions;[2] (3) measures to reduce impacts of reservoir and river channel dredging and disposal; (4) tributary habitat improvement actions and total maximum daily loads; (5) restore an early-spawning fall-run Chinook salmon component in the Clearwater River; (6) additional research, monitoring, and evaluation to answer questions related to relocation of hatchery fish releases to the Salmon River and estimation of the relative contribution of naturally spawning hatchery SR fall-run Chinook salmon to productivity and diversity.

Crozier et al. (2019a) concluded that SR fall-run Chinook salmon have high vulnerability to the effects of climate change, based on high biological sensitivity, high exposure to climate effects, and high adaptive capacity. Adults enter the lower Columbia River from late summer through early fall (August–October) (Crozier et al. 2019a); vulnerability of this ESU during the adult freshwater stage is moderate because most adults migrate after temperatures have peaked, and spawn after temperatures have declined in the fall. The greatest vulnerability is in the freshwater rearing and ocean life stages.

Summary. The status of this ESU has improved since the time of listing. While the population is currently considered to be viable, it is not meeting its recovery goals. This is due to: (1) low population productivity; (2) uncertainty about whether the elevated natural-origin abundance can be sustained over the long term; and (3) high levels of hatchery-origin spawners in natural spawning areas (NMFS 2022a). This ESU also continues to face threats from tributary and mainstem habitat loss, degradation, or modification; disease; predation; harvest; hatcheries; and climate change (NMFS 2022a).

2.2.2. Status of Critical Habitat

In evaluating the condition of designated critical habitat, NMFS examines the PBFs which are essential to the conservation of the ESA-listed species because they support one or more life

[2] Conservation measures in these opinions include hydrosystem operations such as cool-water releases from Dworshak Dam; summer flow augmentation and summer spill at multiple projects; operations at fish ladder cooling stations at Lower Granite and Little Goose Dams to address adult passage delays caused by warm surface waters entering the fish ladders; flexible spring spill and evaluation of its effects; juvenile fish transportation program as outlined in the 2020 biological opinion; and operation of the PIT-tag detector in the removable spillway weir at Lower Granite Dam and use of the data obtained to inform critical uncertainties (NMFS 2022a).

stages of the species. Proper function of these PBFs is necessary to support successful adult and juvenile migration, adult holding, spawning, incubation, rearing, and the growth and development of juvenile fish. Sites required to support one or more life stages of SR fall-run Chinook salmon (i.e., used for spawning, rearing, migration, and foraging) contain PBFs essential to the conservation of the listed species (e.g., spawning gravels, water quality and quantity, side channels, or food) (Table 2).

Table 2. Types of sites, essential physical and biological features (PBFs), and the life stage each PBF supports in designated critical habitat for Snake River fall-run Chinook salmon. The proposed action affects freshwater rearing and juvenile and adult migration habitats.

Site	Essential Physical and Biological Features	Species Life Stages
Spawning and rearing	Spawning gravel, water quality and quantity, cover/shelter,[a] food,[b] riparian vegetation, space, water temperature, and access	Adult and juvenile
Migration corridors	Substrate, water quality and quantity, water temperature, water velocity, cover/shelter, food,[a] riparian vegetation, space, safe passage	Adult and juvenile

[a] Cover/shelter includes shade, large wood, log jams, beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.
[b] Food includes aquatic invertebrate and fish species that support growth and maturation.

Designated critical habitat for SR fall-run Chinook salmon consists of all estuarine areas and river reaches of the Columbia River from its mouth upstream to the Snake River confluence, as well as all reaches of the Snake River, upstream to Hells Canyon Dam. It also includes other river reaches that are presently or historically accessible, except above the Hells Canyon complex on the Snake River, and Dworshak Dam on the North Fork Clearwater River. Critical habitat includes the stream channel, water column, and the riparian zone. The latter is important because it provides shade, streambank stability, organic matter input, and regulation of sediment, nutrients, and chemicals.

Across the designated area, watershed processes have been disrupted by human activities and climate change, reducing water and habitat quality and quantity as well as habitat complexity. This has weakened what were once healthy ecosystems for salmonids. Human activities that have contributed to this change include intensive agriculture, channel modifications and diking, disturbance of riparian vegetation, draining and converting wetlands, livestock grazing, dredging, road construction and maintenance, logging, mining, and urbanization. Water withdrawals for agriculture, particularly when overlapping with low-flow periods, often increase summer stream temperatures, block fish migration, strand fish in shallow pools, and alter sediment transport (Spence et al. 1996). Many of the designated stream reaches are on the Clean Water Act 303(d) list for impaired water quality, such as elevated water temperature (IDEQ 2020). Water quality in spawning and rearing areas has also been impaired by high levels of sedimentation and heavy metal contamination from mine waste (IDEQ 2001; IDEQ and EPA 2003). Measures taken through the efforts of Federal, tribal, State, local, and private entities in the decades since critical habitat was designated have improved the functioning of spawning and rearing area PBFs. These include protecting and improving instream flow, improving habitat complexity, improving the condition of riparian areas, reducing fish entrainment at water diversions, and removing barriers to spawning and rearing habitat. However, more improvements will be needed before critical habitat functions at levels that supports the recovery of SR fall-run Chinook salmon.

The construction and operation of water storage and hydropower projects in the Columbia River basin, including the eight run-of-river dams on the mainstem lower Snake and lower Columbia Rivers, have altered the PBFs of the mainstem migration corridor. Hydrosystem development modified natural flow regimes, resulting in warmer late summer and fall water temperature. Changes in fish communities led to increased rates of piscivorous predation on juvenile salmon. Reservoirs and project tailraces created habitats where avian predators successfully forage for smolts, and the dams themselves created migration delays for both adult and juvenile salmonids. Physical features of the dams, such as turbines, also kill out-migrating fish. However, some of these conditions have improved since the first ESA listings in the 1990s. The Bureau of Reclamation and USACE have implemented measures to improve safe passage and water quality including 24-hour volitional spill, surface passage routes, upgrades to juvenile bypass systems, predator management measures, and systems that cool adult ladders.

Measures taken through the individual and combined efforts of Federal, tribal, State, local, and private entities in the decades since critical habitat was designated have improved the functioning of spawning and rearing area PBFs as well as those in the migration corridors. However, more improvements will be needed before critical habitat functions at levels that support the recovery of SR fall-run Chinook salmon.

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

One factor affecting the rangewide status of SR fall-run Chinook salmon, its designated critical habitat, and aquatic habitat at large is climate change. As observed by Siegel and Crozier (2019), long-term trends in warming have continued at global, national, and regional scales. The 10 warmest years in the historical record have all occurred since 2010 (Lindsey and Dahlman 2023). The year 2020 was another hot year in national and global temperatures; it was the second hottest year in the 141-year record of global land and sea measurements and capped off the warmest decade on record (https://www.ncei.noaa.gov/access/monitoring/monthly-report/global/202013). Events such as the 2014–2016 marine heatwave (Jacox et al. 2018) are likely exacerbated by anthropogenic warming, as noted in the annual special issue of Bulletin of the American Meteorological Society on extreme events (Herring et al. 2018). The U.S. Global Change Research Program reports average warming in the Pacific Northwest of about 1.3ºF from 1895 to 2011, and projects an increase in average annual temperature of 3.3ºF to 9.7ºF by 2070 to 2099 (compared to the period 1970 to 1999), depending largely on total global emissions of heat-trapping gases (predictions based on a variety of emission scenarios including B1, RCP4.5, A1B, A2, A1FI, and RCP8.5 scenarios). The increases are projected to be largest in summer (USGCRP 2018).

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

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

Columbia River basin salmon spend a significant portion of their life-cycle in the ocean, and as such the ocean is a critically important habitat influencing their abundance and productivity. Climate change is also altering marine environments used by Columbia River basin salmon. This includes increased frequency and magnitude of marine heatwaves, changes to the intensity and timing of coastal upwelling, increased frequency of hypoxia (low oxygen) events, and ocean acidification. These factors are already reducing, and are expected to continue reducing, ocean productivity for salmon. This does not mean the ocean is getting worse every year, or that there will not be periods of good ocean conditions for salmon. In fact, near-shore conditions off the Oregon and Washington coasts were considered good in 2021 (NOAA Fisheries 2023). However, the magnitude, frequency, and duration of downturns in marine conditions are expected to increase over time due to climate change. Some stressors that fish experience in freshwater will affect their condition or survival, but not until the fish reaches the marine environment. The likelihood this will occur is amplified by the changes in ocean conditions associated with climate change. Together with increased variation in freshwater conditions, these downturns will further impair the abundance, productivity, spatial structure, and diversity of the region's native salmon stocks (Isaak et al. 2018; ISAB 2007). As such, these climate dynamics will reduce fish survival through direct and indirect impacts at all life stages (NOAA Fisheries 2023).

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

2.3. Action Area

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

The action area for the proposed permit includes all waters within 500 meters (0.31 miles) downstream of Dworshak Dam (Figure 1). Water quality dilution modeling indicates that effects from the pollutants addressed in the proposed permit are negligible beyond this point.

Figure 1. Location of Dworshak Dam on the North Fork Clearwater River, with the 500-meter downstream extent of the action area shown in white.

2.4. Environmental Baseline

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

The action area is used by the juvenile and adult freshwater life history stages of SR fall-run Chinook salmon. The timing of each life stage within the action area is described in Section 2.5.1.

2.4.1. Condition of Salmonid Habitat in the Action Area

We incorporate by reference here Section 4, Description of the Environmental Baseline, in the EPA (2023a). Limited data are available to characterize inflow to Dworshak Dam for the water quality constituents addressed by the proposed permit. The action area has not been assessed for the presence of toxics and water quality impairments. The following is a summary of available influent data, ambient flow data, and ambient temperature data:

- Average daily outflow is highly variable between years, but on average peaks at 11 thousand cubic feet per second (kcfs) in April and again in July (Figure 2); dropping to 2 kcfs during September–December.

- Daily maximum influent temperatures are typically 4–6ºC during winter and increase to 10ºC during September and October (Figure 3).

    - Summer temperatures are well below thresholds for harm to juvenile or adult salmonids (McCullough et al. 2001).

    - Releases of cold water from Dworshak Reservoir during spring and summer inhibit the growth of rearing juveniles so that some hold over an extra year in freshwater (e.g., in the lower Clearwater River and further downstream in lower Snake River reservoirs) and migrate downstream as yearlings (Connor et al. 2001, NMFS 2017).

        - Natural-origin return rates for both outmigrant types (subyearling and yearling) have increased since the early 1990s, indicating that this rearing strategy is capable of producing adult returns (NMFS 2017).

- No data are available on prey resources in the action area, but riprap along the shoreline within the action area degrades shallow water habitat that could act as feeding areas.

    - Prey resources in this reach may be limited to plankton (e.g., *Daphnia spp.*) that grow in the reservoir and are discharged to the tailrace.

- The USACE submitted the results for pH levels for two samples in its permit application, with a higher value of 7.75 standard units.

