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

Refer to NMFS No:
WCRO-2020-00156

June 18, 2020

Karen F. Taylor-Goodrich - Superintendent
North Cascades National Park Service Complex
National Park Service, Department of the Interior
810 State Route 20
Sedro-Woolley, Washington 98284

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for Routine Trail Maintenance 2020 through 2030 in the North Cascades National Park Service Complex, in Whatcom, Skagit, and Chelan Counties, Washington (Fourth Field HUCs: 17110001– Fraser, 17110005 – Upper Skagit, and 17020009 – Lake Chelan).

Dear Ms. Taylor-Goodrich:

Thank you for your letter of February 6, 2020, requesting initiation of formal 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 Park Service's (NPS's) Routine Trail Maintenance 2020 through 2030 in the North Cascades National Park Complex (NCNPC). The NMFS also reviewed the likely effects of the proposed action on essential fish habitat (EFH), pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855(b)).

This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016). The enclosed document contains the biological opinion (Opinion) prepared by the NMFS pursuant to section 7 of the ESA on the effects of the proposed action. In this Opinion, the NMFS concludes that the proposed action would adversely affect but is not likely to jeopardize the continued existence of Puget Sound (PS) Chinook salmon and PS Sound steelhead. We also conclude that the proposed action is likely to adversely affect designated critical habitat for both of those species but is not likely to result in the destruction or adverse modification of those designated critical habitats.

This Opinion includes an incidental take statement (ITS) that describes reasonable and prudent measures (RPMs) the NMFS considers necessary or appropriate to minimize the incidental take associated with this action, and sets forth nondiscretionary terms and conditions that the NPS must comply with to meet those measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA's prohibition against the take of listed species. Section 3 of this document includes our analysis of the action's likely effects on EFH pursuant to Section 305(b) of the MSA. Based on that analysis, the NMFS concluded that the action would adversely affect designated EFH for Pacific Coast Salmon. Therefore, we have provided 1 conservation recommendation that can be taken by the NPS to avoid, minimize, or otherwise offset potential adverse effects on EFH.

Section 305(b) (4) (B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving this recommendation. If the response is inconsistent with the EFH conservation recommendations, the NPS must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the action and recommendations. In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we request that in your statutory reply to the EFH portion of this consultation you clearly identify the number of conservation recommendations accepted.

Please contact Donald Hubner in the North Puget Sound Branch of the Oregon/Washington Coastal Office at (206) 526-4359, or by electronic mail at Donald.Hubner@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Kim W. Kratz, Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

cc: Rob Burrows, NPS

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

Routine Trail Maintenance 2020 through 2030 in the North Cascades National Park Service Complex, in Whatcom, Skagit, and Chelan Counties, Washington (Fourth Field HUCs: 17110001– Fraser, 17110005 – Upper Skagit, and 17020009 – Lake Chelan)

NMFS Consultation Number: WCRO-2020-00156

Action Agency: National Park Service

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?
Chinook salmon (*Oncorhynchus tshawytscha*) Puget Sound (PS)	Threatened	Yes	No	Yes	No
Steelhead (*O. mykiss*)					
PS	Threatened	Yes	No	Yes	No

Affected Essential Fish Habitat (EFH) and NMFS' Determinations:

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

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued By:

Kim W. Kratz, Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

Date: June 18, 2020

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LIST OF ACRONYMS

ACQ – Alkaline Copper Quaternary
ACZA – Ammoniacal Copper Zinc Arsenate
ADA – Americans with Disability Act
BA – Biological Assessment
BMP – Best Management Practices
CFR – Code of Federal Regulations
DBH – Diameter at Breast Height
DIP – Demographically Independent Population
DPS – Distinct Population Segment
DQA – Data Quality Act
EF – Essential Feature
EFH – Essential Fish Habitat
ESA – Endangered Species Act
ESU – Evolutionarily Significant Unit
FR – Federal Register
FMP – Fishery Management Plan
HAPC – Habitat Area of Particular Concern
HUC – Hydrologic Unit Code
ITS – Incidental Take Statement
MPG – Major Population Group
MSA – Magnuson-Stevens Fishery Conservation and Management Act
NMFS – National Marine Fisheries Service
NOAA – National Oceanic and Atmospheric Administration
NPS – National Park Service
NWFSC – Northwest Fishery Science Center
PBF – Physical or Biological Feature
PCE – Primary Constituent Element
PFMC – Pacific Fishery Management Council
PS – Puget Sound
PSSTRT – Puget Sound Steelhead Technical Recovery Team
PSTRT – Puget Sound Technical Recovery Team
RM – River Mile
RPA – Reasonable and Prudent Alternative
RPM – Reasonable and Prudent Measure
VSP – Viable Salmonid Population
WCR – West Coast Region (NMFS)
WDFW – Washington State Department of Fish and Wildlife

1. INTRODUCTION

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

1.1 Background

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

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

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the Oregon Washington Coastal Office.

1.2 Consultation History

On April 2, 2018, the NPS reached out to the NMFS to request pre-consultation review of a draft biological assessment (DBA) for routine trail maintenance activities in the North Cascades National Parks Complex (NCNPC) for the years 2019 through 2023. The NPS requested similar technical assistance from the U.S. Fish and Wildlife Service (USFWS) at about the same time. The NPS's goal was to receive concurrence from the Services that their routine trails maintenance program would be not likely to adversely affect (NLAA) ESA-listed species under our respective jurisdictions.

On February 2, 2019, the NPS inquired about the status of DBA review. On February 12, 2019, the NMFS provided comments on the DBA. The USWS provided their comments three days later. Subsequently, numerous e-mails and telephone calls were exchanged between the NPS and the Services through March 19, 2019, with both services reporting to the NPS that the routine trails maintenance program should be covered under a formal consultation, and that truncating their program such that we could concur with an NLAA determination would be so restrictive that the NPS would be frequently forced to forego desired work, or to conduct additional consultation, which would effectively nullify the value of conducting the multi-year consultation.

However, to meet the then fast-approaching 2019 maintenance season, it was agreed that the NPS would develop a 1-year plan that both services could concur would be NLAA for our respective trust resources, while continuing technical assistance for a longer-term maintenance program. On April 2, 2019, the NPS submitted a request for concurrence from the Services that their 2019 trails maintenance plan would be NLAA for our respective trust resources. The NMFS issued our concurrence on April 15, 2019 (WCRO-2019-00195). The USFWS concurred on April 29, 2019.

Technical assistance for the multi-year trails maintenance program continued, including a 2-day site visit to the NCNPC August 5 & 6, 2019. The NMFS representative participated in the first day of the visit, but did not hike in and camp over-night for the second day of the site visit as did the USFWS and NPS representatives.

On February 6, 2020, the NMFS received the NPS's request for formal consultation (NPS 2020a) for routine trail maintenance activities in the NCNPC for the years 2020 through 2030. The consultation request included an enclosed BA for the proposed action (NPS 2020b), and formal consultation for the proposed action was initiated on that date.

This Opinion is based on the information in the BA; supplemental materials and responses to NMFS questions (NPS 2020c - e); recovery plans, status reviews, and critical habitat designations for ESA-listed PS Chinook salmon and PS steelhead; published and unpublished scientific information on the biology and ecology of those species; and relevant scientific and gray literature (see Literature Cited).

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), whereas the EFH definition of a federal action is any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910).

The NPS proposes to conduct 10 years of routine trail maintenance activities along the existing trail system within the North Cascades National Park Service Complex (the Complex) in Washington State. The Complex is composed of three contiguous units that extend between the US-Canada border and the northern end of Lake Chelan; the North Cascades National Park (NOCA), the Ross Lake National Recreation Area (ROLA), and the Lake Chelan National Recreation Area (LACH) (Figure 1). The complex encompasses about 680,850 acres that are a subset of about 2 million acres of protected federal land in the North Cascades Ecosystem. Non-motorized recreation such as hiking, backpacking, mountaineering, horseback riding/packing, rafting/paddling, and camping are the primary recreational uses within the Complex.

About 94% of the Complex is designated wilderness, within which facilities development is minimal, and maintenance activities are limited by law to the minimum required that would simultaneously preserve the wilderness character of the area (U.S. Public Law 88-577). Further the proposed trails maintenance work would be performed in compliance with the NPS's mission, which is to "…to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." (U.S. Public Law 39-535).

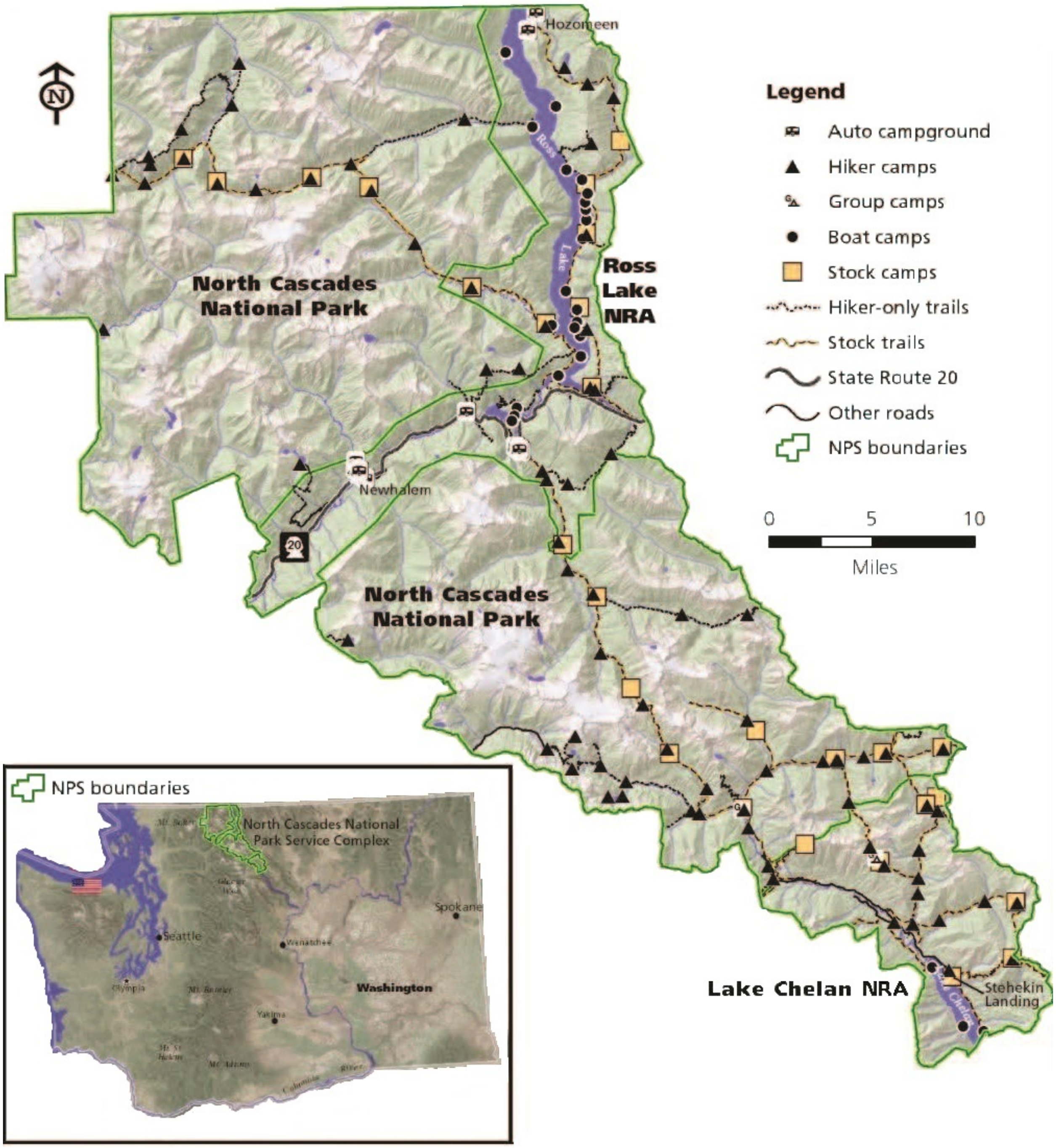

Figure 1. Map of the North Cascades National Park Service Complex in Washington State (Adapted from NPS 2020b Figure 1).