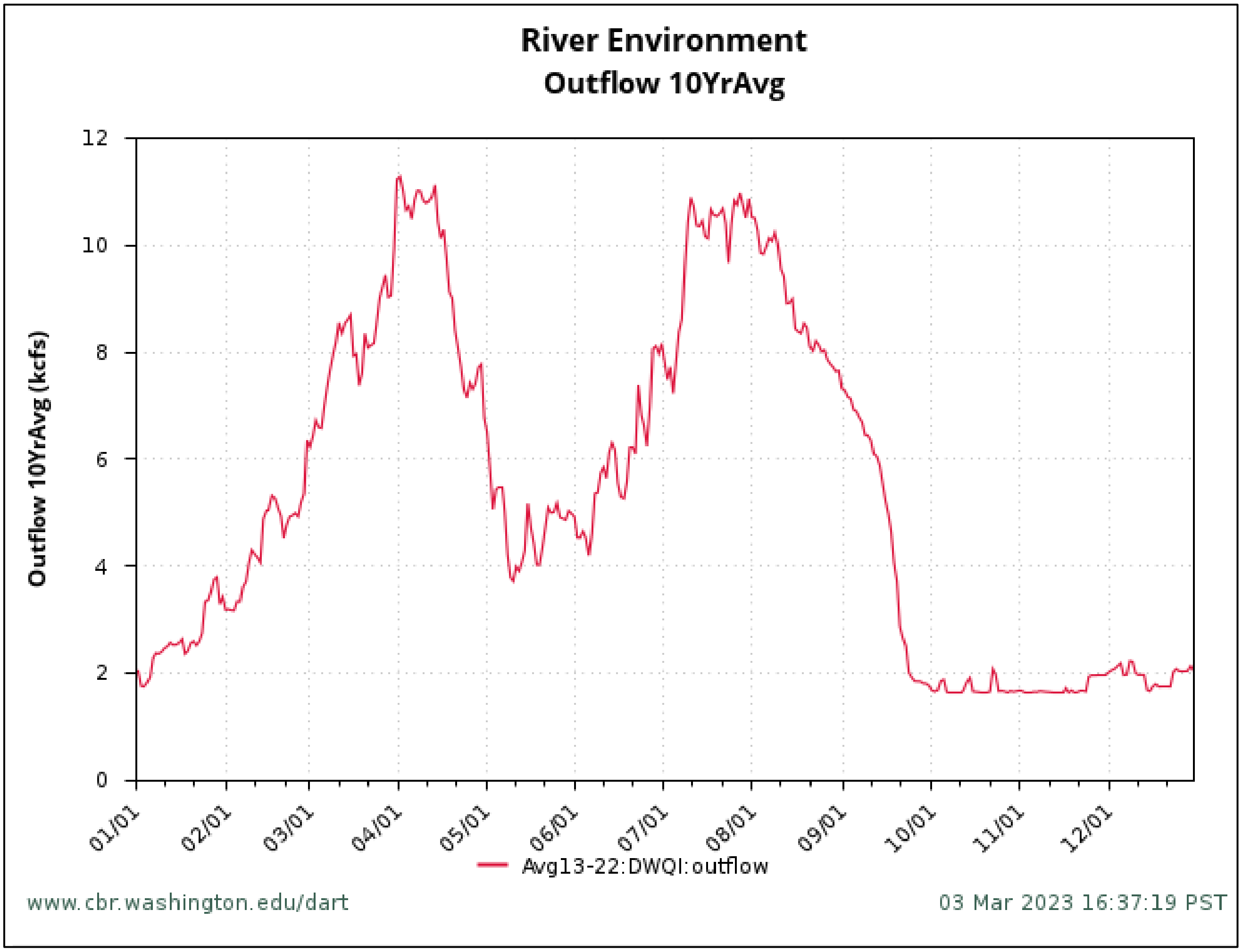

Figure 2. Ten-year average (2013–2022) daily outflow (kcfs) at Dworshak Dam.

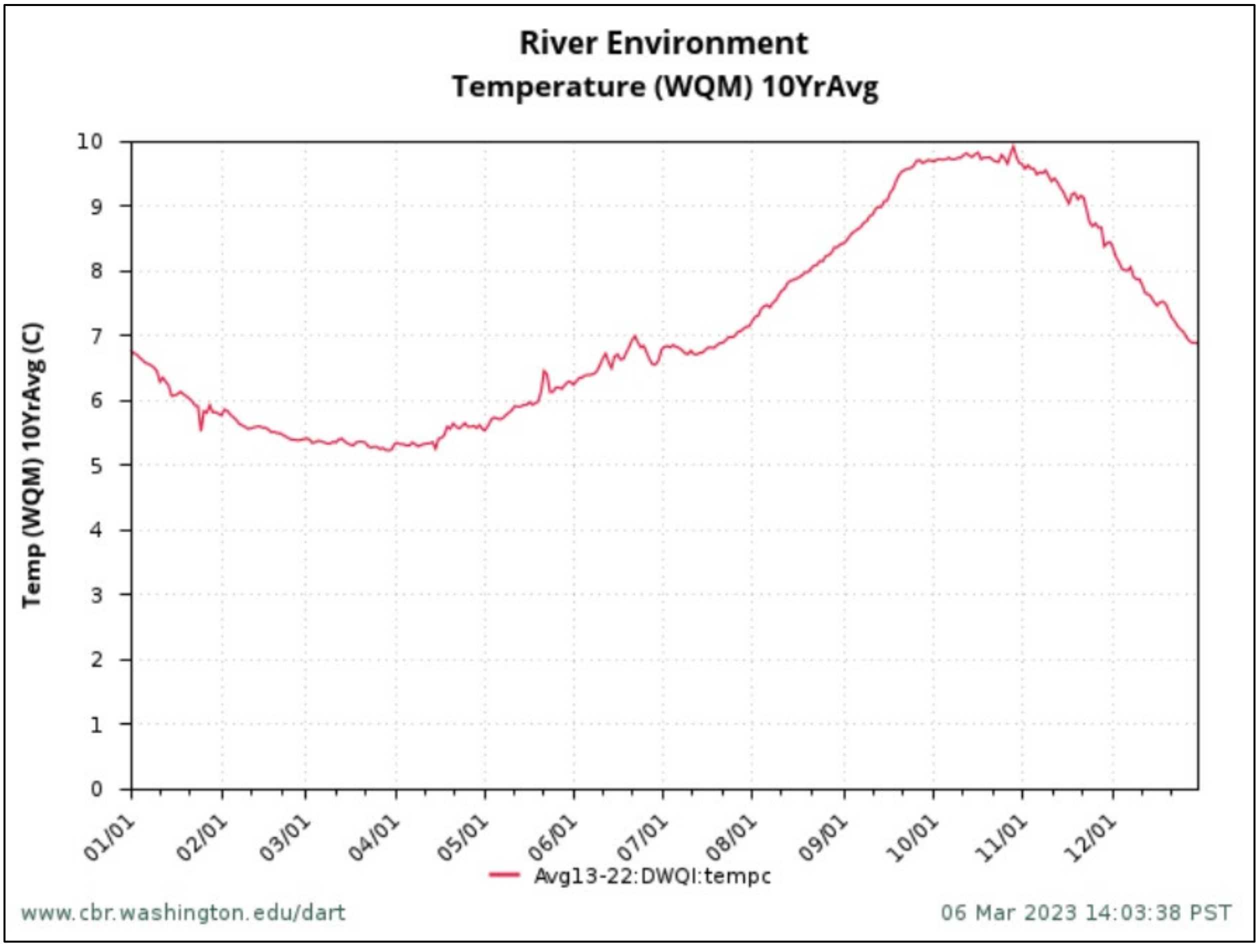

Figure 3. Annual daily average influent temperatures (ºC), measured in the scroll case at Dworshak Dam, 2013–2022.

2.4.2. Condition of Critical Habitat in the Action Area

We included the short segment of the North Fork Clearwater River from Dworshak Dam to its confluence with the Clearwater River in our critical habitat designation for SR fall-run Chinook salmon (58 FR 68543), noting the presence of suitable PBFs in spawning and rearing areas. Water quality within spawning and rearing areas for SR fall-run Chinook in the North Fork Clearwater River appears to be high, although the action area has not been assessed for the presence of toxics or other types of water quality impairments. Dissolved gas in this area is high during spring, but this does not overlap during the vulnerable incubation period in the downstream spawning area. The PBF of prey or forage is likely to be limited along the shorelines in the action area because they are covered with riprap, but plankton produced in Dworshak Reservoir are available within the water column below the dam. The status of PBFs in the action area appears to support the recovery of SR fall-run Chinook salmon.

2.5. Effects of the Action

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

We evaluated the action as proposed in the EPA (2023a), including the permit condition in the CWA section 401 certification. The proposed permit establishes effluent limits, monitoring and reporting requirements, and other conditions necessary to comply with the CWA and applicable water quality standards. The permit includes either numerical or narrative effluent limits for each of the regulated parameters.

The permit regulates discharges to the tailrace of cooling water (Outfalls 001–003), water collected from equipment drainage and floor drains (Outfalls 004 and 005), equipment and facility maintenance-related water (Outfall 005), sump and dam leakage flows (Outfalls 004–006), and lubricants (all outfalls) as well as the operation of two CWISs in the tailrace. The proposed permit does not authorize oils spills or other situations where the permittee is not in compliance. In this section, we describe the presence and timing of SR fall-run Chinook salmon in the action area, their expected exposure to the permitted discharges, and the effects of other permit requirements in more detail.

2.5.1. Presence and Timing of SR Fall-run Chinook Salmon in the Action Area

Adult SR fall-run Chinook salmon return to the Clearwater basin beginning in late August, hold for a month or two, and begin to spawn in October (NMFS 2017). This includes the spawning area in the North Fork Clearwater River, about a mile downstream of the action area near Ahsahka, Idaho. As a result, adults can be present in the action area during August through November (Figure 4, Table 3). This spawning aggregation is part of the Clearwater River Major Spawning Area[3] for the Lower Snake River population of SR fall-run Chinook salmon. The presence of adults in the North Fork Clearwater River up to Dworshak Dam is evidenced by the availability of recreational fishing throughout that reach (BigCountryNewsConnection.com 2021).

There is no specific documentation of juvenile SR fall-run Chinook salmon in the 500-meter action area, but those leaving the nearby spawning area are rearing in the North Fork Clearwater River during March through August (Table 3). For the purpose of this effect’s analysis, it is reasonably likely that some fry and parr are in the action area below the dam during their rearing period but no data are available on abundance of this life stage in the action area.

[3] A major spawning area is a system of one or more branches of a river that together contain enough habitat for at least 500 spawners (Ford 2022).