The Complex trails system includes a total of about 390 miles of trail and 130 backcountry camps. The system includes maintained stream crossings (bridges and fords), drainage structures, trail and camp signs, tent pads, fire grates and pits, pit and composting toilets, and hitch rails.

In general, the routine trail maintenance program would consist of the annual accomplishment of the minimum work necessary to repair and keep safe existing trails, campsites, and associated structures that become degraded over time. Most work would be done by hand with use hand tools, small power tools, and occasional pack animals. Helicopters would be used to transport materials to remote roadless areas, generally less than 10 times per year, and some blasting may be episodically required. Most trails maintenance activities are planned to occur between April and October, but some limited work could occur year-round.

Routine trail maintenance work would be done by work crew with occasional assistance from volunteers. Pack animals (horses and mules) are used to help transport supplies and materials in most areas where access is limited to non-motorized transport. When vehicular and non-motorized transport is not feasible, supplies and materials would be transported by helicopter.

Before the start of work each year, the trails foreman would discuss the year's work plan with an interdisciplinary team, which includes NPS wildlife biologists and aquatic ecologists. The work plan discussions would include assessing the need and efficacy of conservations measures to reduce potential impacts on listed species, and the possible need for additional Section 7 consultation for required work that does not comply with the routine trail maintenance program.

The routine trails maintenance program would consist of two major components; (1) Opening of the trail system and (2) Maintenance and repair of the trail system, which are described below.

<u>Opening of the trail system</u>

Work to open the trail system would typically start in the spring on low elevation trails and progress upward in elevation as the snow melts throughout the summer. The work components consist of opening of trail corridors, light cleaning of trail drainage structures, maintenance of designated campsites, felling of hazard trees, and maintenance of stream fords. The opening of trail corridors may include blasting.

Trail crews of 2-4 people would work their way up assigned trails, opening and clearing as they go. The crews would also record significant damage or other required work that would require a larger effort and/or additional environmental compliance (including additional Section 7 consultation). The timing and duration of opening work on any given trail is highly dependent on the amount of trailside vegetation growth, how many downed trees and other debris need to be cleared, as well as the timing of the winter snowpack melting off of the trails and camps.

<u>Opening of trail corridors:</u> Trail crews would use a combination of hand tools and power saws to brush out trails (clear back overgrown vegetation within the trail corridor) and to cut trees that have fallen across the trail. Hiker-only trails would be cleared to provide 6 feet of lateral and 8 feet of vertical clearance of brush and branches. Stock-use trails would be cleared to provide 8 feet of lateral and 10 feet of vertical clearance. The trail tread widths would be maintained at 18- to 36-inches wide.

The crews would also remove debris from the trail. Small debris and rocks would be moved off the trail tread and deposited adjacent to the trail corridor by hand and/or by using hand tools such as shovels and pry bars. Large rocks, logs, and cut rounds may need the assistance of a mule or mechanical rigging (i.e. grip hoist). Some blasting may be required in extreme situations. As needed, the trail crews would also use native materials such as logs, branches, and rocks to create barriers intended to discourage the development and use of social trails and shortcuts, and trail widening.

The time required to clear a section of trail depends largely on the density of new trailside vegetation growth and/or the size and number of logs that need to be cut. However, in general chainsaw use is infrequent and typically less than 2 minutes in duration, followed by several minutes of physical work to move material away from the trail. Power saw work would take longer in rare situations where a cluster of trees has fallen, or when a large tree with lots of limbs falls lengthwise down a trail. In those situations, multiple cycles of minutes-long saw work followed by extended periods of physical work to clear the material could be repeated in the affected area over an hour or more.

Blasting may occasionally be used to remove portions of bedrock or very large fallen boulders that obstruct the trail. Qualified trail crewmembers would operate a generator and electric rock drills to insert the explosive charges. They would then detonate the charge, and clear away rubble and debris using hand tools, mechanical leverage, and/or stock animals as needed.

No blasting is anticipated in proximity to Chinook salmon or steelhead occupied of designated critical habitat, and no blasting would be conducted within ¼ mile of known northern spotted owl activity centers or suitable habitat for marbled murrelet during each species respective nesting seasons. Blasting with a single charge of up to 6.5 pounds would be allowed no closer than 164 feet from bull trout habitat. Minimum setback distances for charges larger than 6.5 pounds would comply with the blasting guidelines expressed in the USFWS's 2013 Olympic National Forest Biological Opinion (USFWS 2013; Appendix D in the NPS 2020b). In the unlikely circumstance that blasting may be required near Chinook salmon and/or steelhead occupied habitat, work practices would comply with the measures identified above for bull trout.

<u>Light cleaning of trail drainage structures:</u> Drainage structures such as ditches and waterbars are built into every trail to slow, redirect, and disperse overland water flow off of the trails and into the vegetation on the slope below the trail. In some places water is passed through small culverts or step-over open drains to the downslope side of the trail. Short puncheon bridges are installed across some drainage features. In most cases, only very small amounts of water are passed under the trail, and no drainage features are associated with perennial streams or fish critical habitat. As needed, trail crews would clear drainage structures using hand spades, shovels, or other hand tools and place the removed materials just downslope of the trail.

<u>Maintenance of designated campsites:</u> As crews reach designated camp sites along the trail, they would use hand tools and power saws as needed to clear downed trees and limbs. They would use hand tools to repair or replace in-kind campground structural elements such as tent pads, signs, hitch rails, and fire-pits. Where replacement is required in designated wilderness areas, it would typically be done with native material, including trees less than 18" diameter at breast height (DBH) and/or with manufactured materials (e.g. non-treated dimensional lumber). The crews would check the toilets. When needed they would bury the existing toilet with the previously excavated soil, and dig a new pit toilet. As needed, the crew would also identify and fall hazard trees (as described below).

Felling of hazard trees: If a dead or a heavily diseased and dying tree's falling would pose a threat to human life or property it is considered a hazard tree. The work crews would examine the trees that are near buildings, parking areas, picnic areas, campsites, historic structures, and some bridges to determine if there is a risk of their falling that would threaten those structures. Hazard tree removal is an important requirement for designated campsites, where the NPS requires people to use specific tent pads. Protecting bridges and historic structures from hazard trees in the backcountry is also considered very important. Qualified personnel would use power saws and hand tools to directionally fell hazard trees away from threatened structures as soon as possible after they are identified. Hazard tree removal would not be done along roads or trails because the chance of their hitting moving targets is considered too low.

Maintenance of stream fords: Some trails cross small streams without bridges, and the streams must be crossed by foot or on horseback. At these locations, trail crews of 1 to 4 members would periodically perform in-water work move larger rocks and debris out of the ford's path to maintain a relatively flat area that can be safely crossed by hikers and stock animals. This work is typically done by hand using hand tools such as shovels and rock bars, but the use of a mule or mechanical rigging may be required in some situations. Work at individual fords typically last a couple of hours, but in rare situations may require up to 3 days of work. No fords cross streams that are occupied by, or have been designated as critical habitat for listed Chinook salmon or steelhead.

Maintenance and Repair of the Trail System

Routine trail maintenance and repair work would consist of: repair of trail tread; minor trail reroutes; maintenance of drainage structures; repair of small trail structures; repair of major bridges; and maintenance and repair of Americans with Disability Act (ADA) accessible trails. Depending on a project's location and supply requirements, some work may include the use of helicopters. Some of this work could occur coincident with the opening of the trail system, while other projects would likely require planning and procurement of equipment and supplies such that the work would be completed sometime after its need is identified. Small earth moving equipment, such as bobcats, could be used for trail maintenance in some areas outside of wilderness, such as the Newhalem Campground area trails, Gorge Overlook Trail, Thunder Knob Trail, Happy Panther Trail, Thunder Creek to the wilderness boundary, the first 1/2 mile of East Bank Trail, Rainbow Falls, and the hiking path on the closed upper Stehekin Road.

Repair of trail tread: Where trail sections have been damaged by erosion or other forces, work crews would use hand tools such as shovels, picks, hoes, and tampers to restore the trail tread, as well as to correct the cause of the damage if possible. Work crews would rebuild the tread by first recovering as much of the lost material as possible. If needed, they would use additional locally derived native material (soil, rock, and wood). The preferred sources are nearby exposed root wads from fallen trees, however material from drainage cleaning is also sometimes used. No material would be taken from streams.

Minor trail reroutes: Short sections of trail (generally less than 200 feet in length) may need to be rerouted in locations where trail damage is too severe to repair as described above, or when severe tread damage is likely to reoccur frequently. Longer reroutes may be undertaken as long as NPS biologists determine that doing so would have "No Effect" on listed species. Work crews would use hand tools and chainsaws to clear brush and branches as needed, and use shovels, picks, hoes, and tampers to create a new trail tread around the problem area. The abandoned trail sections would be scarified, "naturalized" by spreading logs, brush, and duff across the surface, and when practicable planted with seeds or seedlings of native plants.

<u>Maintenance of drainage structures:</u> Drainage structures such as ditches, drains, water bars, and small culverts that have become severely blocked or damaged would be cleared of debris, rebuilt, or relocated as needed. Note that culverts are very rare on trails in the Complex. They are only used in places where there is a small steady amount of water that would cause a mud hole in the trail. Work crews would use hand tools such as shovels, picks, and pry bars to remove blockage and/or to restore or relocate the drainage feature in a manner best suited to reduce future problems.

Crews would preferentially use recovered material to restore the structure and the trail tread adjacent to it. However, they may also need to use some additional native materials as described above under repair of the trail tread, including the use of nearby trees smaller than 18-inches in diameter at breast height (DBH). In some cases they may need to use manufactured replacement materials, such as new culvert pipes, as well as pre-cut (dimensional) lumber. Dimensional lumber from rot resistant species such as Alaska Yellow Cedar is typically used.

<u>Repair of small trail structures:</u> Puncheon bridges, turnpikes, and boardwalks would be repaired, replaced in kind, or built onsite. The work crews would use hand tools, power saws, and other power tools such as hand drills to repair or construct the structures as needed. When possible, they would preferentially reuse material from the original structure. However, they may often need to use trees smaller than 18-inches DBH, as well as dimensional lumber. Dimensional lumber would be a rot resistant species or certified pressure treated lumber. However, no treated lumber would be installed where it would be regularly immersed in water, and all use of treated lumber would be done in compliance with the guidelines for the use of treated lumber below.

<u>Repair of major bridges:</u> Repair of major trail bridges would include the repair and/or replacement of bridge approaches, stringers, decking, and railings, but not abutments or other in-water work. The work crews would use hand tools, power saws, and other power tools such as hand drills to repair or construct the structures as needed.

Locally derived native material is typically used in designated wilderness, including the occasional use of trees larger than 18-inches DBH that would be felled and used as bridge stringers. The felling of stringer trees would be treated the same way and subject to the same conditions and conservation measures as large hazard trees. As above, rot resistant and/or certified pressure treated dimensional lumber may also be used where it would not be regularly immersed in water, and all use of treated lumber would be done in compliance with the guidelines described below. Helicopters may be used to transport bridge materials and are likely to be required to position large bridge stringers.