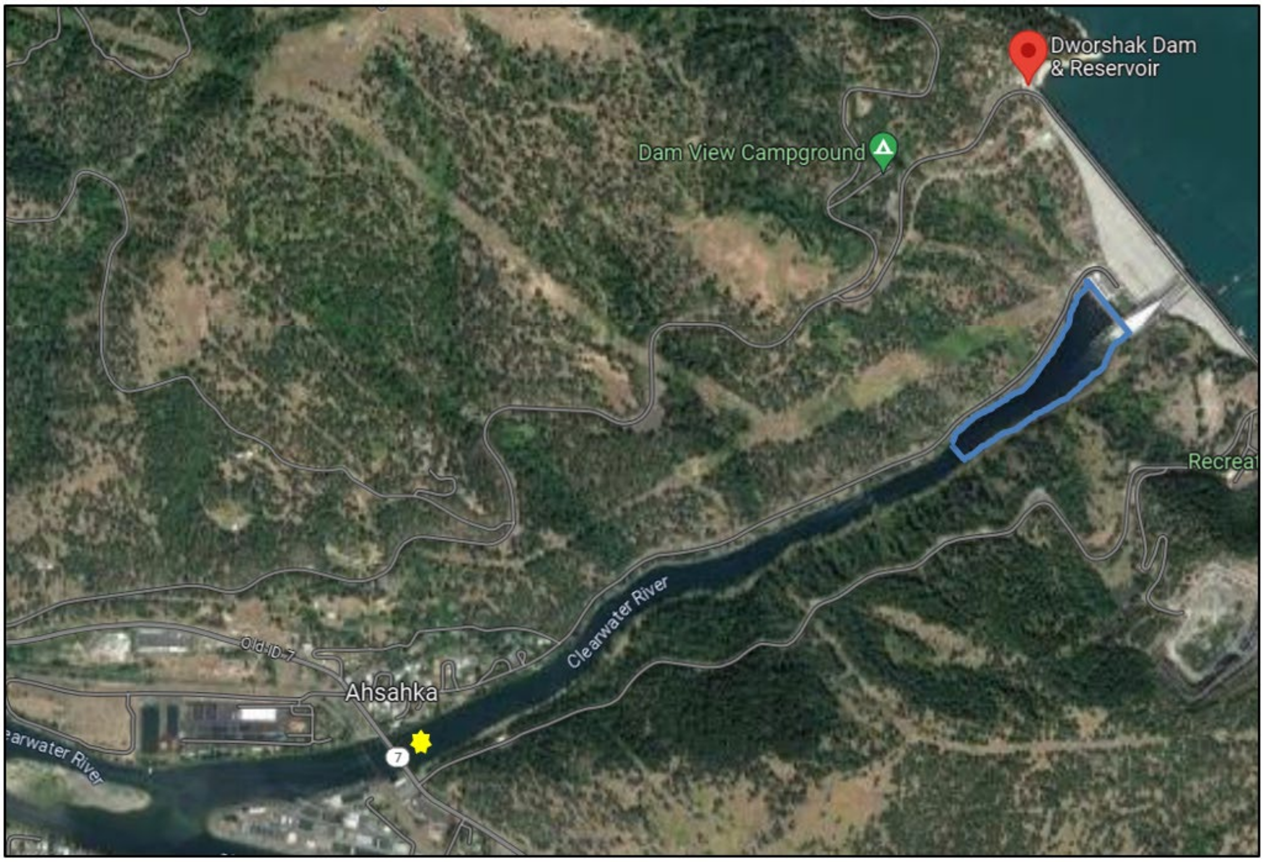

Figure 4. Snake River fall-run Chinook spawning area (yellow star), about one mile downstream of the action area (blue polygon) in the lower North Fork Clearwater River.

Table 3. Life stages and timing of Snake River fall-run Chinook salmon in the action area.

Life Stage	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Adult presence[a]								■	■	■	■	
Spawning										■	■	
Juvenile rearing[b]			■	■	■	■	■	■				

[a] Adult fall-run Chinook salmon can hold in the action area for one to two months before returning downstream to spawn.
[b] "Juveniles" refers to the presence of fry (subyearlings smaller than about 2 inches in length). Larger juveniles (parr) may be present year-round.

2.5.2. Effects to Species

The EPA (2023a) proposes numerical effluent limits for oil and grease and for pH levels in discharges generated by operations at Dworshak Dam. The EPA used the CORMIX (Cornell Mixing Zone Expert System) water quality model (Jirka et al. 1996) to estimate dilution factors and resulting concentrations of several constituents of the effluent at distances of 1 to 471 meters (3 to 1,545 feet) downstream from each outfall. This included modeling the expected downstream concentrations resulting from the proposed 5 mg/L limit for oil and grease. The permit does not establish a numerical limit for biochemical oxygen demand (BOD) or chemical oxygen demand (COD), but in this case the EPA used influent, effluent, and flow data from the

USACE's permit application as inputs to estimate the resulting downstream concentrations of these parameters. Because the USACE submitted just a single sample result from each of Outfalls 001, 003, 005, and 006 in its permit application and not data for Outfalls 002 and 004, which were not discharging during the sampling event, the EPA had little empirical data to use as inputs. However, we used the available information in our exposure/response analysis.

Despite the uncertainty in modeled results due to a paucity of empirical inputs, the resulting estimates of downstream concentrations described in the following sections may be conservative for several reasons. First, for oil and grease, the modeled outfall was assumed to discharge at the effluent limit of 5 mg/L, although USACE reported non-detections for samples taken from each of the four outfalls on the downstream face of the dam (Appendix B in EPA 2023a). For BOD and COD, the EPA assumed the outfall was discharging at the maximum concentration reported in the permit application, despite lower values reported for three other outfalls.[4] Second, the model assumed that each outfall was discharging at the maximum daily rate observed for any outfall (4,000 gallons per minute [GPM]) although discharge rates vary from 650 to 4,000 GPM (EPA 2022b). Finally, we interpret the results as though the modeled outfall would operate continuously instead of at the frequencies shown in Table 4. Because these assumptions are conservative, we expect that the downstream exposure of fish to these parameters is likely to be lower than shown by the CORMIX results.

Table 4. Discharge rates, in gallons per minute (GPM) and millions of gallons per day (MGD), and frequencies of outfalls at Dworshak Dam.

Unit	Discharge Rate (GPM/MGD)	Discharge Frequency
001	900/1.3	10 months/yr.
002	650/1.3	6 months/yr.
003	1,400/3.0	6 months/yr.
004	2,500/1.8	2.5 hrs./day, year-round
005	3,000/2.1	12 hrs./day, 2 days/yr.
006	4,000/2.9	7.5 hrs./day, year-round

2.5.2.1. Oil and Grease Effluent Limits

The water quality parameter "oil and grease" measures a variety of substances that can occur in the influent and effluent waters at Dworshak Dam. These include fuels, motor oil, lubricating oil, hydraulic oil, and animal- and plant-derived fats. The category "oil and grease" also includes EALs. Most sources of oil and grease are insoluble in water, although agitation in the tailrace can create a temporary emulsion.

[4] The USACE's permit application did not include sampling data for Outfall 004, which it describes as "the primary source of potential oil and grease discharges at Dworshak Dam," because the outfall was not discharging during the sampling event (EPA 2023). However, the effluent that reaches this outfall has passed through a sump with an oil/water separator that removes most, if not all of this material (EPA 2023b). As a result, effluent concentrations of oil and grease and oxygen-demanding materials are likely to be low.

The EPA (2023a) describes the following potential sources of oil and grease in discharges from Dworshak Dam:

- Cooling Water Discharges (Outfalls 001, 002, and 003)
    - The USACE uses water to cool down equipment such as generating units, air conditioning units, and transformer banks. Cooling water moves through a single-walled tube next to the generating and air conditioning units. Cooling water is then pumped to the turbine bearing oil cooler, thrust bearing oil cooler, and surface air cooler of each unit before discharge to the tailrace through Outfalls 001, 002, and 003.
- Equipment and Floor Drainage Discharges (Outfall 004)
    - River water continuously leaks into Dworshak Dam as at other hydroelectric facilities. It is channeled to Outfall 004 through a series of canals and tunnels, collecting in floor drains, trench drains, station sumps, and spillway sumps. Each sump has an oil/water separator and oil skimmers that continuously remove any oil and decant it into storage vessels. Water is pumped from the bottom of each sump for discharge through the outfalls.
- Unwatering Sump (Outfall 005)
    - Outfall 005 services the unwatering sump, discharging water removed from the draft tubes mixed with water received from the drainage sump via a cross-connecting pipe.[5] The unwatering sump discharges through this outfall only two days per year.
- Stormwater from the Transformer Sump (Outfall 006)
    - Outfall 006 services a portion of the powerhouse where generating units 4, 5, and 6 were planned, but never built. However, there are several transformers, with low levels of PCBs, in this bay, standing within a concrete vault. Although the vault is open to the weather (USACE 2022), water in the vault, including stormwater runoff, is drained to a sump before discharge through this outfall. If oil is present in the sump, it activates a carbon sensor, triggering the operation of an oil/water separator. The treated water is then drained to the skeleton bay before it is pumped to the tailrace/river through Outfall 006 (EPA 2023b).

Fish Exposure to Oil and Grease in the Mainstem Portion of the Action Area. The EPA interprets a maximum daily effluent limit of 5 mg/L as ensuring that the narrative water quality standards for deleterious, aesthetic, and no visible oil sheen will be met, which are designed to be protective of aquatic life including salmonids (Section 2.5.2 in EPA 2023a). The EPA used this value to calculate exposure concentrations within the action area (Table 5). Under the modeled conditions (i.e., the permit limit), SR fall-run Chinook salmon will be exposed to the 5 mg/L

[5] The USACE uses the term "unwatering" to describe removing water from a location where it is not desirable.

effluent limit within 1 meter of the discharge, and effluent concentrations will dissipate to 1 mg/L within 23 m.

Fish can be exposed to oil and grease through their gills or through food, and exposures can be chronic or acute. Toxic effects include delayed growth, decreased survival, and carcinogenic and mutagenic activity (Ober 2010; Perhar and Arhonditsis 2014). Juveniles and adults may experience sub-lethal effects including avoidance behaviors and olfactory effects. The EPA (1976) listed lethal toxicities to freshwater finfish of petroleum-based lubricants ranging from 10 ppm (approximately 10 mg/L) from soluble hydrocarbons to 180,000 mg/L for "lubricants." For other finfish, lethal toxicities ranged from 5 ppm (approximately 5 mg/L) from soluble hydrocarbons to greater than 10,000 mg/L from dispersants and residual oils. The EPA (1976) describes long-term sublethal effects that interfere with cellular and physiological processes such as feeding and reproduction, but do not lead to immediate death of the organism. Pink salmon fry moved to the other end of the tank when water contaminated with Prudhoe Bay crude oil (1.6 mg/L) was introduced (Rice 1973). Exposure to 5 mg/L benzene caused an increase in the respiration rates of juvenile Chinook salmon irrespective of exposure time (1 to 96 hours) (Brockson and Bailey 1973). Risks are higher to the development of cardiac tissue in incubating eggs and larvae (Incardona 2017; Incardona and Scholz 2016, 2017, 2018; Incardona et al. 2011), but no redds are present in the action area.

We do not expect concentrations of oil and grease to be high enough to affect the survival or fitness of SR fall-run Chinook salmon for the following reasons:

- A juvenile or adult fall-run Chinook salmon from the nearby spawning area would have to hold within 1 meter of an outfall for hours at a time to receive an acute or sublethal chronic exposure to 5 mg/L. This is highly unlikely given the active hydraulic environment in the tailrace.

- Concentrations fall to less than 0.060 mg/L at the downstream end of the action area (500 meters from the dam), which carry a low risk of acute or chronic effects.

- Outfall 004, the drainage sump, which the EPA (2023a) describes as the primary source of potential oil and grease discharges at Dworshak Dam, discharges only 2.5 hours per day (Table 4). This implies that the downstream concentrations of oil and grease encountered by an individual Chinook salmon at any given time will likely be lower than indicated in Table 5.

Table 5. Calculated oil and grease concentrations in the effluent in milligrams per liter (mg/L), after dilution, within the action area.

Effluent Limit (mg/L)	Distance Downstream (m)	Dilution Factor	Downstream Effluent Concentration (mg/L)
5	1	1	5
	10	2	2.5
	15	3	1.667
	23	5	1
	100	29	0.172
	300	56	0.089
	471	83	0.060

Some planktonic prey for juvenile and adult SR fall-run Chinook salmon are likely to be exposed to the oil and grease discharges up to 5 mg/L in the water column right next to the outfalls at Dworshak Dam. These very brief exposures could affect the survival of individual invertebrates and their quality as prey, but the numbers affected are likely to be extremely small compared to those available. In addition, the upstream source of planktonic prey will be maintained. Therefore, NMFS does not expect prey exposure to oil and grease discharges at Dworshak Dam to negatively affect any life stage of SR fall-run Chinook salmon.

2.5.2.2. Permitted pH Levels

The EPA proposes a numerical effluent limit for pH of 6.5 to 9.0 standard units. The EPA considers a pH of 6.5 protective of the effects of acidity for salmonids. At higher (more alkaline) levels, salmonids are sensitive to pH in the range of 9.2 to 9.7; levels greater than 9.0 could also harm benthic invertebrate populations, altering the prey base (ODEQ 1995). We consider the pH range in the proposed permit (6.5 to 9.0 at the discharge point) to be protective and do not expect the proposed effluent limit to have negative effects on any life stage of SR fall-run Chinook salmon.

The USACE (2019) submitted data for a single pH measurement for each of the four outfalls 001, 003, 005, and 006 in its permit application. All were reported as between 7.0 and 8.5 standard units, which are within the proposed effluent limits. The proposed permit also requires the USACE to take weekly grab samples for pH for each outfall over the first year of the permit. If none of the weekly samples for an outfall exceeds 6.5 to 9.0 standard units, the required monitoring frequency for that outfall will be reduced to once per month for the remainder of the permit term. Based on this monitoring schedule and the requirement to develop and implement a BMP plan, we do not expect the pH levels of the effluent to exceed the permit limits.

2.5.2.3. Heat Discharges

The EPA does not include a numerical criterion for the discharge of heat generated at Dworshak Dam in the proposed permit. The maximum discharge temperature in the data submitted with the USACE's permit application (USACE 2019) was 12.1°C, which is similar to tailrace temperatures during the warmest time of year (late summer) (Figure 3). Although data in the application were based on a single data point for each of four outfalls (001, 003, 005, and 006), we assume that 12.1°C represents the maximum discharge temperature at Dworshak Dam. This discharge temperature is below thresholds of concern for acute (instantaneous mortality) or chronic effects (loss of fitness) to salmonids:

- Lethal conditions for both juveniles and adults (21 to 22°C constant) (McCullough et al. 2001).
- Migration blockage conditions for migrating adults (21 to 22°C average) (McCullough et al. 2001; Sauter et al. 2001).
- High risk of disease (greater than 18 to 20°C constant) (Materna 2001).

In summary, based on the expected temperatures below Dworshak Dam, we do not expect the lack of an effluent limit for heat in cooling water discharges to expose juvenile or adult SR fall-run Chinook salmon to temperatures that would have negative effects on their fitness or survival.

The proposed permit requires the USACE to make a monthly measurement of effluent temperature at each outfall for the first 6 months of the permit, and to generate continuous temperature measurements thereafter. The latter will be used to calculate and report 7-Day (rolling) average daily maximum temperatures,[6] daily maximum temperatures, and daily average temperatures. The EPA will use these data to assess the need for a numerical temperature criterion during the next 5-year permit period.

2.5.2.4. Levels of Total Suspended Solids

Total suspended solids (TSS) includes both organic and inorganic particulate matter and refers to the dry weight of total solids retained on a 2-micron (or smaller) filter. Depending on the duration of fish exposure, elevated levels of TSS can reduce growth rates and disease resistance, increase mortality, harm the development of eggs and larvae, alter migratory behavior, and reduce prey abundance (EPA 1986). Herbert and Merkens (1961) found that suspended solids at concentrations of 270 mg/L caused fin rot. Concentrations of 90 to 270 mg/L decreased the survival of rainbow trout, although no effects on survival, gill health, or fin health were observed at 30 mg/L. Herbert and Merkins (1961) also found that TSS measurements above 1,000 mg/L were associated with reduced abundance of brown trout, whereas concentrations of about 60 mg/L had no effect. Similarly, Servizi and Martens (1992) reported that TSS concentrations of 240 to 2,550 mg/L caused a variety of effects including increased cough frequency and increased glucose levels in fish, but at 20 mg/L no adverse effects were found. After reviewing these studies, the EPA (2021d) determined that the "No Observed Effect Concentration" ranged from 20 to 60 mg/L.

The EPA did not include TSS limits or monitoring in the proposed permit. The USACE reported TSS concentrations of less than 1 mg/L in the forebay sample and in effluent samples from Outfalls 001, 003, 005, and 006 that it submitted with the permit application (EPA 2023a). The EPA does not expect TSS to accumulate in the facility except in the drainage sump that discharges to Outfall 004; the BMP plan will therefore require the facility to minimize pollutants, including TSS, entering this sump. For these reasons, it is unlikely that TSS will be discharged at levels higher than the "No Observed Effect Concentration" of 20 to 60 mg/L. We do not expect the lack of effluent limits for this parameter in the proposed permit to have negative effects on the fitness or survival juvenile or adult SR fall-run Chinook salmon. Therefore, we do not expect TSS in effluent from Dworshak Dam to have negative effects on juvenile or adult SR fall-run Chinook salmon.

[6] The 7-day average daily maximum for any individual day is calculated by averaging that day's maximum temperature with the maximum temperatures of the 3 days before and the 3 days after that date.

2.5.2.5. Oxygen-demanding Materials

Biochemical oxygen demand (BOD) and COD are measures of the degree to which an effluent can deplete oxygen in its receiving water while undergoing degradation. Biochemical oxygen demand represents the amount of oxygen consumed by bacteria and other microorganisms while they decompose organic matter. Materials that contribute to BOD include organic matter used as food by aerobic organisms; oxidizable nitrogen from nitrites; ammonia, a breakdown product of animal or vegetable matter; and materials such as ferrous iron, sulfides, and sulfites that can be metabolized by some bacteria. The COD is a chemical test that measures the amount of oxygen needed to oxidize the organic matter in a volume of water. The COD test is more precise, accurate, and rapid than the BOD test.

Oil and grease are an example of an oxygen-demanding substance that can be added to the effluent by operations at Dworshak Dam. In addition, any oxygen-demanding substances that are present in both influent and dewatering and cooling water could become concentrated in the drainage sump (EPA 2023a). The EPA does not include limits for BOD or COD in the proposed permit because the effluent limit for oil and grease (5 mg/L) and the oil and grease concentrations in the samples submitted by the USACE (2019) were well below (maximum of 5.5 mg/L) the EPA's toxicity benchmark (EPA 2023a). The EPA based its benchmark on observations of no toxicity to *Pseudomonas putida*, *Vibrio fisheri*, zebrafish (*Brachydanio rerio*), or the green alga *Selenastrum capricornutum* when these organisms were exposed to effluents containing less than or equal to 310 mg/L COD.

The EPA's modeling indicates that the highest concentrations of BOD and COD in effluent from the outfalls will result in concentration of less than 5 mg/L beyond 1 meter of each outfall (Tables 6 and 7). The low expected BOD and COD concentrations in the action area indicate that oxygen-demanding materials produced at the dam are not likely to have negative effects on juvenile or adult SR fall-run Chinook salmon. The permit requires quarterly grab samples for dissolved oxygen monitoring, which the EPA can use to reassess the need for effluent limits under the next 5-year permit. Based on the information available at this time, we do not expect the lack of an effluent limit for oxygen-demanding materials discharged from Dworshak Dam to have negative effects on the fitness or survival of juvenile or adult SR fall-run Chinook salmon.

Table 6. Maximum biological oxygen demand exposure concentrations in milligrams per liter (mg/L) below Dworshak Dam.

Maximum Observed Concentration (mg/L)	Distance Downstream (m)	Dilution Factor	Downstream Concentration (mg/L)
2.48	1	1	2.48
	10	2	1.24
	15	3	0.827
	100	29	0.086
	300	56	0.044
	471	83	0.030
Assumes a BOD concentration of 0 in the influent.			

Table 7. Maximum chemical oxygen demand exposure concentrations in milligrams per liter (mg/L) below Dworshak Dam.

Maximum Observed Concentration (mg/L)	Distance Downstream (m)	Dilution Factor	Downstream Concentration (mg/L)
5.5	1	1	5.5
	10	2	2.25
	15	3	1.833
	100	29	0.190
	300	56	0.098
	471	83	0.066
Assumes a COD concentration of 0 in the influent.			

2.5.2.6. Discharge Prohibitions

"Visible Oil Sheen or Floating, Suspended, or Submerged Matter." The proposed permit prohibits the discharge of a visible oil sheen or floating, suspended, or submerged matter of any kind "in concentrations causing nuisance or objectionable conditions or that may impair the designated beneficial uses of the receiving water." Further, the permit states, "There shall be no foam other than in trace amounts."

The EPA (2023a) expects a daily maximum oil and grease effluent limitation of 5 mg/L to represent the highest concentration at which there is no oil sheen on surface waters. With the 5 mg/L effluent limit for oil and grease plus the permit's monitoring and reporting requirements and the measures in the BMP Plan to prevent and minimize oil, grease, and hydraulic fluids from all sources from entering the river, we do not expect visible oil sheens to occur as a result of the proposed permit. Therefore, we do not expect floating, suspended, or submerged matter to have negative effects on the fitness or survival of juvenile or adult SR fall-run Chinook salmon.

Toxicants. The proposed permit prohibits the discharge of toxic substances in concentrations that would impair the designated beneficial uses of the receiving water, including the protection of aquatic life as described in the Idaho Administrative Procedures Act (IDAPA 58.01.02.210.01a). The permittee (USACE) must notify the Director of the EPA's Water Division and the Nez Perce Tribe if: (1) any activity would result in a discharge, on a routine or frequent basis, of any toxic pollutant that is not limited in the permit, if that discharge would exceed the highest of the "notification levels" in Section III.I.1 of the proposed permit; and (2) any activity would result in a discharge, on a non-routine or infrequent basis, of any toxic pollutant that is not limited in the permit if that discharge would exceed the highest of the "notification levels" in Section III.I.2 of the proposed permit.

The proposed permit identifies acrolein and acrylonitrile; 2,4-dinitrophenol and for 2-methyl-4, 6-dinitrophenol; and antimony as the specific pollutants of concern, but the EPA (2022b) states that:

- Non-contact cooling water at Dworshak Dam does not contain or come into contact with raw materials, intermediate products, finished products, or process wastes.

- There is no information to indicate that these outfalls discharge effluent containing toxic or hazardous pollutants other than oil and grease.

- These reporting requirements are required of all facilities with NPDES permits.

As a result, we do not expect negative effects to juvenile or adult fall-run Chinook salmon from toxic pollutants in effluent.

Polychlorinated Biphenyls. Polychlorinated biphenyls (PCBs) have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment. The manufacture of PCBs was stopped in the United States in 1977 because of evidence these chemicals build up in the environment and can cause harmful health effects. Products such as transformers that were made before 1977 can contain PCBs in their hydraulic oils.

Polychlorinated biphenyls are present in the transformers serviced by Outfall 006, but the proposed permit prohibits their discharge from the project. The USACE expects that the discharge of PCBs is unlikely because the transformers stand in a concrete vault, which can be drained to a sump with an oil/water separator that is triggered by a carbon sensor. "… [We] have multiple intermediate steps including inspections by staff before moving water [by opening valves], a hydrocarbon sensor that activates an oil/water separator when oil is sensed, and the way the transformer sump is piped and near constant eyes on the skeleton bay for sheens by project personnel" (EPA 2023b). The USACE did not submit any data for Outfall 006 in its permit application to demonstrate the effectiveness of the oil/water separator because this outfall was not operating during the sampling event.