<u>General helicopter use:</u> Helicopters would occasionally land or use long-line/sling-load drops to transport supplies, equipment, and building materials at some sites. Helicopter operations would

typically occur April through October, and would depend on weather, helicopter availability, and conservation measures identified for listed and other sensitive species such as migratory birds.

Maintenance and repair of ADA accessible trails: A small subset of trails in the Complex are maintained to comply with ADA guidelines. These include a few front county trails in the Newhalem area that are on flat terrain and traverse low gradient slopes. Besides the necessary drainage structures as described above, these trails have "curb logs" along the edge of the trail that helps contain the tread. The tread of these trails must be firm and stable. Consequently, the trail tread typically consists of a mix of 3/4 inch and below sized angular crushed gravel compacted with a roller to provide the required degree of stability and firmness. The work crews would use hand tools such as shovels, picks, hoes, as well as power tools such as saws, hand drills, and a small compactor/roller to repair the tread and border structures as needed.

The following activities are expressly excluded from the routine trails maintenance plan and would be considered under separate consultations as needed.

- Extensive trail reroutes – Generally anything longer than 200 feet, unless determined to have no effect on listed species by NPS biologists;
- Major off-trail drainage redirection – Generally, any diversion of water from its natural drainage pattern beyond 20 feet upslope and 15 feet downslope of a trail, other than sheet flow;
- Replacement of major bridges;
- Repair, replacement, relocation of bridge footings and/or abutments below OHWM;
- Streambank hardening;
- In-water work area isolation;
- Felling of a large number of hazard trees in any one location;
- Replacement or maintenance of historic structures;
- Construction new camps or relocation of existing camps;
- Activities occurring at a great distance from the trail corridor;
- Blasting within the minimum harassment or harm threshold distances for listed species;
- Blasting within 164 feet of any stream;
- Herbicide application (Currently covered under the 2012 Invasive Plant Management Plan for the Complex: NMFS # WCR-2012-00934; USFWS #0lEWFW00-2012-1-0191);
- Fire management activities (Currently covered under the 2007 Fire Management Plan for the Complex: USFWS biological opinion #1-3-05-F-0683).

Trails maintenance work components would be done in compliance with the Avoidance, Minimization, and Mitigation measures identified in Appendix C of the NPS BA for this action. Further, any blasting that may be required would be done in compliance with the Blasting Guidelines expressed in Appendix D of the NPS BA for this action, with the additional limitation that no blasting, regardless of charge size, would be allowed within 164 feet of any occupied listed-fish habitat.

Guidelines for the use of treated lumber (NPS 2020x):

1. All use of treated lumber shall be limited to wood that has been pressure-treated with Ammoniacal Copper Zinc Arsenate (ACZA) or Alkaline Copper Quaternary (ACQ) certified to comply with the standards of the Western Wood Preservers Institute or the American Wood Protection Association. Any use of wood treated with oil-type preservatives or with chromated copper arsenate (CCA) is expressly prohibited.

2. Treated wood may not be used in any structure that will be in or over water or over flooded wetlands (permanently or seasonally) except to maintain or repair an existing wood bridge or boardwalk (see #9 below).

3. Treated wood shall be stored out of contact with standing water and wet soil, and protected from precipitation.

4. Each load and piece of treated wood shall be visually inspected and rejected for use in or above aquatic environments if visible residue, bleeding of preservative, preservative-saturated sawdust, contaminated soil, or other matter is present.

5. Prefabrication shall be used whenever possible to minimize in-the-field cutting, drilling, and application of preservatives.

6. When in-the-field fabrication is necessary, all cutting, drilling, and application of preservative treatments to cut surfaces shall be done outside of ordinary high water (OHW) to limit discharge of sawdust, drill shavings, and preservative to the water. All cut surfaces that are treated in the field shall be wiped with an absorbent towel or rag to remove excess preservative.

7. Tarps, plastic tubs or similar devices shall be used to contain fabrication debris and soiled wiping towels and rags for removal from the field and proper disposal.

8. All decommissioned treated wood shall be removed from the field and properly disposed of.
   a. All decommissioned wood and debris, including piles, shall be evaluated to determine if it has been treated.
   b. All decommissioned treated wood and debris shall be prevented from entering the water, and shall be removed immediately if it does so.
   c. In-the-field temporary storage of decommissioned treated wood and debris shall be done in dry areas. No decommissioned treated wood or debris shall be stacked in water or on the streambank at or below OHW.
   d. All treated wood debris shall be removed from project sites as soon as possible for proper disposal.

9. For the maintenance or repair of an existing wood bridge or boardwalk:
   a. No part of the treated wood may be exposed to leaching by precipitation, overtopping waves, or submersion;

b. Stringers and/or decking of a bridge can be made from treated wood only if they will be covered by a non-treated wood wearing surface that covers the entire roadway width; and
c. All treated wood elements of the structure shall be designed to avoid or minimize impacts or abrasion that could create treated wood debris or dust.

The NMFS also considered whether or not the proposed action would cause other activities that may affect listed species and designated critical habitats. The NPS reports that the purpose of the proposed repair and maintenance of the existing trails and designated campsites is to provide safe non-motorized visitor access and recreation within the Complex. We believe that over the next 10 years, continued activities such as human and pack animal fording of streams, as well as wading, swimming, and fishing in streams that are in close proximity to the trails and campsites would be consequences of the proposed action because they would be much less likely to occur if the trail system did not exist. Therefore, we have also analyzed the effects of visitor use of the trail system in the effects section of this Opinion.

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

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

The NPS determined that the proposed action would adversely affect PS Chinook salmon and PS steelhead, but is not likely to adversely affect designated critical habitat for either species. Because the proposed action is likely to adversely affect PS Chinook salmon and PS steelhead, the NMFS has proceeded with formal consultation. Further, as described below in section 2.5.2, the NMFS has concluded that the proposed action is also likely to adversely affect designated critical habitat for PS Chinook salmon and PS steelhead (Table 1).

Table 1. ESA-listed species and critical habitats that may be affected by the proposed action.

ESA-listed species and critical habitat likely to be adversely affected (LAA)				
Species	**Status**	**Species**	**Critical Habitat**	**Listed / CH Designated**
Chinook salmon (*Oncorhynchus tshawytscha*) Puget Sound	Threatened	LAA	LAA	06/28/05 (70 FR 37160) / 09/02/05 (70 FR 52630)
Steelhead (O. mykiss) Puget Sound	Threatened	LAA	LAA	05/11/07 (72 FR 26722) / 02/24/16 (81 FR 9252)

LAA = likely to adversely affect NLAA = not likely to adversely affect
N/A = not applicable. The action area is outside designated critical habitat, or critical habitat has not been designated.

2.1 Analytical Approach

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

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

Critical habitat designations prior to 2016 used the terms “primary constituent element” (PCE) or “essential feature” (EF) to identify important habitat qualities. However, the 2016 critical habitat regulations (50 CFR 424.12) replaced those 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, EFs, or PBFs. In this biological opinion, we use the term PBF to mean PCE or EF, as appropriate for the specific critical habitat.

The 2019 regulations define effects of the action using the term “consequences” (50 CFR 402.02). As explained in the preamble to the regulations (84 FR 44977), that definition does not change the scope of our analysis and in this opinion we use the terms “effects” and “consequences” interchangeably.

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

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

2.2 Rangewide Status of the Species and Critical Habitat

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

The summaries that follow describe the status of the ESA-listed species, and their designated critical habitats, that occur within the action area and are considered in this opinion. More detailed information on the biology, habitat, and conservation status and trend of these listed resources can be found in the listing regulations and critical habitat designations published in the Federal Register and in the recovery plans and other sources at: https://www.fisheries.noaa.gov/species-directory/threatened-endangered, and are incorporated here by reference.

Listed Species

Viable Salmonid Population (VSP) Criteria: For Pacific salmonids, we commonly use four VSP criteria (McElhany et al. 2000) to assess the viability of the populations that constitute the species. These four criteria (spatial structure, diversity, abundance, and productivity) encompass the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. When these parameters are collectively at appropriate levels, they maintain a population's capacity to adapt to various environmental conditions and allow it to sustain itself in the natural environment.

"Spatial structure" refers both to the spatial distributions of individuals in the population and the processes that generate that distribution. A population's spatial structure depends on habitat quality and spatial configuration, and the dynamics and dispersal characteristics of individuals in the population.

"Diversity" refers to the distribution of traits within and among populations. These range in scale from DNA sequence variation in single genes to complex life history traits.

"Abundance" generally refers to the number of naturally-produced adults that return to their natal spawning grounds.

"Productivity" refers to the number of naturally-spawning adults produced per parent. When progeny replace or exceed the number of parents, a population is stable or increasing. When progeny fail to replace the number of parents, the population is in decline.

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

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

<u>Puget Sound (PS) Chinook Salmon:</u> The PS Chinook salmon evolutionarily significant unit (ESU) was listed as threatened on June 28, 2005 (70 FR 37160). We adopted the recovery plan for this ESU in January 2007. The recovery plan consists of two documents: the Puget Sound salmon recovery plan (SSPS 2007) and the final supplement to the Shared Strategy's Puget Sound salmon recovery plan (NMFS 2006). The recovery plan adopts ESU and population level viability criteria recommended by the Puget Sound Technical Recovery Team (PSTRT) (Ruckelshaus et al. 2002). The PSTRT's biological recovery criteria will be met when all of the following conditions are achieved:

- The viability status of all populations in the ESU is improved from current conditions, and when considered in the aggregate, persistence of the ESU is assured;
- Two to four Chinook salmon populations in each of the five biogeographical regions of the ESU achieve viability, depending on the historical biological characteristics and acceptable risk levels for populations within each region;
- At least one population from each major genetic and life history group historically present within each of the five biogeographical regions is viable;
- Tributaries to Puget Sound not identified as primary freshwater habitat for any of the 22 identified populations are functioning in a manner that is sufficient to support an ESU-wide recovery scenario; Production of Chinook salmon from tributaries to Puget Sound not identified as primary freshwater habitat for any of the 22 identified populations occurs in a manner consistent with ESU recovery; and
- Populations that do not meet all the Viable Salmon Population (VSP) parameters are sustained to provide ecological functions and preserve options for ESU recovery.

<u>General Life History:</u> Chinook salmon are anadromous fish that require well-oxygenated water that is typically less than 63º F (17º C), but some tolerance to higher temperatures is documented with acclimation. Adult Chinook salmon spawn in freshwater streams, depositing fertilized eggs in gravel "nests" called redds. The eggs incubate for three to five months before juveniles hatch and emerge from the gravel. Juveniles spend from three months to two years in freshwater before migrating to the ocean to feed and mature. Chinook salmon spend from one to six years in the ocean before returning to their natal freshwater streams where they spawn and then die.

Chinook salmon are divided into two races, stream-types and ocean-types, based on the major juvenile development strategies. Stream-type Chinook salmon tend to rear in freshwater for a year or more before entering marine waters. Conversely, ocean-type juveniles tend to leave their natal streams early during their first year of life, and rear in estuarine waters as they transition into their marine life stage. Both stream- and ocean-type Chinook salmon are present, but ocean-type Chinook salmon predominate in Puget Sound populations.

Chinook salmon are further grouped into “runs” that are based on the timing of adults that return to freshwater. Early- or spring-run chinook salmon tend to enter freshwater as immature fish, migrate far upriver, and finally spawn in the late summer and early autumn. Late- or fall-run Chinook salmon enter freshwater at an advanced stage of maturity, move rapidly to their spawning areas, and spawn within a few days or weeks. Summer-run fish show intermediate characteristics of spring and fall runs, without the extensive delay in maturation exhibited by spring-run Chinook salmon. In Puget Sound, spring-run Chinook salmon tend to enter their natal rivers as early as March, but do not spawn until mid-August through September. Returning summer- and fall-run fish tend to enter the rivers early-June through early-September, with spawning occurring between early August and late-October.

Yearling stream-type fish tend to leave their natal rivers late winter through spring, and move relatively directly to nearshore marine areas and pocket estuaries. Out-migrating ocean-type fry tend to migrate out of their natal streams beginning in early-March. Those fish rear in the tidal delta estuaries of their natal stream for about two weeks to two months before migrating to marine nearshore areas and pocket estuaries in late May to June. Out-migrating young of the year parr tend to move relatively directly into marine nearshore areas and pocket estuaries after leaving their natal streams between late spring and the end of summer.

Spatial Structure and Diversity: The PS Sound Chinook salmon ESU includes all naturally spawning populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Straits of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington. The ESU also includes the progeny of numerous artificial propagation programs (NWFSC 2015). The PSTRT identified 22 extant populations, grouped into five major geographic regions, based on consideration of historical distribution, geographic isolation, dispersal rates, genetic data, life history information, population dynamics, and environmental and ecological diversity. The PSTRT distributed the 22 populations among five major biogeographical regions, or major population groups (MPGs), that are based on similarities in hydrographic, biogeographic, and geologic characteristics (Table 2).

Hatchery-origin spawners are present in high fractions in most populations within the ESU, with the Whidbey Basin the only MPG with consistently high fractions of natural-origin spawners. Between 1990 and 2014, the fraction of natural-origin spawners has declined in many of the populations outside of the Skagit watershed (NWFSC 2015).

Table 2. Extant PS Chinook salmon populations in each biogeographic region (Ruckelshaus et al. 2002, NWFSC 2015).

Biogeographic Region	Population (Watershed)
Strait of Georgia	North Fork Nooksack River
	South Fork Nooksack River
Strait of Juan de Fuca	Elwha River
	Dungeness River
Hood Canal	Skokomish River
	Mid Hood Canal River
Whidbey Basin	Skykomish River
	Snoqualmie River
	North Fork Stillaguamish River
	South Fork Stillaguamish River
	Upper Skagit River
	Lower Skagit River
	Upper Sauk River
	Lower Sauk River
	Suiattle River
	Upper Cascade River
Central/South Puget Sound Basin	Cedar River
	North Lake Washington/ Sammamish River
	Green/Duwamish River
	Puyallup River
	White River
	Nisqually River

Abundance and Productivity: Available data on total abundance since 1980 indicate that abundance trends have fluctuated between positive and negative for individual populations, but productivity remains low in most populations, and hatchery-origin spawners are present in high fractions in most populations outside of the Skagit watershed. Available data now show that most populations have declined in abundance over the past 7 to 10 years. Further, escapement levels for all populations remain well below the PSTRT planning ranges for recovery, and most populations are consistently below the spawner-recruit levels identified by the PSTRT as consistent with recovery (NWFSC 2015). The current information on abundance, productivity, spatial structure and diversity suggest that the Whidbey Basin MPG is at relatively low risk of extinction. The other four MPGs are considered to be at high risk of extinction due to low abundance and productivity (NWFSC 2015). The most recent 5-year status review concluded that the ESU should remain listed as threatened (NMFS 2017).

Limiting Factors: Factors limiting recovery for PS Chinook salmon include:

- Degraded floodplain and in-river channel structure
- Degraded estuarine conditions and loss of estuarine habitat
- Riparian area degradation and loss of in-river large woody debris
- Excessive fine-grained sediment in spawning gravel

- Degraded water quality and temperature
- Degraded nearshore conditions
- Impaired passage for migrating fish
- Severely altered flow regime

PS Chinook Salmon within the Action Area: Figure 2 shows the extent of PS Chinook salmon designated critical habitat within the Complex. The shown critical habitat closely mirrors the occupied habitat for this species within the Complex, most of which is spawning habitat. Additional spawning habitat is documented for about 2 miles upstream of the end of critical habitat in Goodell Creek. PS Chinook salmon are also documented in Newhalem Creek for about 0.4 mile upstream of its confluence with the Skagit River. Numerous natural barriers that include numerous falls, bedrock cascades, and velocity barriers block the upstream migration of anadromous fish in the Skagit River. The downstream most of these barriers is located slightly upstream of Newhalem, at river mile (RM) 95.

The PS Chinook salmon most likely to occur in the action area would be summer-run fish from the Upper Skagit River population (NWFSC 2015; WDFW 2020a). Both stream- and ocean-type Chinook salmon are present in the population, with the majority being ocean-types. Between 1974 and 2018, the total abundance for PS Chinook salmon in the Upper Skagit River population has fluctuated between about 3,586 and 20,040 individuals. The average trend has been flat to slightly positive (NWFSC 2015; WDFW 2020b). The total return in 2018 was 8,602 fish (WDFW 2020b).

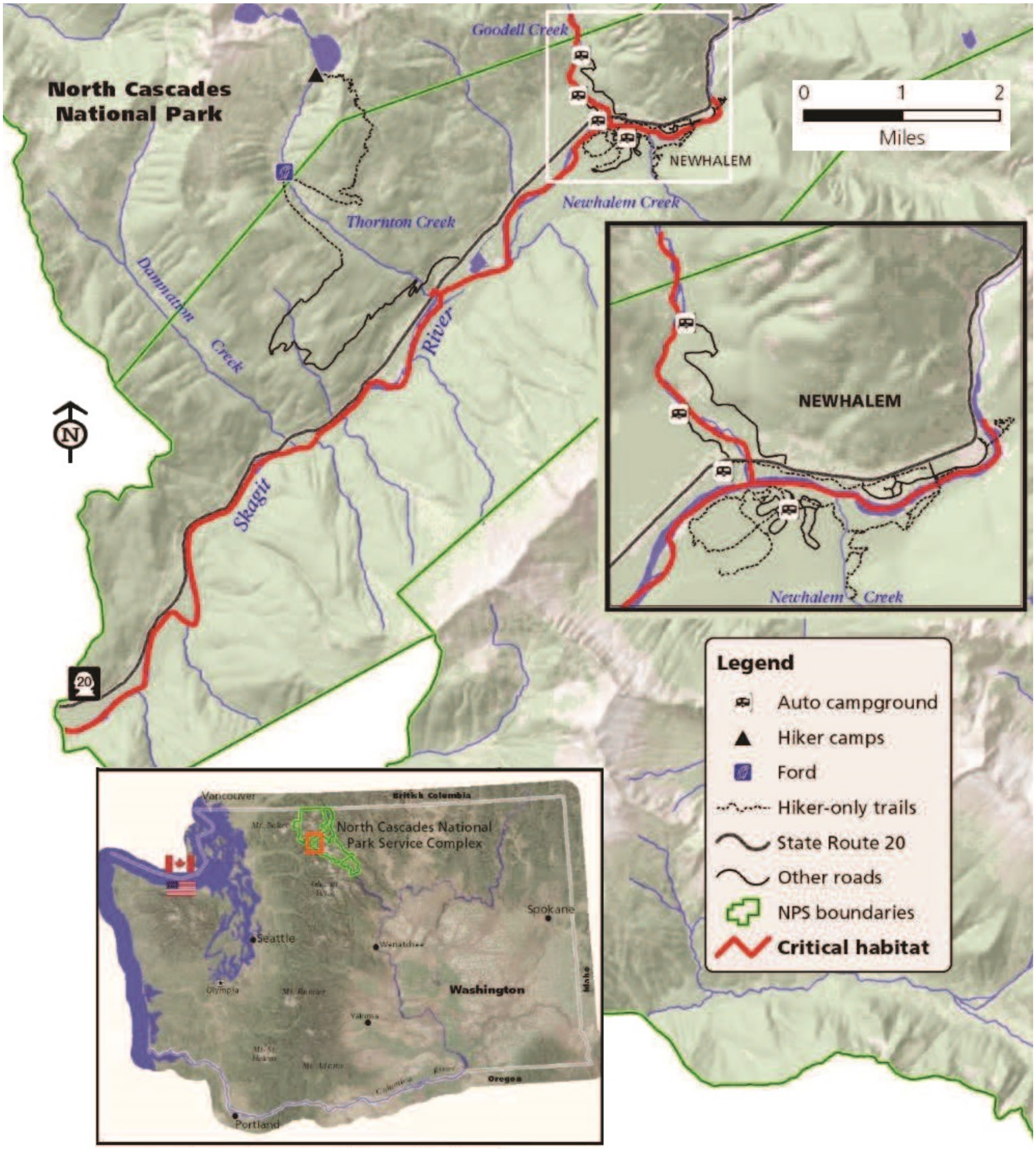

Figure 2. Map of Puget Sound Chinook salmon designated critical habitat within the North Cascades National Park Service Complex (Adapted from NPS 2019b Figure 9).

<u>Puget Sound (PS) steelhead</u>

The PS steelhead distinct population segment (DPS) was listed as threatened on May 11, 2007 (72 FR 26722). The recovery plan for this DPS is under development. In 2013, the Puget Sound Steelhead Technical Recovery Team (PSSTRT) identified 32 demographically independent populations (DIPs) within the DPS, based on genetic, environmental, and life history characteristics. Those DIPs are distributed among three geographically-based MPGs; Northern Cascades, Central and South Puget Sound; and Hood Canal and Strait de Fuca (Myers et al. 2015) (Table 3).

Table 3. PS steelhead Major Population Groups (MPGs), Demographically Independent Populations (DIPs), and DIP Viability Estimates (Modified from Figure 58 in Hard et al. 2015).

Geographic Region (MPG)	Demographically Independent Population (DIP)	Viability
Northern Cascades	Drayton Harbor Tributaries Winter Run	Moderate
	Nooksack River Winter Run	Moderate
	South Fork Nooksack River Summer Run	Moderate
	Samish River/Bellingham Bay Tributaries Winter Run	Moderate
	Skagit River Summer Run and Winter Run	Moderate
	Nookachamps River Winter Run	Moderate
	Baker River Summer Run and Winter Run	Moderate
	Sauk River Summer Run and Winter Run	Moderate
	Stillaguamish River Winter Run	Low
	Deer Creek Summer Run	Moderate
	Canyon Creek Summer Run	Moderate
	Snohomish/Skykomish Rivers Winter Run	Moderate
	Pilchuck River Winter Run	Low
	North Fork Skykomish River Summer Run	Moderate
	Snoqualmie River Winter Run	Moderate
	Tolt River Summer Run	Moderate
Central and South Puget Sound	Cedar River Winter Run	Low
	North Lake Washington and Lake Sammamish Winter Run	Moderate
	Green River Winter Run	Low
	Puyallup River Winter Run	Low
	White River Winter Run	Low
	Nisqually River Winter Run	Low
	South Sound Tributaries Winter Run	Moderate
	East Kitsap Peninsula Tributaries Winter Run	Moderate
Hood Canal and Strait de Fuca	East Hood Canal Winter Run	Low
	South Hood Canal Tributaries Winter Run	Low
	Skokomish River Winter Run	Low
	West Hood Canal Tributaries Winter Run	Moderate
	Sequim/Discovery Bay Tributaries Winter Run	Low
	Dungeness River Summer Run and Winter Run	Moderate
	Strait of Juan de Fuca Tributaries Winter Run	Low
	Elwha River Summer Run and Winter Run	Low

In 2015, the PSSTRT concluded that the DPS is at “very low” viability; with most of the 32 DIPs and all three MPGs at “low” viability based on widespread diminished abundance, productivity, diversity, and spatial structure when compared with available historical evidence (Hard *et al*. 2015). Based on the PSSTRT viability criteria, the DPS would be considered viable when all three component MPG are considered viable. A given MPG would be considered viable when: 1) 40%or more of its component DIP are viable; 2) mean DIP viability within the MPG exceeds the threshold for viability; and 3) 40% or more of the historic life history strategies (i.e., summer runs and winter runs) within the MPG are viable. For a given DIP to be considered viable, its probability of persistence must exceed 85%, as calculated by Hard et al. (2015), based on abundance, productivity, diversity, and spatial structure within the DIP.