The proposed permit requires the USACE to develop a PCB Management Plan (PMP) within the first year of the 5-year permit cycle, including monitoring and reporting requirements. Purposes of the PMP are to:

- Identify potential sources and potential pathways for PCB discharges at Dworshak Dam to interact with discharge water.

- Document actions that have been and will be established to limit the likelihood of PCB discharges through removal, containment, or other mechanisms.

- Identify outfalls associated with potential PCB discharges.

After developing the PMP, the USACE must conduct two consecutive years of monitoring to characterize the presence of PCBs in the effluent associated with any outfalls associated with potential discharges due to exposure to equipment, paint, caulk, oil, or other materials that may have legacy PCBs or outfalls that could discharge PCBs if there is a failure in containment equipment. The permit also requires Dworshak Dam to use lubricants, paint, and caulk that do not contain PCBs, unless technically infeasible.

Based on the configuration of the transformer vault and oil/water separator equipment, and the effluent assessment, containment, and monitoring activities that the USACE will complete under the PMP, we do not expect juvenile or adult SR fall-run Chinook salmon to experience reduced fitness or survival due to exposure to PCBs as a result of the proposed permit.

2.5.2.7. Interactive and Synergistic Effects of Multiple Pollutants

The multiple pollutant discharges that would be authorized by the proposed permit do not act on aquatic organisms in isolation of one another. Mixtures of chemicals can have additive, synergistic, or antagonistic effects. An additive effect occurs when the individual toxic effects of chemicals in a mixture produce a biological effect that is the sum of the individual effects. Synergism occurs when the toxicity of a mixture is greater than that which would be expected from a simple additive effect. Antagonism occurs when the toxicity of multiple chemicals in a mixture is less than that expected from a simple additive effect.

Many of the pollutants addressed in the proposed permit are not individual chemicals or compounds (e.g., oil and grease mixtures, pH, heat, and TSS), and the concept that multiple stressors may act synergistically is important. For example, oil exposure can impair diffusion across gills and contribute to respiratory acidosis in fish, potentially compounding effects of low pH in the environment (Evans et al. 2005; Khursigara et al. 2019). The pH level affects many chemical and biological processes in water and thus affects toxicity of many pollutants. We therefore understand that the combinations of pollutants addressed in the proposed permit could reduce the tolerance of individual juvenile and adult SR fall-run Chinook salmon to normal environmental disturbances (Khursigara et al. 2019).

Water temperature is known to affect toxicity of contaminants to aquatic organisms (either decreasing or, more often, increasing toxicity) (Cairns et al. 1975). Fish metabolism increases at higher temperatures. Temperatures outside of an individual's thermal tolerance window can impact metabolic capacities, available energy stores, and fitness (Khursigara et al. 2019). Increased water temperatures accelerate rates of aerobic decomposition and result in higher BOD levels. And chronic exposure to pollutants can reduce the upper thermal tolerance limits of freshwater fish (Patra et al. 2015).

The degree of synergistic effects on pollutant toxicity to SR fall-run Chinook salmon and its prey species are difficult to estimate because they will depend on the levels of specific pollutants and the magnitude and timing of exposures. The low concentrations of pollutants allowed by the proposed permit indicate that synergistic effects are likely to be minor for the discharges on the face of the dam. Therefore, NMFS does not expect negative effects to juvenile or adult fall-run SR Chinook salmon from synergistic effects on pollutant toxicity.

2.5.2.8. Operation of the Cooling Water Intake System

The proposed permit would authorize the operation of the two CWISs in the tailrace of Dworshak Dam. Section 316(b) of the CWA allows the NPDES permit writer to use best professional judgment to determine the best technology available to ensure that adverse effects are minimized to reduce impingement and entrainment of aquatic organisms at existing power generating and manufacturing facilities. Entrainment occurs when fish are pulled through the screens (or in this case, debris grates) and into the cooling water system. Impingement occurs when fish become trapped on the outer part of a screen.

Each of the two CWISs at Dworshak Dam feeds a 12-inch (CWIS #1) or 18-inch (CWIS #2) intake pipe, respectively. Each is screened with rectangular bars (strainers) to prevent debris from entering. The bars on the 12-inch intake are 1-inch deep by 0.25-inch wide, and spaced 1.5 inches apart on-center. The bars on the 18-inch intake are 1-inch deep by 0.5-inch wide with the same spacing. Water is pumped through these openings to the turbine bearing oil cooler, thrust bearing oil cooler, and surface air cooler of each generating unit as non-contact cooling water. After circulating through the cooling system, this water is discharged through Outfalls 001, 002, and 003. The maximum withdrawal rates are 2.6 million gallons per day (MGD) for CWIS #1 and 3 MGD for CWIS #2 (EPA 2023d).

River water entering each CWIS passes through a steel mesh basket strainer with 0.125-inch perforated openings before it reaches the pump; USACE staff check these baskets on a weekly basis and when sensors indicate a pressure differential (USACE 2023). Project personnel report they have not seen any fish and that contents of the basket strainers are mostly vegetation. The intakes for the CWIS are not inspected regularly because they are submerged about 20 feet underwater (USACE 2023) and monitoring would require observation by divers. Access would be especially difficult when the CWISs are in operation.

NMFS independently evaluated the design and operation of the two CWISs at Dworshak Dam and found the following concerns:

- Velocities across the submerged entrances (1.25 ft/sec at CWIS #1 and 1.45 ft/sec at CWIS #2; EPA 2023a) exceed the maximum allowable approach velocity (0.4 ft/sec for exposures less than 60 sec) that we apply to fish exclusion screens in ESA-listed salmonid bearing waters (NMFS 2022b).

- The 1/8-inch mesh on the strainers exceeds the allowable width of 3/32-inch that NMFS applies in these circumstances.

As a result, the operation of the two CWISs under the proposed permit is a potential pathway for mortality for juvenile salmonids. We expect actual risk to be moderate for juvenile SR fall-run Chinook salmon, which could move into the action area as fry and parr from the nearby spawning area. Therefore, NMFS agrees with the EPA that it is important to include the proposed requirement for USACE to prepare a CWIS Evaluation Report with:

- Locations of the CWISs.

- An evaluation of strainers and fish presence.

- Information on current fish impingement and entrainment.

- An evaluation of additional operations or technologies to minimize fish impingement and entrainment.

- Information on cooling water use relative to waterbody flows.

The CWIS Evaluation Report will provide better information for evaluating the longer-term risks to juvenile SR fall-run Chinook salmon of entrainment and impingement within the two CWISs, which will inform whether structural or operational changes are needed.

Using the best available scientific information at this time, it is NMFS' opinion that some juvenile SR fall-run Chinook salmon are likely to become entrained into the CWIS at Dworshak Dam. Whether or not they become impinged onto the surfaces of the basket strainers, they are unlikely to swim out of the CWIS and survive. This assumption is based on the likely presence of small juveniles in the action area, combined with the configurations of the intake grates and basket strainers compared to our fish passage criteria (NMFS 2022b). Therefore, NMFS expects the mortality of small numbers of juvenile SR fall-run Chinook salmon rearing in the lower North Fork Clearwater River each year. However, we are unable to estimate the numbers of fish that will be killed through this pathway, but assume that the magnitude of exposure to and the likelihood of mortality is a function of the expected maximum daily withdrawal rates of cooling water from the tailrace that will be allowed by the proposed permit. Adult Chinook salmon are not at risk of entrainment because of their large size compared to that of the strainers and their much stronger swimming ability.

2.5.2.9. Permit Conditions Added by the EPA under CWA Section 401

The proposed permit condition added by the EPA at the request of the NPT through the Clean Water Act 401 certification process requires that the USACE monitor mercury (Hg) and methylmercury (MeHg) concentrations in each outfall twice per year. This monitoring requirement will provide information on potential effects of methylmercury on downstream fish resources and human health risks from fish consumption. This permit condition could therefore lead to actions that improve, compared to current conditions, the survival and fitness of SR fall-run Chinook salmon.

2.5.2.10. Summary—Effects of the Proposed Permit on the Species

The discharges allowed by the proposed permit are not likely to have negative effects on juvenile or adult SR fall-run Chinook salmon. However, some juvenile fall-run Chinook salmon are likely to become entrained into each of the two CWISs each year.

2.5.3. Effects to Critical Habitat

The proposed permit has effluent limits that could affect the water quality or forage PBFs in rearing or migration areas of SR fall-run Chinook salmon designated critical habitat. Operation of the two CWISs during the 5-year term of the permit could affect safe passage in juvenile rearing areas. The other PBFs of critical habitat for SR fall-run Chinook salmon will not be affected.

2.5.3.1. Effects of Oil and Grease Effluent Limits on PBFs

As discussed above, the permitted maximum concentration of oil and grease (5 mg/L) will be diluted even further beyond 1 meter from each outfall on the downstream face of the dam. Therefore, we do not expect negative effects to the water quality or forage PBFs in rearing or migration areas of SR fall-run Chinook salmon designated critical habitat at the scale of the action area.

2.5.3.2. Effects of Permitted pH Levels on PBFs

The permitted levels of pH in the effluent of 6.5 to 9.0 standard units is essentially neutral (i.e., neither acidic nor alkaline) and meets the biological needs of salmon and their prey. Therefore, we do not expect the pH levels in the proposed permit to have negative effects on the functioning of the water quality or forage PBFs in rearing or migration areas of SR fall-run Chinook salmon at the scale of the action area.

2.5.3.3. Effects of Heat Discharges on PBFs

The proposed permit does not set effluent limits for heat discharged from Dworshak Dam. However, we do not expect the discharge of 12ºC cooling water to have negative effects on the water quality or forage PBFs in rearing or migration areas. As discussed above, this temperature is well below threshold of concern for effects on juvenile and adult SR fall-run Chinook salmon.

2.5.3.4. Effects of Levels of Total Suspended Solids on PBFs

Total suspended solids are not likely to accumulate within Dworshak Dam except potentially in the drainage sump that discharges to Outfall 004. The BMP plan will require the facility to minimize pollutants entering this sump, including TSS. We do not expect levels of TSS to exceed the 20 to 60 mg/L “No Observed Effect Concentration” or to have negative effects on the water quality or forage PBFs in rearing or migration areas at the scale of the action area.

2.5.3.5. Effects of Levels of Oxygen-demanding Materials on PBFs

The EPA does not include limits for BOD or COD in the proposed permit because the highest concentration in the influent and effluent samples (5.5 mg/L) was well below the toxicity benchmark of 310 mg/L (EPA 2023a). Dilution will reduce these levels even further beyond 1 meter from each outfall. Therefore, we do not expect negative effects on the water quality or forage PBFs in rearing or migration areas at the scale of the action area.

2.5.3.6. Effects of the Permit’s Discharge Prohibitions on PBFs

The proposed permit prohibits the discharge of a visible oil sheen or floating, suspended, or submerged matter of any kind “in concentrations causing nuisance or objectionable conditions or that may impair the designated beneficial uses of the receiving water.” It also prohibits the discharge of “hazardous material” or “toxic substances,” including PCBs, that could impair the beneficial uses of the receiving water. These limits are designed to prevent negative effects, including risks to the functioning of water quality or forage in rearing or migration areas within the action area and will not have negative effects on the water quality or forage PBFs in rearing or migration areas of SR Chinook salmon at the scale of the action area.