General Life History: Steelhead are anadromous fish that require well-oxygenated water that is typically less than 63º F (17º C). PS steelhead exhibit two major life history strategies. Ocean-maturing, or winter-run fish typically enter freshwater from November to April at an advanced stage of maturation, and then spawn from February through June. Stream-maturing, or summer-run fish typically enter freshwater from May to October at an early stage of maturation, migrate to headwater areas, and hold for several months prior to spawning in the following spring. After hatching, juveniles rear in freshwater from one to three years prior to migrating to marine habitats (two years is typical). Smoltification and seaward migration typically occurs from April to mid-May. Smolt lengths vary between watersheds, but typically range from 4.3 to 9.2 inches (109 to 235 mm) (Myers et al. 2015). Juvenile steelhead are generally independent of shallow nearshore areas soon after entering marine water (Bax et al. 1978, Brennan et al. 2004, Schreiner et al. 1977), and are not commonly caught in beach seine surveys. Recent acoustic tagging studies (Moore et al. 2010) have shown that smolts migrate from rivers to the Strait of Juan de Fuca from one to three weeks. PS steelhead feed in the ocean waters for one to three years (two years is again typical), before returning to their natal streams to spawn. Unlike Chinook salmon, most female steelhead, and some males, return to marine waters following spawning (Myers et al. 2015).

Spatial Structure and Diversity: The PS steelhead DPS includes all naturally spawned anadromous steelhead populations in streams in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington, bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive). The DPS also includes six hatchery stocks that are considered no more than moderately diverged from their associated natural-origin counterparts (USDC 2014). PS steelhead are the anadromous form of *O. mykiss* that occur below natural barriers to migration in northwestern Washington State (NWFSC 2015). Non-anadromous ‘‘resident’’ *O. mykiss* (a.k.a. rainbow trout) occur within the range of PS steelhead but are not part of the DPS due to marked differences in physical, physiological, ecological, and behavioral characteristics (Hard et al. 2015). As stated above, the DPS consists of 32 DIPs that are distributed among three geographically-based MPG. An individual DIP may consist of winter-run only, summer-run only, or a combination of both life history types. Winter-run is the predominant life history type in the DPS (Hard et al. 2015).

Abundance and Productivity: Available data on total abundance since the late 1970s and early 1980s indicate that abundance trends have fluctuated between positive and negative for individual DIPs. However, low productivity persists throughout the 32 DIPs, with most showing downward trends, and a few showing sharply downward trends (Hard et al. 2015, NWFSC 2015). Since the mid-1980s, trends in natural spawning abundance have also been temporally variable for most DIP but remain predominantly negative, and well below replacement for at least 8 of the DIP (NWFSC 2015). Smoothed abundance trends since 2009 show modest increases for 13 DIPs. However, those trends are similar to variability seen across the DPS, where brief periods of increase are followed by decades of decline. Further, several of the upward trends are not statistically different from neutral, and most populations remain small. Nine of the evaluated DIPs had geometric mean abundances of fewer than 250 adults, and 12 had fewer than 500 adults (NWFSC 2015). Over the time series examined, the over-all abundance trends, especially for natural spawners, remain predominantly negative or flat across the DPS, and general steelhead abundance across the DPS remains well below the level needed to sustain natural production into the future (NWFSC 2015). The PSSTRT recently concluded that the PS steelhead DPS is currently not viable (Hard et al. 2015). The DPS's current abundance and productivity are considered to be well below the targets needed to achieve delisting and recovery. Growth rates are currently declining at 3 to 10% annually for all but a few DIPs, and the extinction risk for most populations is estimated to be moderate to high. The most recent 5-year status review concluded that the DPS should remain listed as threatened (NMFS 2017a).

Limiting Factors: Factors limiting recovery for PS steelhead include:

- The continued destruction and modification of steelhead habitat
- Widespread declines in adult abundance (total run size), despite significant reductions in harvest in recent years
- Threats to diversity posed by use of two hatchery steelhead stocks (Chambers Creek and Skamania)
- Declining diversity in the DPS, including the uncertain but weak status of summer run fish
- A reduction in spatial structure
- Reduced habitat quality through changes in river hydrology, temperature profile, downstream gravel recruitment, and reduced movement of large woody debris
- In the lower reaches of many rivers and their tributaries in Puget Sound where urban development has occurred, increased flood frequency and peak flows during storms and reduced groundwater-driven summer flows, with resultant gravel scour, bank erosion, and sediment deposition
- Dikes, hardening of banks with riprap, and channelization, which have reduced river braiding and sinuosity, increasing the likelihood of gravel scour and dislocation of rearing juveniles

PS Steelhead within the Action Area: Figure 3 shows the extent of PS steelhead designated critical habitat within the Complex. The critical habitat closely mirrors the occupied habitat for this species, most of which within the displayed reach of the Skagit River is spawning habitat. Additional occupied habitat extends slightly into the Complex in Triumph Creek, just north of Bacon Creek. Numerous natural barriers that include numerous falls, bedrock cascades, and velocity barriers block the upstream migration of anadromous fish in the Skagit River. The downstream most of these barriers is located slightly upstream of Newhalem, at river mile (RM) 95. Additionally, the designated critical habitat shown in the Baker River system is currently unoccupied due impassable dams on that river downstream of the Complex.

The PS steelhead most likely to occur in the action area would be summer- and winter-run fish from the Skagit River DIP (NWFSC 2015; WDFW 2020a). WDFW defines this population as a native stock with wild production. Between 1978 and 2018, the total abundance for PS steelhead in the Skagit River DIP has fluctuated between about 2,502 and 13,194 individuals, with a relatively flat trend, and 6,084 adults returning in 2018 (WDFW 2020c).

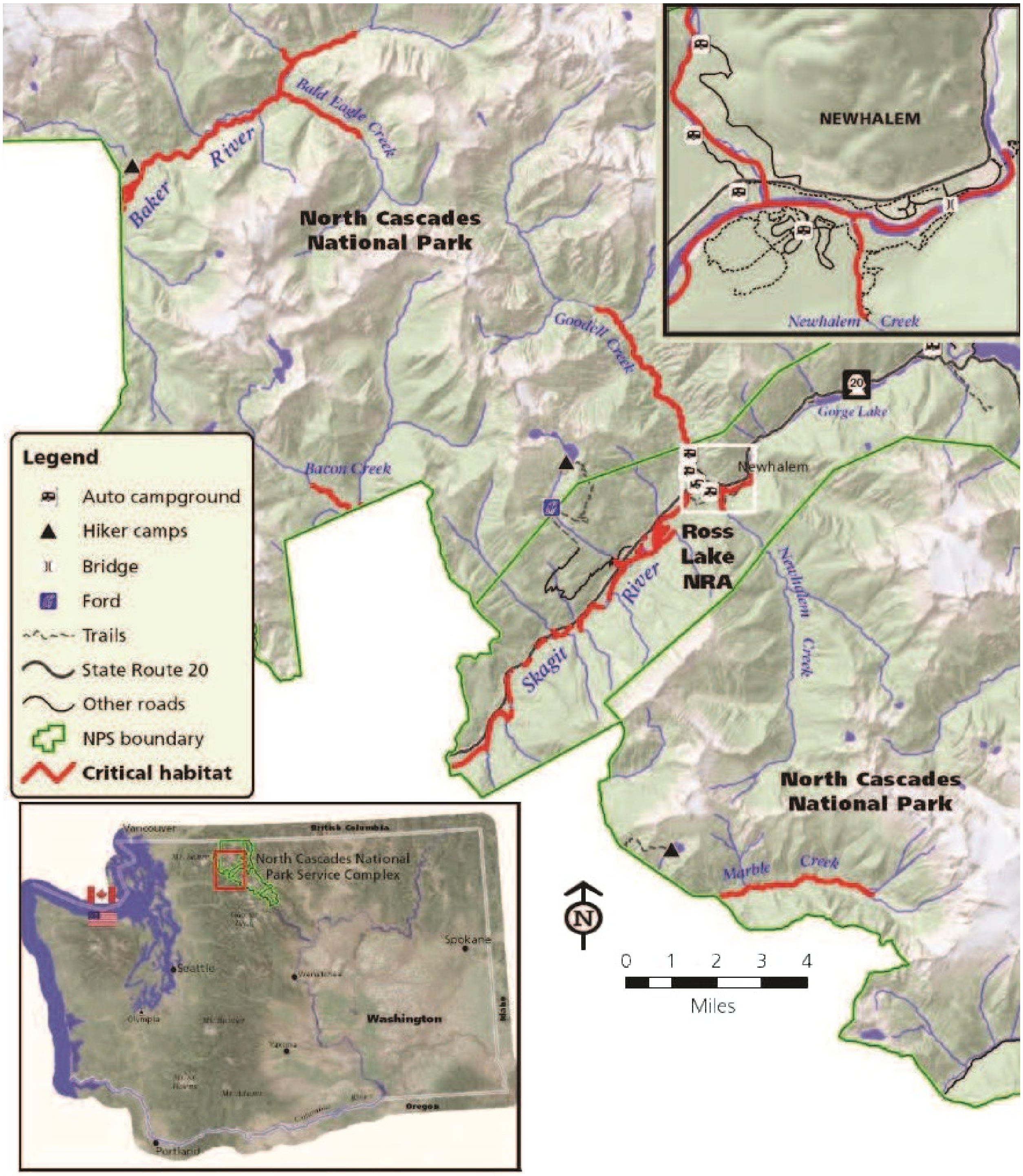

Figure 3. Map of Puget Sound steelhead designated critical habitat within the North Cascades National Park Service Complex (Adapted from NPS 2019b Figure 11).

Critical Habitat

This section describes the status of designated critical habitat that would be affected by the proposed action by examining the condition and trends of physical or biological features (PBFs) that are essential to the conservation of the listed species throughout the designated areas. The PBFs are essential because they support one or more of the species' life stages (e.g., sites with conditions that support spawning, rearing, migration and foraging). The proposed project would affect critical habitat for PS Chinook salmon and PS steelhead (Figures 2 & 3).

Puget Sound Chinook Salmon Critical Habitat: The NMFS designated critical habitat for PS Chinook salmon on September 2, 2005 (70 FR 52630). That critical habitat is located in 16 freshwater subbasins and watersheds between the Dungeness/Elwha Watershed and the Nooksack Subbasin, inclusively, as well as in nearshore marine waters of the Puget Sound that are south of the US-Canada border and east of the Elwha River, and out to a depth of 30 meters. Although offshore marine is an area type identified in the final rule, it was not designated as critical habitat for PS Chinook salmon.

Puget Sound steelhead critical habitat: The NMFS designated critical habitat for PS steelhead on February 24, 2016 (81 FR 9252). That critical habitat is located in 18 freshwater subbasins between the Strait of Georgia Subbasin and the Dungeness-Elwha Subbasin, inclusively. No marine waters were designated as critical habitat for PS steelhead.

The PBFs of salmonid critical habitat include: (1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development; (2) Freshwater rearing sites with: (i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; (ii) Water quality and forage supporting juvenile development; and (iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks; (3) Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival; (4) Estuarine areas free of obstruction and excessive predation with: (i) Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and (iii) Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation; (5) Nearshore marine areas free of obstruction and excessive predation with: (i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and (6) Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. The PBF for PS Chinook salmon CH are listed in Table 4.