2.5.3.7. Effects of Permitting the Operation of the Cooling Water Intake System on PBFs

Based on our comparison of the design and operation of the CWIS with our fish passage criteria (NMFS 2022b), these systems could have a negative effect on the safe passage in juvenile rearing and migration areas in SR fall-run Chinook salmon critical habitat.

2.5.3.8. Effects of Permit Conditions Added by the EPA Under CWA Section 401 on PBFs

The proposed permit includes a condition added by the EPA at the request of the Nez Perce Tribe requiring that the USACE monitor Hg and MeHg concentrations in each outfall twice per year. If MeHg is present, this monitoring requirement will provide information that could lead to actions that improved the functioning of water quality in the action area.

2.5.3.9. Summary: Effects of the Proposed Permit on Critical Habitat

The discharges allowed by the proposed permit are not likely to have negative effects on the water quality or forage in rearing or migration areas for SR fall-run Chinook salmon critical habitat in the action area. Operation of the CWIS is likely to have a negative effect on safe passage within a few feet of each intake grate within action area.

2.6. Cumulative Effects

"Cumulative effects" are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02 and 402.17(a)). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

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

We adopt by reference here Section 6 in the EPA (2023a), which describes cumulative effects within the action area. The action area is a 500-meter reach of the North Fork Clearwater River. Ongoing non-Federal actions along the shoreline that could affect conditions in this reach include agriculture, grazing, road building, and recreational activities such as fishing, hiking, and camping. If present, these non-Federal actions would have adverse effects on SR fall-run Chinook salmon at levels similar to those observed in recent years.

Therefore, cumulative effects in the action area have the potential to continue to reduce the conservation value of SR fall-run Chinook salmon critical habitat, but due to their small spatial extent and low intensity, are not likely to affect the productivity, spatial structure, or abundance of SR fall-run Chinook salmon at the population level.

2.7. Integration and Synthesis

The Integration and Synthesis section is the final step assessing the risk that the proposed action poses to species and critical habitat. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

2.7.1. Snake River Fall-run Chinook Salmon

The SR fall-run Chinook salmon ESU includes one extant population (Lower Snake River) with spawning in all five historical major spawning areas. The spatial structure risk for this population is therefore low and is not precluding the species' recovery. Although natural-origin returns have declined in recent years, the geometric mean abundance during 2010–2019 was 9,034 adults, exceeding the recovery plan objective of greater than 4,200. There are concerns about the diversity of the remaining extant population because hatchery-origin fish constitute 70 percent of the adults in each of the major spawning areas. While the below-replacement returns in recent years are concerning, the long-term (15-year) abundance trend is stable and the population remains well above the minimum abundance threshold set by the ICTRT. Because the Lower Snake River is the only extant population, it needs to achieve highly viable status for the ESU to achieve recovery.

Factors limiting the recovery of the ESU include the loss, degradation, or modification of tributary and mainstem habitat; disease; predation; harvest; hatcheries; and climate change. The environmental baseline is characterized by high water quality, with summer temperatures below thresholds for concern. Winter temperatures in the action area, and elsewhere in the Clearwater River basin are cold enough to slow the development and emergence of eggs and fry, and the growth of rearing juveniles, but the production of a yearling in addition to the dominant subyearling life history type may support the viability of the ESU over time. Forage is reduced along the riprapped shoreline in the action area, but plankton continue to be flushed out of the reservoir to provide prey for juvenile Chinook salmon rearing in this reach.

As described in Section 2.5.1, the proposed permit is not likely to result in effluent discharges from Outfalls 001–006 that will affect the fitness or survival of juvenile or adult SR fall-run Chinook salmon. However, the permit will authorize the operation of two CWISs that do not meet our fish passage criteria. During the permit period, the USACE must prepare a CWIS Evaluation Report that includes information for determining whether structural or operational changes are needed. We expect that some fish leaving the spawning and incubation area located about a mile downstream will rear within the lower North Fork Clearwater River in the action area. As a result, we expect the entrainment and mortality of small numbers of juvenile SR fall-run Chinook salmon each year for 5 years. We do not expect adult SR fall-run Chinook salmon to become entrained into the CWIS because of their large size compared to that of the strainers and because of their greater swimming capability.

The draft 401 certification condition that requires monitoring of Hg and MeHg has the potential to result in actions that improve the functioning of water quality and forage in rearing and migration areas for SR fall-run Chinook salmon. Its purpose is to gather information regarding the potential for discharges of these toxics from Dworshak Reservoir based on the presence of these compounds in other dam sites such as the Hells Canyon Complex. This information could affect the terms of the next 5-year permit.

The mortality of small numbers of juvenile SR fall-run Chinook salmon due to entrainment and impingement in the CWIS each year over the 5-year term of the permit is not expected to appreciably alter the abundance, productivity, spatial structure, or diversity of the Lower Snake River population. Because there is only one population in this ESU, and because we do not anticipate a change in the VSP of the population as a consequence of the action, we do not expect a change in the viability of the ESU. Thus, it is NMFS' opinion that when the effects of the action and cumulative effects are added to the environmental baseline, and in light of the status of the species, the effects of the action will not cause reductions in reproduction, numbers, or distribution that would reasonably be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of SR fall-run Chinook salmon.

Critical Habitat for Snake River Fall-run Chinook Salmon. Critical habitat is present in the action area for SR fall-run Chinook salmon. NMFS designated critical habitat for SR fall-run Chinook salmon throughout its current range, including the mainstem Columbia and Snake River migration corridor and the spawning and rearing areas in the lower Snake River and the lower reaches of its tributaries. Across these areas, human activities and climate change have disrupted watershed processes and the functioning of PBFs. This has reduced water and habitat quality and quantity as well as habitat complexity. Measures taken through the efforts of Federal, tribal, State, local, and private entities in the past two decades have improved the functioning of PBFs in some of the spawning and rearing areas and in the mainstem and tributary migration corridors. More improvements will be needed before critical habitat supports the recovery of SR fall-run Chinook salmon across the designated areas.

With respect to the action area, water quality appears to be high with summer temperatures near 12ºC. The shoreline is mostly riprapped, limiting its value as rearing habitat, but planktonic forage is available from upstream.

As noted in Section 2.2.3, climate change is likely to further impact designated critical habitat. Increases in water temperature and changes to the hydrological regime will reduce suitable salmon habitat and cause earlier migration of smolts. Warmer temperatures will likely lead to increased predation on juvenile salmonids in mainstem reservoirs (ISAB 2007). This is particularly true of non-native species such as bass and channel catfish where climate change will likely further accelerate their expansion (ISAB 2007). In addition, the warmer water temperatures will increase consumption rates by predators due to increased metabolic rates, which influence food demand. Slight changes in environmental conditions during the 5-year permit term due to climate change could amplify the proposed action's effects on water quality to some small degree.

We do not expect the permitted discharges to have negative effects on water quality in the action area. The effluent limit for oil and grease is 5 mg/L, which will not be exceeded beyond 1 meter from each outfall. Heat discharges and levels of oxygen demanding materials will be below levels that could cause acute or chronic effects; pH levels will be approximately neutral. The proposed permit does not authorize oil spills and prohibits the discharge of toxicants, including PCBs.

We expect the ongoing operation of the two CWISs under the proposed permit to affect safe passage in the action area due to entrainment and impingement risk for juvenile fish. This is based on our comparison of the configurations of the intakes and perforated basket strainers with our fish passage criteria. The described effects on the fish passage PBFs in rearing and migration areas for SR fall-run Chinook salmon will be limited to an area several feet in diameter near each CWIS, constituting a very small proportion of habitat at the designation scale. The proposed permit requires the USACE to prepare a CWIS Evaluation Report, which will provide better information for evaluating the risks to safe passage in rearing habitat within the action area and inform whether structural or operational changes are needed.

For the reasons identified, we do not expect a reduction in the conservation value of critical habitat in the action area. As we scale up from the action area to the designation area of critical habitat for each species, the conservation value of designated critical habitat for SR fall-run Chinook salmon will not be appreciably diminished by the proposed permit.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed permit is not likely to jeopardize the continued existence of SR fall-run Chinook salmon, or to destroy or adversely modify designated critical habitat for SR fall-run Chinook salmon.

2.9. Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Harass" is further defined by interim guidance as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns, which include but are not limited to, breeding, feeding, or sheltering." "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1. Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur due to entrainment of juvenile SR fall-run Chinook salmon in the CWIS. NMFS is reasonably certain the incidental take described here will occur because: (1) small juveniles are likely to occur in the action area; and (2) the proposed permit includes operation of two CWISs that do not meet our fish passage criteria (NMFS 2022b).

Incidental Take from Entrainment into the CWIS. Due to the highly variable number of individual juveniles that will be present in the action area at any given time, and difficulties in the ability to observe entrainment, we cannot precisely determine the number of ESA-listed fish that will be killed, injured, or otherwise adversely affected due to entrainment into the CWIS. In this case, we assume that the magnitude of exposure to and the likelihood of mortality is a function of the expected maximum daily withdrawal rates of cooling water from the tailrace that will take place under the proposed permit. This is an appropriate surrogate for this pathway because it is a clear, measurable limit that can be readily monitored for any exceedances, so reinitiation could be triggered at any time during the period covered by the NPDES permit. This surrogate is causally related to the take because the scale of the negative effect is related to the water withdrawal rate. Thus, the extent of take will be exceeded if the rate of water withdrawals through the CWIS exceed 2.6 MGD and 3.2 MGD for CWIS #1 and #2, respectively.

2.9.2. 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 to SR fall-run Chinook salmon or destruction or adverse modification of critical habitat for SR fall-run Chinook salmon.

2.9.3. Reasonable and Prudent Measures

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

The EPA shall:

1. Provide NMFS with an opportunity to review and comment on the draft CWIS study plan and any draft reports.

2. Provide NMFS the final versions of the required BMPs, EAL, and PCB Management Plans and all monitoring reports generated by these plans.

2.9.4. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. The EPA or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this

ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. To implement RPM 1, the EPA will ensure that the USACE gives NMFS an opportunity to review and comment on the draft CWIS study plan and any draft reports generated by the plan. Drafts and the final report will be emailed to Ritchie.Graves@noaa.gov and Jeffrey.Brown@noaa.gov.

2. To implement RPM 2, the EPA will make available to NMFS the final versions of required BMPs, EAL, PCB Management Plans, and all monitoring reports generated by these plans. The plans and monitoring reports will be emailed to Ritchie.Graves@noaa.gov.

2.10. Reinitiation of Consultation

This concludes formal consultation for the EPA's proposal to finalize its NPDES permit for Dworshak Dam.

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

2.11. "Not Likely to Adversely Affect" Determinations

On January 13, 2023, NMFS received a request from the EPA for a written concurrence that its proposed issuance of an NPDES permit for Dworshak Dam is not likely to adversely affect SR spring/summer Chinook salmon and SRB steelhead under the ESA. In this section we describe our concurrence with their conclusion that the proposed permit is not likely to adversely affect these species. NMFS prepared this response to the EPA's request pursuant to section 7(a)(2) of the ESA, implementing regulations at 50 CFR 402, and agency guidance for preparation of letters of concurrence.