Table 4. Physical or biological features (PBFs) and corresponding life history events of designated critical habitat for PS Chinook salmon and PS steelhead. Although nearshore and offshore marine areas were identified in the FRs, no offshore marine areas were designated as critical habitat for PS Chinook salmon, and neither was designated as critical habitat for PS steelhead.

Physical or Biological Features		
Site Type	**Site Attribute**	**Life History Event**
Freshwater spawning	Water quantity Water quality Substrate	Adult spawning Embryo incubation Alevin growth and development
Freshwater rearing	Water quantity and Floodplain connectivity Water quality and Forage Natural cover	Fry emergence from gravel Fry/parr/smolt growth and development
Freshwater migration	(Free of obstruction and excessive predation) Water quantity and quality Natural cover	Adult sexual maturation Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Estuarine	(Free of obstruction and excessive predation) Water quality, quantity, and salinity Natural cover Forage	Adult sexual maturation and "reverse smoltification" Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Nearshore marine	(Free of obstruction and excessive predation) Water quality, quantity, and forage Natural cover	Adult growth and sexual maturation Adult spawning migration Nearshore juvenile rearing
Offshore marine	Water quality and forage	Adult growth and sexual maturation Adult spawning migration Subadult rearing

Critical habitat throughout the Puget Sound basin has been degraded by numerous activities, including hydropower development, loss of mature riparian forests, increased sediment inputs, removal of large wood from the waterways, intense urbanization, agriculture, alteration of floodplain and stream morphology (i.e., channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, dredging, armoring of shorelines, marina and port development, road and railroad construction and maintenance, logging, and mining. Changes in habitat quantity, availability, and diversity, and flow, temperature, sediment load and channel instability are common limiting factors of critical habitat throughout the basin.

Land use practices have likely accelerated the frequency of landslides delivering sediment to streams. Fine sediment from unpaved roads also contributes to stream sedimentation. Unpaved roads are widespread on forested lands in the Puget Sound basin, and to a lesser extent, in rural residential areas. Historical logging removed most of the riparian trees near stream channels. Subsequent agricultural and urban conversion permanently altered riparian vegetation in the river valleys, leaving either no trees, or a thin band of trees. The riparian zones along many agricultural areas are now dominated by alder, invasive canary grass and blackberries, and provide substantially reduced stream shade and LW recruitment (SSPS 2007).

Diking, agriculture, revetments, railroads and roads in lower stream reaches have caused significant loss of secondary channels in major valley floodplains in this region. Confined main channels create high-energy peak flows that remove smaller substrate particles and LW. The loss of side-channels, oxbow lakes, and backwater habitats has resulted in a significant loss of juvenile salmonid rearing and refuge habitat. When the water level of Lake Washington was lowered 9 feet in the 1910s, thousands of acres of wetlands along the shoreline of Lake Washington, Lake Sammamish and the Sammamish River corridor were drained and converted to agricultural and urban uses. Wetlands play an important role in hydrologic processes, as they store water which ameliorates high and low flows. The interchange of surface and groundwater in complex stream and wetland systems helps to moderate stream temperatures. Thousands of acres of lowland wetlands across the region have been drained and converted to agricultural and urban uses, and forest wetlands are estimated to have diminished by one-third in Washington State (FEMAT 1993; Spence et al. 1996; SSPS 2007).

Loss of riparian habitat, elevated water temperatures, elevated levels of nutrients, increased nitrogen and phosphorus, and higher levels of suspended sediment, presumably from urban and highway runoff, wastewater treatment, failing septic systems, and agriculture or livestock impacts, have been documented in many Puget Sound tributaries (SSPS 2007).

Peak stream flows have increased over time due to paving (roads and parking areas), reduced percolation through surface soils on residential and agricultural lands, simplified and extended drainage networks, loss of wetlands, and rain-on-snow events in higher elevation clear cuts (SSPS 2007). In urbanized Puget Sound, there is a strong association between land use and land cover attributes and rates of coho spawner mortality likely due to runoff containing contaminants emitted from motor vehicles (Feist et al. 2011).

Dams constructed for hydropower generation, irrigation, or flood control have substantially affected PS Chinook salmon populations in a number of river systems. The construction and operation of dams have blocked access to spawning and rearing habitat, changed flow patterns, resulted in elevated temperatures and stranding of juvenile migrants, and degraded downstream spawning and rearing habitat by reducing recruitment of spawning gravel and LW to downstream areas (SSPS 2007). These actions tend to promote downstream channel incision and simplification (Kondolf 1997), limiting fish habitat. Water withdrawals reduce available fish habitat and alter sediment transport. Hydropower projects often change flow rates, stranding and killing fish, and reducing aquatic invertebrate (food source) productivity (Hunter 1992).

Juvenile mortality occurs in unscreened or inadequately screened diversions. Water diversion ditches resemble side channels in which juvenile salmonids normally find refuge. When diversion headgates are shut, access back to the main channel is cut off and the channel goes dry. Mortality can also occur with inadequately screened diversions from impingement on the screen, or mutilation in pumps where gaps or oversized screen openings allow juveniles to get into the system. Blockages by dams, water diversions, and shifts in flow regime due to hydroelectric development and flood control projects are major habitat problems in many Puget Sound tributary basins (SSPS 2007).

The nearshore marine habitat has been extensively altered and armored by industrial and residential development near the mouths of many of Puget Sound's tributaries. A railroad runs along large portions of the eastern shoreline of Puget Sound, eliminating natural cover along the shore and natural recruitment of beach sand (SSPS 2007).

Degradation of the near-shore environment has occurred in the southeastern areas of Hood Canal in recent years, resulting in late summer marine oxygen depletion and significant fish kills. Circulation of marine waters is naturally limited, and partially driven by freshwater runoff, which is often low in the late summer. However, human development has increased nutrient loads from failing septic systems along the shoreline, and from use of nitrate and phosphate fertilizers on lawns and farms. Shoreline residential development is widespread and dense in many places. The combination of highways and dense residential development has degraded certain physical and chemical characteristics of the near-shore environment (HCCC 2005; SSPS 2007).

Critical Habitat within the Action Area: Critical habitat for PS Chinook salmon and PS steelhead has been designated on the west side of the Complex (Figures 2 & 3). The critical habitat in the Skagit River system provides the freshwater migration corridor and freshwater spawning and rearing PCEs. The unoccupied PS steelhead critical habitat that has been designated in the Baker River system would likely provide the freshwater migration corridor PCE, and may also provide freshwater spawning and rearing PCEs should access to it be provided in the future.

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).

As described in the Proposed Federal Action and in the Status of the Species Sections (1.3 & 2.2), the NPS's project would overlap with PS Chinook salmon and PS steelhead occupied habitat and designated critical habitat in the Upper Skagit River watershed, close to the western boundary of North Cascades National Park Service Complex (Figures 1 - 3). As described in the Proposed Federal Action and Effects of the Action Sections (1.3 & 2.5), project-related in-water effects would be limited to scattered locations where NPS trails cross or are within close proximity to streams, and for short distances downstream from those locations. For simplicity and to be protective of listed species and critical habitats, this consultation considers the action area to include all occupied habitat and/or designated critical habitat for PS Chinook salmon and PS steelhead within the Complex. In addition to the ESA-listed species and designated critical habitats identified in Table 1, the action area also overlaps with areas that have been designated, under the MSA, as EFH for Pacific Coast salmon.

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).

Environmental conditions within the action area: For PS Chinook salmon, PS steelhead, and their designated critical habitats, the action area for the NPS’s Trails Maintenance Program would be located along western slopes of the Cascade Mountains, within the Upper Skagit River watershed (Figures 1 – 3). The NPS Complex encompasses about 680,850 acres that are a subset of about 2 million acres of protected federal land in the North Cascades Ecosystem. The Complex spans the Cascade Crest, which dissects the landscape and creates over 9,000 feet of vertical relief with extreme gradients and variable topography, as well as mixed climate types and a variety of vegetation communities. About 94 % of the Complex is designated wilderness, within which facilities development and maintenance are intentionally limited to preserve the wilderness character of the area. Washington State Route 20 (SR 20) bisects the Complex, and a low number of smaller roads are present in some areas outside of the designated wilderness. The Complex hosts, but does not operate or maintain, four reservoirs associated with hydroelectric projects (Gorge Lake, Diablo Lake, Ross Lake, and Lake Chelan), which provide motorized and non-motorized boating, fishing, camping, and hiking opportunities along the shores. Ross Lake is considered the most popular backcountry area in the Complex.

In general, the protected nature of the overwhelming majority of the Complex supports dynamic ecosystem processes such as fire, flooding, mass wasting, and avalanches, which contribute to a predominantly natural mosaic of habitats. Numerous forest types cover much of the landscape. Extensive alpine meadows, and water-associated habitats including glaciers, snowfields, lakes, ponds, tarns, wetlands, rivers, and streams are also present. These diverse and healthy ecological conditions support a diverse range of terrestrial and aquatic wildlife communities.

Most access within the Complex is non-motorized. Hiking, backpacking, horseback riding/packing, rafting/paddling, and camping are the primary recreational uses within the Complex. However, the NPS also maintains some drive-up visitor services, such as the visitor center and camping sites just off SR 20 in the Newhalem area (Figure 1). They also maintain lakeshore camping sites, and facilities to support boating, fishing, hunting, and travel with stock animals. Non-NPS roads within the Complex also exist to provide motorized access to the 4 the hydroelectric projects their associated reservoirs.

The Complex maintains a relatively low-density system of non-motorized trails, overlooks, and campsites throughout the complex. Trails such as the Pacific Crest National Scenic Trail and the

Pacific Northwest National Scenic Trail connect hikers and stock animal users in the Complex with other public lands within the Pacific Northwest. Most of the NPS trails and their associated campsites primarily follow the valley bottoms of the major drainages within the Complex. However, some also climb into subalpine and alpine areas. Trail elevations range from about 800 feet in forests near the Baker River, to over 6,300 feet at South Pass.

The hydroelectric dams on the Skagit River and the Baker River are arguably the greatest source of anthropogenic impact on aquatic habitats within the action area. Just upstream from Newhalem, natural barriers prevent anadromous fish passage above RM 95 in the Skagit River. Above that, series of three fish-impassable hydroelectric dams that are owned and operated by Seattle City Light were constructed across the river, the Gorge, the Diablo, and the Ross. The first and farthest downstream of these dams is the Gorge Dam, which was initially constructed of timber in 1919, then later replaced by the existing concrete-arch dam in 1961. The operation of these dams is strictly managed to minimize their effect on protected fish species in the river below them. Flow management was first enacted in 1946, and has been updated over time. Seattle City Light's license was amended in 2013 to incorporate a revised flow plan that was developed as part of the fisheries settlement agreement. The plan requires Seattle City Light to put the needs of salmon and steelhead ahead of power production. Flows are adjusted on a seasonal, monthly, and daily basis to supply water for spawning, incubation, and protection of juvenile salmon and steelhead. Although infrequent, unintentional deviations from license conditions have occurred. Lower than minimum flows, excessive down ramping, and amplitude fluctuations occurred on August 19, 1997, during a transition from planned spill to generation operations, and on August 10, 2013, a prolonged lightning storm disabled all communications and control systems at the Gorge Dam powerhouse, and caused an unintentional dewatering event downstream of the powerhouse (Seattle City Light 2020).

On the Baker River, Puget Sound Energy's Baker River Hydroelectric Project constructed two fish-impassable dams several miles downstream of the Complex. The Lower Baker Dam was completed in 1925, about 1 mile upstream from the town of Concrete. The Upper Baker Dam was constructed in 1959, about 9 miles upstream from there. These dams extirpated historic runs of Chinook salmon and steelhead that extended about 10 miles beyond the upper reservoir and into the Complex.