2.11.1. Background and Action Agency's Effects Determinations

We adopt by reference here Section 1 of the attached biological opinion, including the Consultation History and the Proposed Federal Action.

2.11.2. Snake River Spring/Summer Chinook Salmon

NMFS listed the SR spring/summer Chinook salmon ESU as threatened under the ESA on April 22, 1992 (57 FR 14653). On August 18, 2022, in the agency's 5-year review for this species, NMFS concluded that it should remain listed as threatened (NMFS 2022).

Snake River spring/summer Chinook salmon are not present in the action area and will not be exposed to the effects of the proposed permit. As a result, the likelihood of any negative effects on individuals of this species is discountable.

2.11.3. Snake River Basin Steelhead

NMFS listed SRB steelhead as a threatened ESU on August 18, 1997 (62 FR 43937), with a revised listing as a DPS on January 5, 2006 (71 FR 834). On August 18, 2022, in the agency's 5-year review, NMFS concluded that the species should remain listed as threatened (NMFS 2022).

In its BE, the EPA (2023a) determined that the proposed permit would have insignificant or discountable effects on SRB steelhead. This determination was based on the extremely low likelihood than any individuals would be within 1 meter of an outfall long enough to be exposed to undiluted amounts of the discharges regulated by the permit (e.g., oil and grease, pH, and toxicants). The EPA also concluded that any juvenile steelhead that are found within the action area are unlikely to travel close enough to the CWIS to become impinged or entrained. Upon further analysis, NMFS agrees with this reasoning.

The nearest spawning areas used by this species are in the lower mainstem Clearwater, tens of miles downstream of the action area. Although some of the adult steelhead returning to the Dworshak National Fish Hatchery hold in the tailrace of Dworshak Dam, it is unlikely that individuals are within a meter of an outfall long enough to experience acute or chronic toxic effects of oil and grease or any of the other permitted parameters. Some juveniles leaving natural spawning areas in the lower mainstem Clearwater or its tributaries may move upstream and into the North Fork Clearwater River, but they also are not likely to hold within a meter of an outfall long enough to experience negative effects. Fry-sized juveniles, small enough to be entrained into the CWIS, are highly unlikely to be present this far from a natural spawning and incubation area, and even the steelhead raised at Dworshak National Fish Hatchery are released outside the North Fork Clearwater River. Thus, the likelihood of any negative effects on individuals of this species due to reduced water quality is insignificant and the likelihood of negative effects due to entrainment in the CWIS is discountable.

3. Data Quality Act Documentation and Pre-Dissemination Review

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

3.1. Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the EPA and the USACE. Other interested users could include the Nez Perce Indian Tribe, the Idaho Department of Environmental Quality, other Indian tribes, ports, recreational and commercial vessel owners, recreational and commercial fishers, and environmental organizations. Individual copies of this opinion were provided to the EPA. The document will be available within 2 weeks at the NOAA Library Institutional Repository at https://repository.library.noaa.gov/welcome. The format and naming adhere to conventional standards for style.

3.2. 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.

3.3. 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 Magnuson–Stevens Fishery Conservation and Management Act 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 contain more background on information sources and quality.

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

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

4. References

BigCountryNewsConnection.com. 2021. Idaho Fish & Game Commission approves fall Chinook, coho salmon fishing seasons. July 14, 2021.

Bowerman, T., M. L. Keefer, and C. C. Caudill. 2021. Elevated stream temperature, origin, and individual size influence Chinook salmon prespawn mortality across the Columbia River Basin. Fisheries Research 237:105874.

Brockson, R. W., and H. T. Bailey. 1973. Respiratory response of juvenile Chinook salmon and striped bass exposed to benzene, a water-soluble component of crude oil. Pages 783–791 *in* Proceedings of Joint Conference on Prevention and Control of Oil Spills, March 13–15, 1973. Washington, D.C.

Cairns, J. Jr., A. G. Heath, and B. C. Parker. 1975. Temperature influence on chemical toxicity to aquatic organisms. Journal of the Water Pollution Control Federation 47(2):267–80.

Caudill, C. C., M. L. Keefer, T. S. Clabough, G. P. Naughton, B. J. Burke, and C. A. Peery. 2013. Indirect effects of impoundment on migrating fish: temperature gradients in fish ladders slow dam passage by 37 adult Chinook Salmon and steelhead. PLoS ONE 8:e85586. DOI: 10.1371/journal.pone.0085586.

Connor, W. P., and H. L. Burge. 2003. Growth of wild subyearling fall Chinook salmon in the Snake River. North American Journal of Fisheries Management 23:594–599.

Connor, W. P., H. L. Burge, R. Waitt, A. P. Garcia, and T. C. Bjornn. 2001. Snake River fall chinook salmon early life history and growth as affected by dams. Chapter 3 *in* Post-release attributes and survival of hatchery and natural fall chinook salmon in the Snake River. K. F. Tiffan, D. W. Rondorf, and H. L. Burge (eds.) Annual Report, 1999. U.S. Geological Survey, Columbia River Research Lab, Cook, WA. Prepared for Bonneville Power Administration, Portland, OR. January, 2001.

Coutant, C. C., and R. R. Whitney. 2006. Hydroelectric system development: effects on juvenile and adult migration. Pages 249–324 in R. N. Williams, editor. Return to the River – Restoring Salmon to the Columbia River. Elsevier Academic Press, Amsterdam.

Crozier, L. G., A. P. Hendry, P. W. Lawson, T. P. Quinn, N. J. Mantua, J. Battin, R. G. Shaw, and R. B. Huey. 2008. Potential responses to climate change in organisms with complex life histories: evolution and plasticity in Pacific salmon. Evolutionary Applications 1:252—270.

Crozier, L. G., B. J. Burke, B. J., B. E. Chasco, D. L. Widener, and R. W. Zabel. 2021. Climate change threatens Chinook salmon throughout their life cycle. https://www.nature.com/articles/s42003- 021-01734-w.pdf

Crozier, L. G., J. E. Siegel, L. E. Wiesebron, E. M. Trujillo, B. J. Burke, B. J., B. P. Sandford, and D. L. Widener. 2020. Snake River sockeye and Chinook salmon in a changing climate: Implications for upstream migration survival during recent extreme and future climates. PLoS ONE 15(9): e0238886. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0238886

Crozier, L. G., M. M. McClure, T. Beechie, S. J. Bograd, D. A. Boughton, M. Carr, T. D. Cooney, J. B. Dunham, C. M. Greene, M. A. Haltuch, E. L. Hazen, D. M. Holzer, D. D. Huff, R. C. Johnson, C. E. Jordan, I. C. Kaplan, S. T. Lindley, N. J. Mantua, P. B. Moyle, J. M. Myers, M. W. Nelson, B. C. Spence, L. A. Weitkamp, T .H. Williams, and E. Willis–Norton. 2019a. S3 Appendix: Distinct population segment scores and narratives, supporting information for: climate vulnerability assessment for Pacific salmon and steelhead in the California Current Large Marine Ecosystem. PLoS ONE:49. https://doi.org/10.1371/journal.pone.0217711.s001

Crozier, L. G., M. M. McClure, T. Beechie, S. J. Bograd, D. A. Boughton, M. Carr, T. D. Cooney, J. B. Dunham, C. M. Greene, M. A. Haltuch, E. L. Hazen, D. M. Holzer, D. D. Huff, R. C. Johnson, C. E. Jordan, I. C. Kaplan, S. T. Lindley, N. J. Mantua, P. B. Moyle, J. M. Myers, M. W. Nelson, B. C. Spence, L. A. Weitkamp, T .H. Williams, and E. Willis–Norton. 2019b. Climate vulnerability assessment for Pacific salmon and steelhead in the California Current Large Marine Ecosystem: PLoS ONE 14(7):e0217711. https://doi.org/10.1371/journal.pone.0217711

Dauble D. D., L. R. Johnson, and A. P. Garcia. 1999. Fall Chinook salmon spawning in the tailraces of lower Snake River hydroelectric projects. Transactions of the American Fisheries Society 128(4): 672–679.

EPA (U.S. Environmental Protection Agency). 1976. Quality criteria for water. U.S. EPA Report 440/5-86-001 (Red Book). EPA Office of Water, Washington, D.C. July 26, 1976.

EPA. 1986. Quality criteria for water. U.S. EPA Report 440/5-86-001 (Gold Book). EPA Office of Water, Washington, D.C. May 1, 1986.

EPA. 2011. Environmentally Acceptable Lubricants. U.S. Environmental Protection Agency, Washington, D.C. https://www3.epa.gov/npdes/pubs/vgp_environmentally_acceptable_lubricants.pdf

EPA. 2021a. Columbia and Lower Snake Rivers Temperature Total Maximum Daily Load. EPA, Region 10, Seattle. May, 2021.

EPA. 2021b. Assessment of impacts to Columbia and Snake River temperatures using the RBM10 Model, Scenario Report: Appendix D to the Columbia and Lower Snake Rivers Temperature Total Maximum Daily Load. EPA, Region 10, Seattle. May, 2021.

EPA. 2021c. Columbia River Cold Water Refuges Plan. Final. EPA-910-R-21-001. EPA, Region 10, Seattle. January, 2021.

EPA. 2021d. Biological Evaluation of EPA-issued NPDES permits for Federal dams in the lower Columbia and Snake Rivers basin. EPA, Region 10, Water Division, Seattle. May, 2021.

EPA. 2022a. Draft Authorization to Discharge under the National Pollutant Discharge Elimination System, Dworshak Project. EPA, Region 10, Water Division, Seattle. September, 2022.

EPA. 2022b. Fact Sheet. The U.S. Environmental Protection Agency (EPA) proposes to reissue a National Pollutant Discharge Elimination System (NPDES) permit to discharge pollutants Pursuant to the Provisions of the Clean Water Act (CWA) to: Dworshak Dam. EPA, Region 10, Water Division, Seattle. September, 2022.

EPA. 2023a. Request for concurrence on Endangered Species Act (ESA) and Essential Fish Habitat (EFH) determinations of NPDES permit for Dworshak Dam, Permit number ID0028568, and Final Biological Evaluation. EPA, Region 10, Seattle. January 11, 2023.

EPA. 2023b. RE: FW: WCRO-2022-03050 NPDES permit for Dworshak Dam. Email from A. Connor (EPA) to L. Krasnow (NMFS). June 14, 2023.

EPA. 2023c. FW: WCRO-2022-03050 NPDES permit for Dworshak Dam. Email from A. Connor (EPA) to L. Krasnow (NMFS). June 2, 2023.

EPA. 2023d. FW: Questions on Dworshak Dam from NMFS. Email from J. Wu (EPA) to L. Krasnow (NMFS). June 26, 2023.

Evans, D. H., P. M. Piermarini, and K. P. Choe. 2005. The multifunctional fish gill: dominant site of gas exchange, osmoregulation, acid-base regulation, and excretion of nitrogenous waste. Physiological Reviews 85: 97–177.

Ford, M. J. (ed.) 2011. Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest. U.S. Department of Commerce, NOAA Technical Memorandum. NMFS-NWFSC-113. November, 2011. https://repository.library.noaa.gov/view/noaa/4018

Ford, M. J. (ed.) 2022. Biological viability assessment update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest. U.S. Department of Commerce, NOAA Technical Memorandum. NMFS-NWFSC-171. January, 2022. https://doi.org/10.25923/kq2n-ke70

Good, T. P., R. S. Waples, and P. Adams (eds.) 2005. Updated status of Federally listed ESUs of West Coast salmon and steelhead. U.S. Department of Commerce, NOAA Technical Memorandum. NMFS-NWFSC-66. June, 2005. https://repository.library.noaa.gov/view/noaa/3413

Herbert, D. W. M. and J. C. Merkins. 1961. The effect of suspended mineral solids on the survival of trout. International Journal of Air and Water Pollution 5:46–55.