The past and ongoing anthropogenic impacts described above have reduced the action area's ability to support PS Chinook salmon and PS steelhead. However, the Upper Skagit River and portions of some of its tributaries remain occupied by both species. Those reaches provide a combination of freshwater migratory, spawning, and rearing habitat, and most of those occupied reaches have been designated as critical habitat for both species as well. PS Chinook salmon and PS steelhead are currently excluded from the Baker River above the Baker River Dams. However, critical habitat for PS steelhead has been designated above the dams, including in Baker River and Bald Eagle Creek within the Complex, which are expected to provide freshwater migratory, spawning, and rearing habitat for both species if anadromous fish passage past the dams resumes.

<u>Climate Change:</u> Climate change has affected the environmental baseline of aquatic habitats across the region and within the action area. However, the effects of climate change have not

been homogeneous across the region, nor are they likely to be in the future. During the last century, average air temperatures in the Pacific Northwest have increased by 1 to 1.4° F (0.6 to 0.8º C), and up to 2° F (1.1º C) in some seasons (based on average linear increase per decade; Abatzoglou et al. 2014; Kunkel et al. 2013). Recent temperatures in all but two years since 1998 ranked above the 20th century average (Mote et al. 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3 to 10° F (1.7 to 5.6º C), with the largest increases predicted to occur in the summer (Mote et al. 2014).

Decreases in summer precipitation of as much as 30% by the end of the century are consistently predicted across climate models (Mote et al. 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007; Mote et al. 2013 and 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote et al. 2014). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez et al. 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote et al. 2014).

The combined effects of increasing air temperatures and decreasing spring through fall flows are expected to cause increasing stream temperatures; in 2015, this resulted in 3.5-5.3º C increases in Columbia Basin streams and a peak temperature of 26º C in the Willamette (NWFSC 2015). Overall, about one-third of the current cold-water salmonid habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Mantua et al. 2009).

Higher temperatures will reduce the quality of available salmonid habitat for most freshwater life stages (ISAB 2007). Reduced flows will make it more difficult for migrating fish to pass physical and thermal obstructions, limiting their access to available habitat (Isaak et al. 2012; Mantua et al. 2010). Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic food webs (Crozier et al. 2011; Tillmann and Siemann 2011; Winder and Schindler 2004). Higher stream temperatures will also cause decreases in dissolved oxygen and may also cause earlier onset of stratification and reduced mixing between layers in lakes and reservoirs, which can also result in reduced oxygen (Meyer et al. 1999; Raymondi et al. 2013; Winder and Schindler 2004). Higher temperatures are likely to cause several species to become more susceptible to parasites, disease, and higher predation rates (Crozier et al. 2008; Raymondi et al. 2013; Wainwright and Weitkamp 2013).

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

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

2.5 Effects of the Action

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

As described in Section 1.3, the NPS would implement a 10-year program to conduct routine maintenance of about 390 miles of trail and 130 backcountry camps within the Complex (Figure 1). In general, trail maintenance work would include the use of hand tools and power saws to clear back overgrown vegetation, remove debris, clear tree falls from trails, repair damaged trail treads, clean out trail drainage structures, make minor repairs to campsites and small wooden trail structures, fell hazard trees, and remove obstacles from stream fords. Blasting may be used in extreme situations. Repair of major trail bridges would include the repair and/or replacement of bridge approaches, stringers, decking, and railings, but not abutments or other in-water work. The work crews would use hand tools, power saws, and other power tools such as hand drills to repair or construct the structures as needed. Only a very small subset of the Complex's trails and camp sites are within the action area for PS Chinook salmon and PS steelhead, most of which are located near Newhalem (Figures 2 & 3).

In this opinion, we analyze the effects of the proposed action by considering how project elements are likely to impact important salmonid habitat indicators, and then considered how exposed individuals and the PBFs of their critical habitats are likely to respond to the impacts on those habitat indicators. The habitat indicators considered here are:

1. Stream Temperature;
2. Suspended Sediment and Substrate Embeddedness;
3. Chemicals and Nutrients;
4. Woody Material;
5. Pool Frequency and Quality;
6. Changes in Peak/Base Flows;
7. Drainage Network Increase;
8. Road Density and Location;
9. Disturbance History and Regime; and
10. Riparian Reserves.

We also analyze how listed individuals and the PBFs of their critical habitat are likely to respond to direct exposure to project-related blasting and to indirect effects that would result from visitors' use of the trail system.

2.5.1 Effects on Listed Species

Stream Temperature

Action-related in-stream water temperature changes would be extremely unlikely to detectably affect PS Chinook salmon and PS steelhead. The proposed action component most likely to affect in-stream water temperatures would be vegetation removal related to trail opening and hazard tree removal because the removal of vegetation that normally shades a stream would increase the stream's exposure to sunlight. However, the system trails approach or cross streams within the action area very infrequently (Figures 1 - 3), and at their largest, the trails would be cleared to provide no more than 8 feet of lateral and 10 feet of vertical clearance. Hazard tree removal in a given area would typically be limited to single or very low numbers of trees that are relatively well removed from streams, such as around buildings, parking areas, picnic areas, campsites, and historic structures. Although it may occasionally occur to protect some bridges, it would not be done along roads or trails. The resulting increased exposure of streams to sunlight from vegetation removal would consist of widely scattered and very small patches that are extremely unlikely to cause any detectable increases in water temperatures.

Suspended Sediment and Substrate Embeddedness

Action-related increased in-stream suspended sediment and substrate embeddedness would cause minor effects on PS Chinook salmon and PS steelhead. The proposed action components that are most likely to affect suspended sediment and substrate embeddedness would be vegetation removal and ground-disturbing activities related to maintaining or repairing trail treads and drainage structures in close proximity to stream reaches. Visitors' use of the trails may also increase sediment delivery to streams.

The best available information on increased sediment delivery to streams that may be cause by the proposed action are studies that consider timber harvest and related road work, the impacts of which would greatly exceed the effects expected to be caused by the proposed action. Numerous studies document the importance of the presence and width of herbaceous streamside vegetation to reduce sediment delivery from logging activities (Burroughs and King 1989, Corbett and Lynch 1985, Gomi et al. 2005), with buffers as narrow as 33-foot wide being likely to prevent sediment delivery to streams from about 95% of harvest-related erosion features (Rashin et al. 2006).

Removal of vegetation for trail opening would slightly increase the amount of fine sediments that could become mobilized by rain, as well as increase the distance that mobilized sediments would travel downslope, by reducing the available herbaceous vegetation to intercept the runoff.

All work to maintain and repair trail treads and drainage structures would be done in a manner intended to reduce the potential for erosion, including maintaining drainage structures that are designed to limit sediment transfer to streams. This work would also reduce sediment availability by reusing displaced sediments to the greatest extent practicable. If blasting is needed for this action, it is extremely unlikely to occur within the action area. Further, no blasting would be allowed within 164 feet of a stream occupied by PS Chinook salmon or PS steelhead. However, the ground disturbance cause by the maintenance and repair of trail tread and drainage structures would temporarily increase the soil's vulnerability to erosion. Additionally, the use of the trails by visitors would increase the amount of sediment availability because walking on the trails would create fine sediments and/or muds that would be easily mobilized.

Most of the vegetation removal and trails maintenance work would likely occur in small isolated areas along trails that are far removed from the action area. Further, within the action area the vast majority of the trails maintenance work would occur more than 33 feet from streams. Although some small sections of trail in the Newhalem area may be within 33 feet of streams that are occupied by, or have been designated as critical habitat for PS Chinook salmon and/or PS steelhead, the small scale of the work that could occur along those trail sections, combined with the protective measures that would be taken to limit erosion suggest that action-related sediment transport to the streams would too small to cause detectable effects on either species.

<u>Chemicals and Nutrients</u>

Exposure to action-related chemicals and nutrients is likely to adversely affect PS Chinook salmon and PS steelhead.. The proposed action components that are most likely to affect in-stream chemicals and nutrients would be vegetation removal and other trail maintenance activities that would include the use of chainsaws and other gasoline-powered tools in close enough proximity to stream reaches where spills and discharges could enter streams directly, or be carried to the streams by runoff.

The use of chainsaws and other gasoline-powered tools would be relatively limited, and the trial maintenance program includes best management practices (BMPs) specifically intended to reduce the potential for and the intensity of spills, and requirements to report and clean spills should they occur. Also, as described above, only small sections of trail in the Newhalem area are expected to be close enough to streams that stormwater runoff might be expected to carry trail-related sediments to an adjacent stream. Using similar logic only a small subset of the trails would be close enough to streams such that spilled chemicals could potentially be carried to the stream with stormwater. Based on the available information, it is extremely unlikely that the any action-related chemicals would enter streams occupied by PS Chinook salmon and/or PS steelhead, and that the in-water concentration of any spilled chemicals that might enter the water would be too low to cause detectable effects on the fitness or normal behaviors of any juvenile salmon that might be exposed to them.

The trail maintenance program includes the use of lumber pressure-treated with ACZA or ACQ for certain near- and over-water structures. Wet treated wood leaches some of the metals used for wood preservation. Of these metals, dissolved copper is of most concern to fish because of its higher leaching rate compared to arsenic and zinc (Poston 2001). Exposure to dissolved copper concentrations between 0.3 to 3.2 μg/L above background levels has been shown to cause avoidance of an area, to reduce salmonid olfaction, and to induce behaviors that increase juvenile salmon's vulnerability to predators in freshwater (Giattina et al. 1982; Hecht et al. 2007; McIntyre et al. 2012; Sommers et al. 2016; Tierney et al. 2010).

The in-water dissolved copper concentration from treated wood depends on many factors, including the amount of treated wood present, its contact with the water, the wood's leaching rate, which is affected by the post-treatment procedures that are applied to the wood, and water chemistry. Copper leaching is highest when the treated wood is immersed in freshwater. The leaching rate decreases with reduced contact with the water and with time. Post-treatment BMPs further reduce the intensity and duration of leaching. The NPS's guidelines for the use of treated wood prohibit its use in situations where it would be immersed in water, require that all treated wood used in the trail maintenance program comply with the approved post-treatment BMPs, and require that structures be designed to limit the discharge of copper and other preservative agents to the water.

The available information is insufficient to allow the NMFS to accurately estimate the in-water dissolved copper concentrations that action-related upslope treated lumber structures would be likely to cause. The NPS did not identify or quantify the locations where treated lumber would be used in close proximity (i.e. within about 33 feet upslope of streams where an herbaceous vegetation buffer exists, or greater distances where stormwater would not be intercepted by vegetation or otherwise allowed to infiltrate). Nor are models readily available to estimate the leaching potential for the individual structures, or to estimate the cross-ground transport of dissolved and/or sediment-adsorbed copper from those structures.

Based on the description the proposed action, including the protective measures to be taken by the NPS, the NMFS believes that most treated-lumber structures would be located too far from salmon bearing streams or critical habitat to introduce copper and other preservatives to adjacent streams. However, in some instances, it is likely that copper and other preservative chemicals would enter occupied streams, either directly, or over time as stormwater runoff moves those materials to the stream.

The NMFS believes that, in general, the in-water concentrations of preservative agents from the up-slope lumber structures would normally be very low. However, copper would persist and accumulate in trail and stream sediments, and would likely increase over time. Therefore, in the absence of quantifiable information to the contrary, and to be protective of listed fish and critical habitats, the NMFS believes that it is reasonably likely that, over the 10-year life of this action, copper and other preservative chemicals at concentrations high enough to measurably affect listed fish would enter occupied streams, either directly, or over time as stormwater runoff moves those materials to the stream from upslope treated lumber structures.