Herring, S. C., N. Christidis, A. Hoell, J. P. Kossin, C. J. Schreck III, and P. A. Stott (eds.) 2018. Explaining extreme events of 2016 from a climate perspective. Bulletin of the American Meteorological Society 99(1):S1–S157. doi:10.1175/BAMS-D-17-0119.1

ICTRT (Interior Columbia Technical Recovery Team). 2007. Viability criteria for application to Interior Columbia Basin salmonid ESUs. Review Draft. March, 2007. https://www.nwcouncil.org/reports/review-of-draft-viability-criteria-for-application-to-interior-columbia-basin-salmonid-esus/

IDEQ (Idaho Department of Environmental Quality). 2001. Middle Salmon River–Panther Creek Subbasin Assessment and TMDL. IDEQ, Boise, ID. March, 2001.

IDEQ. 2020. Idaho's 2018/2020 Integrated Report, Final. Appendix A: Clean Water Action Section 305(b) List and Section 303(d) List. IDEQ, Boise, ID. October, 2020.

IDEQ and EPA (Environmental Protection Agency). 2003. South Fork Clearwater River Subbasin Assessment and Total Maximum Daily Loads. IDEQ, Boise, ID. October, 2003.

Incardona, J. P. 2017. Molecular mechanisms of crude oil developmental toxicity in fish. Archives of Environmental Contamination and Toxicology 73:19–32.

Incardona, J. P., and N. L. Scholz. 2016. The influence of heart developmental anatomy on cardiotoxicity-based adverse outcome pathways in fish. Aquatic Toxicology 177:15–525.

Incardona, J. P., and N. L. Scholz. 2017. Environmental pollution and the fish heart. In: Fish Physiology, the cardiovascular system: phenotypic and physiological responses. A. K. Gamperl et al. (eds). Elsevier, London. Vol. 36B.

Incardona, J. P., and N. L. Scholz. 2018. Case study: the 2010 Deepwater Horizon oil spill. In: Development, Physiology, and Environment: A Synthesis. W. Burggren, and B. Dubansky (eds). Springer, London.

Incardona, J. P., T. K. Collier, and N. L. Scholz. 2011. Oil spills and fish health: exposing the heart of the matter. Journal of Exposure Science and Environmental Epidemiology 21:3–4.

Isaak, D. J., C. H. Luce, D. L. Horan, G. L. Chandler, S. P. Wollrab, and D. E. Nagel. 2018. Global warming of salmon and trout rivers in the northwestern U.S.: road to ruin or path through purgatory? Transactions of the American Fisheries Society 147:566–587.

ISAB (Independent Scientific Advisory Board). 2007. Climate change impacts on Columbia River Basin fish and wildlife. ISAB Climate Change Report, ISAB 2007-2. Northwest Power and Conservation Council, Portland, OR. May 11, 2007.

Jacox, M. G., M. A. Alexander, N. J. Mantua, J. D. Scott, G. Hervieux, R. S. Webb, and F. E. Werner. 2018. Forcing of multiyear extreme ocean temperatures that impacted California Current living marine resources in 2016. In: S. C. Herring et al. (eds). Explaining extreme events of 2016 from a climate perspective. Bulletin of the American Meteorological Society 99(1):S1–S33. doi:10.1175/BAMS-D-17-0119.1

Jirka, G. H., R. L. Donneker, and S.W. Hinton. 1996. User's manual for CORMIX: A hydrodynamic mixing zone model and decision support system for pollutant discharges into surface waters. September, 1996.

Jorgensen, J. C., C. Nicol, C. Fogel, and T. J. Beechie. 2021. Identifying the potential of anadromous salmonid habitat restoration with life cycle models. PLoS ONE 16(9): e0256792. https://doi.org/10.1371/journal.pone.0256792

Khursigara, A. J., K. L. Ackerly, and A. J. Esbaugh. 2019. Oil toxicity and implications for environmental tolerance in fish. Comparative Biochemistry and Physiology, Part C 220:52–61.

Lindsey, R., and L. Dahlman. 2023. Climate change: global temperature. Downloaded June 29, 2023.

Materna, E. 2001. Issue paper 4: temperature interaction. EPA-910–D-01-004. EPA, Region 10, Seattle. May, 2001. https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P100T9NB.txt

McCullough, D. A., S. Spalding, D. Sturdevant, and M. Hicks. 2001. Issue paper 5: summary of technical literature examining the physiological effects of temperature on salmonids. EPA-910-D-01-005. EPA, Region 10, Seattle. May, 2001. https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P100LVKL.txt

McElhany, P., M. H. Ruckelshaus, M. J. Ford, T. C. Wainwright, and E. P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of Evolutionarily Significant Units. NOAA Technical Memorandum NMFS-NWFSC-42. National Marine Fisheries Service, Seattle. June, 2000. https://repository.library.noaa.gov/view/noaa/3139

NMFS (National Marine Fisheries Service). 2006. National Marine Fisheries Service's comments and preliminary recommended terms and conditions for an application for a major new license for the Hells Canyon hydroelectric project (FERC No. 1971). National Marine Fisheries Service, Seattle. January 24, 2006.

NMFS. 2017. ESA Recovery Plan for Snake River Fall Chinook Salmon (*Oncorhynchus tshawytscha*). NMFS, Portland, OR. November, 2017. https://www.fisheries.noaa.gov/resource/document/recovery-plan-snake-river-fall-chinook-salmon

NMFS. 2020. Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act Essential Fish Habitat Response, Continued Operation and Maintenance of the Columbia River System. NMFS Consultation Number: WCRO 2020-00113. NMFS, West Coast Region, Portland, OR. July 24, 2020. https://doi.org/10.25923/3tce-8p07

NMFS. 2022a. 2022 5-Year Review: Summary & evaluation of Snake River fall-run Chinook Salmon. NMFS, West Coast Region, Portland, OR. https://www.fisheries.noaa.gov/resource/document/2022-5-year-review-summary-evaluation-snake-river-fall-run-chinook-salmon

NMFS. 2022b. NOAA Fisheries West Coast Region Anadromous Salmonid Passage Design Manual. National Marine Fisheries Servce, West Coast Region, Portland, OR. https://www.fisheries.noaa.gov/resource/document/anadromous-salmonid-passage-facility-design-manual

NOAA Fisheries (National Oceanic and Atmospheric Administration, National Marine Fisheries Service). 2023. Ocean ecosystem indicators of Pacific salmon marine survival in the Northern California Current. Web page accessed May 4, 2023. https://www.fisheries.noaa.gov/west-coast/science-data/ocean-ecosystem-indicators-pacific-salmon-marine-survival-northern#stoplight-table

Ober, H. K. 2010. Effects of oil spills on marine and coastal wildlife. University of Florida IFAS Extension. WEC285.

ODEQ (Oregon Department of Environmental Quality). 1995. pH. 1992–1994 Water Quality Standards Review. Final Issue Papers. Portland, OR. June, 1995.

Patra, R. W., J. C. Chapman, R. P. Lim, P. C. Gehrke, and R. M. Sunderam. 2015. Interactions between water temperature and contaminant toxicity to freshwater fish. Environmental Toxicology and Chemistry 34(8):1809–1817.

Perhar, G., and G. B. Arhonditsis. 2014. Aquatic ecosystem dynamics following petroleum hydrocarbon perturbations: A review of the current state of knowledge. Journal of Great Lakes Research, 40(3):56–72.

Philip, S.Y., S. F. Kew, G. J. van Oldenborgh, F. S. Anslow, S. I. Seneviratne, R. Vautard, et al. 2021. Rapid attribution analysis of the extraordinary heatwave on the Pacific Coast of the U.S. and Canada. Earth System Dynamics 13:1689–1713. DOI: 10.5194/esd-2021-90

Rice, S. D. 1973. Toxicity and avoidance tests with Prudhoe Bay oil and pink salmon fry. Pages 667–670. In: Proceedings of Joint Conference on Prevention and Control of Oil Spills, March 13–15, 1973. Washington, D.C.

Sauter, S. T., J. McMillan, and J. Dunham. 2001. Issue paper 1: Salmonid behavior and water temperature. EPA-910-01-001. EPA, Region 10, Seattle. May, 2001. https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P100TNSE.txt

Scott, M. H. 2020. Statistical modeling of historical daily water temperatures in the lower Columbia River. 2020. Dissertations and Theses. Paper 5594. Portland State University, Portland, OR. https://doi.org/10.15760/etd.7466

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.

Siegel, J. and L. Crozier. 2019. Impacts of climate change on salmon of the Pacific Northwest: A review of the scientific literature published in 2018. Fish Ecology Division, Northwest Fisheries Science Center, Seattle. December, 2019. DOI:10.13140/RG.2.2.35382.04164

Spence, B., G. Lomnicky, R. Hughes, and R. P. Novitski. 1996. An ecosystem approach to salmonid conservation. TR-4501-96-6057. ManTech Environmental Research Services Corporation, Corvallis, OR. December, 1996.

Tiffan, K. F., and W. P. Connor. 2012. Seasonal use of shallow water babitat in the lower Snake River reservoirs by juvenile fall Chinook salmon, 2010–2011. U.S. Geological Survey, Western Fisheries Research Center, Cook, WA. Final Report of Research to U.S. Army Corps of Engineers, Walla Walla District, Walla Walla, WA. January 6, 2012.

Tiffan, K. F., J. M. Erhardt, and S. J. St. John. 2014. Prey availability, consumption, and quality contribute to variation in growth of subyearling Chinook salmon rearing in riverine and reservoir habitats. Transactions of the American Fisheries Society 143:219–229.

Tonina, D., J. A. McKean, D. Isaak, R. M. Benjankar, C. Tang, and Q. Chen. 2022. Climate change shrinks and fragments salmon habitats in a snow dependent region. Geophysical Research Letters 49: e2022GL098552. https://doi.org/10.1029/2022GL098552

USACE (U.S. Army Corps of Engineers). 2019. NPDES permit application for Dworshak Dam. USACE, Walla Walla District, Walla Walla, WA. February 19, 2019.

USACE. 2022. USACE Comments to EPA's draft proposed NPDES Permit for the North Fork of the Clearwater River Hydroelectric Facility: Dworshak Dam (#ID0028586) North Fork of the Clearwater River. Fact Sheet. November 14, 2022.

USACE. 2023. RE: [Non-DoD Source] Fwd: DWR cooling water strainers. Email from E. Holdren (USACE) to T. Conder (NMFS). February 23, 2023.

USGCRP (U.S. Global Change Research Program). 2018. Impacts, risks, and adaptation in the United States: Fourth National Climate Assessment, Volume II. In: D. R. Reidmiller et al. (eds.) U.S. Global Change Research Program, Washington, D.C. DOI:10.7930/NCA4.2018

WDFW (Washington Department of Fish and Wildlife) and ODFW (Oregon Department of Fish and Wildlife). 2021. 2021 Joint staff report: Stock status and fisheries for fall Chinook salmon, coho salmon, chum salmon, summer steelhead, and white sturgeon. Joint Columbia River Management Staff. July 19, 2001.