The annual numbers of individuals that would be impacted by exposure to copper and other preservative chemicals is unquantifiable with any degree of certainty, and the numbers are likely to vary greatly over time. However, the available information suggests that the probability of exposure would be very extremely low for any individual fish, and only a subset of the exposed individuals would be measurably affected. Therefore, the proportion of any year's cohort that would be killed or experience measurably reduced fitness from exposure to this stressor would be too low to cause any detectable population-level effects.

Woody Material

Action-related impacts on in-stream woody material would be extremely unlikely to detectably affect PS Chinook salmon and PS steelhead, because the described vegetation removal related to trail opening and hazard tree removal would be too small to cause detectable effects on in-stream wood recruitment.

Pool Frequency and Quality

Action-related impacts on pool frequency and quality would be extremely unlikely to detectably affect PS Chinook salmon and PS steelhead, because no in-stream or streambank work that could affect stream hydrology is included in the program, and because the a action would not detectably impact in-stream substrates or the availability of in-stream wood, both of which are important contributors to pool formation and quality.

Changes in Peak and Base Flows

Action-related impacts on peak and base flows would cause minor effects on PS Chinook salmon and PS steelhead. Forest management activities, such as timber thinning and the presence of forest roads, can affect the rate that water is stored or discharged within a watershed, causing increased peak and base in-stream flows, and also possibly cause peak discharges to occur earlier in the year than would normally occur (Jones and Grant 1996; Satterlund and Adams 1992). The intensity of these effects depend largely on the type of activity (i.e. the type of thinning and road design), the proportion of the basin that has been altered, and the affected area's location within a watershed (Grant et al. 2008). However, the area affected by the NPS trail system is extremely small compared to the surrounding landscape, and its intersections with streams within the action area are very limited and widely scattered. Further, the trail treads and drainage features are designed to reduce erosion and sheet flows. Based on the very small scale of the trail system, combined with the its design features to manage stormwater, any changes the system may cause in peak and based flows in adjacent streams would be too small to cause detectable effects on the fitness or normal behaviors of PS Chinook salmon and PS steelhead in the action area.

Drainage Network Increase

Action-related drainage network increase would be extremely unlikely to detectably affect PS Chinook salmon and PS steelhead, because the program is designed to maintain the existing trail system, and includes no construction of new trails.

Road Density and Location

Action-related changes in road density and location would cause no effect on PS Chinook salmon and PS steelhead, because no road construction or maintenance is included in the program.

Disturbance History and Regime

Action-related impacts on the disturbance history and regime within the action area would cause minor effects on PS Chinook salmon and PS steelhead. The trail maintenance program would not measurably affect the disturbance history and regime within the action area because it would maintain an existing system of low-impact trails and campsites that are scattered across a large area that consists mostly of relatively undisturbed wilderness area. No new trails or campsites would be constructed. Therefore, any action-related effects on the disturbance history and regime within the action area would be too small to cause detectable effects on the fitness or normal behaviors of PS Chinook salmon and PS steelhead.

Riparian Reserves

Action-related impacts on riparian vegetation within the action area would be extremely unlikely to detectably affect PS Chinook salmon and PS steelhead. As described above, particularly under the assessments of Stream Temperature, and of Woody Material, action-related vegetation removal within the riparian zone would be too small to cause measurable effects on PS Chinook salmon and PS steelhead.

Direct exposure to blasting

Direct exposure to project-related blasting would cause minor effects on PS Chinook salmon and PS steelhead. As discussed under Suspended Sediment and Substrate Embeddedness, if action-related blasting is needed, it is extremely unlikely to occur within the action area. Further, no blasting would be allowed within 164 feet of a stream occupied by PS Chinook salmon or PS steelhead, and all blasting would comply with the protective measures identified in the NPS BA. Based on the best available information, the NMFS expects that PS Chinook salmon and PS steelhead that may be exposed to project-related blasting would experience no more than very brief and mild behavioral disturbances that would cause no fitness impacts nor alter normal behaviors.

Indirect effects from use of the trail system

Indirect effects of the trail maintenance program are likely to adversely affect PS Chinook salmon and PS steelhead. The trail system facilitates visitor access to streams in several areas, some of which are occupied by PS Chinook salmon and PS steelhead. The NPS didn’t report the annual numbers of trail users within the action area. However, they did report that during the years of 2014 through 2018, the annual numbers of campers at each of 4 backcountry camps ranged between 325 to 985 people. Therefore, for the trails within the action area, especially those in the Newhalem area that are easily accessed by car, the annual numbers of users are likely measured in thousands of people. In addition to hiking and camping along the trail system, the NPS reports that visitors participate in a range of aquatic activities within the Complex such as wading, swimming, boating, and fishing.

The NPS BA identified 6 stream fords that cross Bull Trout critical habitat, but none within PS Chinook salmon and/or PS steelhead habitats. Therefore. It is unlikely that hikers and pack animals would ford streams within the action area. However, within the action area where trails are in close proximity to streams, shoreline wading by visitors is very likely to disturb shoreline obligated juveniles of both species, and it may affect spawning adults and redds. The vast majority of the reported swimming within the Complex takes place in lakes that are located outside of Chinook salmon and steelhead habitats, and it is uncertain if any swimming takes place within the action area. However, any swimming that may occur in the action area would include some degree of wading. Therefore, the effects of swimming would be identical to, and a subset of the effects of wading.

When visitors enter trailside streams to wade or fish where rearing juvenile salmonids are present, the exposed juveniles would most likely respond by rapidly abandoning their preferred shallow water areas immediately close to shore. Depending on the intensity of their response, exposed juveniles would likely experience varying levels of stress. Displaced juveniles would also experience varying degrees of reduced foraging success, as well as increased exposure and vulnerability to piscivorous predators. Therefore, trail-related wading would cause combinations of altered behaviors and increased risk of predation that would reduce fitness or cause mortality for some juvenile PS Chinook salmon and PS steelhead. Entry into trailside streams in close proximity to spawning adults could cause a range of behavioral responses in the exposed adults. Likely responses would include varying levels of courtship disruption, interrupted spawning, and abandonment of the site, all of which would be likely to reduce the spawning success of the exposed individuals. Waders may also trample redds, which would injure or kill eggs and alevins that are within the gravel.

The vast majority of the reported boating and fishing within the Complex likely takes place in lakes that are located outside of Chinook salmon and steelhead habitats. It is uncertain if any trail-related boating or fishing occurs within the action area. However, some level of trail-related bankside fishing is reasonably likely to occur within the action area, whether or not that activity is specifically authorized. Chasing a bait or lure, or fighting once hooked would cause energetic expenditures with no commensurate forage intake. Also, adult Chinook salmon stop foraging soon after returning to freshwater. Therefore, their energetic expenditures would be permanent. The hooking of a fish would injure or kill the affected individual. Individuals that are harvested would die, and post-hooking mortality would also kill some individuals, including some that are released alive.

The annual numbers of individuals that would be impacted by the indirect effects of the trail maintenance program is unquantifiable with any degree of certainty, and the numbers are likely to vary greatly over time. However, the available information suggests that the probability of exposure would be very low for any individual fish, and only a subset of the exposed individuals would be measurably affected. Therefore, the proportion of any year's cohort that would be killed or experience measurably reduced fitness from exposure to trail-related indirect effects would be too low to cause any detectable population-level effects.

2.5.2 Effects on Critical Habitat

This assessment considers the intensity of expected effects in terms of the change they would cause in affected Physical or Biological Features (PBFs) from their baseline conditions, and the severity of each effect, considered in terms of the time required to recover from the effect. Ephemeral effects are those that are likely to last for hours or days, short-term effects would likely last for weeks, and long-term effects are likely to last for months, years or decades.

Critical Habitat for Puget Sound Chinook Salmon and Puget Sound Steelhead: The proposed action, including full application of the planned conservation measures and BMPs, is likely to adversely affect designated critical habitat for PS Chinook salmon and PS steelhead. The expected effects would be limited to impacts on freshwater PBFs as described below.

1. Freshwater spawning sites:
    a. Water quantity – The proposed action would cause no effect on this attribute.
    b. Water quality – The proposed action would cause long term minor adverse effects on water quantity. The use of treated wood in near- and over-water trail structures would introduce low levels of copper and other preservative chemicals at scattered locations across the action area.
    c. Substrate – The proposed action would cause long term minor adverse effects on substrate. The continued presence and use of the trails would cause small amounts of trail-related sediments to be transported to streams at scattered locations across the action area, where the sediments would cause low levels of gravel embeddedness in the areas very close to the sediment input locations (likely within 10s of feet).

2. Freshwater rearing sites:
    a. Floodplain connectivity – The proposed action would cause no measurable effect on this attribute.
    b. Forage – The proposed action would cause no measurable effect on this attribute.
    c. Natural cover – The proposed action would cause no measurable effect on this attribute.
    d. Water quantity – Same as above.
    e. Water quality – Same as above.

3. Freshwater migration corridors:
    a. Free of obstruction and excessive predation – The proposed action would cause no measurable effect on this attribute.
    b. Water quantity – Same as above.
    c. Water quality – Same as above.
    d. Natural Cover – Same as above.

4. Estuarine areas – None in the action area.

5. Nearshore marine areas – None in the action area.

6. Offshore marine areas – None in the action area.

2.6 Cumulative Effects

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

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

The current condition of ESA-listed species and designated critical habitat within the action area are described in the status of the species and critical habitat and the environmental baseline sections above. The contribution of non-federal activities to those conditions include past forest management, as well as past and on-going road construction, hydropower flow management, recreation, and restoration activities. Those actions were driven by a combination of economic conditions that characterized traditional natural resource-based industries, general resource demands associated with settlement of local and regional population centers, and the efforts of conservation groups dedicated to river restoration and use of natural amenities, such as cultural inspiration and recreational experiences.

The entire action area is within federal lands in the upstream portions of the affected watershed (Figure 1). The most common private activity likely to occur within the action area is managed recreation, including hiking, camping, wading, boating, and fishing. Although the NPS manages recreational activities to a large degree, some amount of dispersed unmanaged recreation likely occurs. Expected impacts to salmon and steelhead from this type of recreation include impacts to water quality such as minor releases of suspended sediment and wastes, short-term barriers to fish movement, and minor changes to habitat structures. Streambanks, riparian vegetation, and spawning redds can be disturbed wherever human use is concentrated. Recreational fishing within the action area is expected to continue to be subject to WDFW regulations. The level of take of ESA-listed salmon and steelhead within the action area from angling is unknown, but is expected to remain at current or lower levels as the State enacts increasingly protective regulations.

Across the state, the economic and environmental significance of a natural resource-based economy is declining as the region shifts toward an economic model based more on high technology, mixed manufacturing, and marketing. Nonetheless, resource-based industries and agriculture are likely to continue, especially in more rural areas. Within the action area, hydropower flow management, recreation, and restoration activities are likely to continue affecting environmental conditions for decades to come.

The intensity of these influences depends on many social and economic factors, and therefore is difficult to predict. Further, the adoption of more environmentally acceptable practices and standards may gradually reduce some negative environmental impacts over time. Interest in restoration activities has increased as environmental awareness rises among the public. State, tribal, and local governments have developed plans and initiatives to benefit ESA-listed PS Chinook salmon and PS steelhead within the action area. However, the implementation of plans, initiatives, and specific restoration projects are often subject to political, legislative, and fiscal challenges that increase the uncertainty of their success.

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) appreciably reduce 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.

As described in more detail above at Section 2.4, climate change is likely to increasingly affect the abundance and distribution of the ESA-listed species considered in the Opinion. It is also likely to increasingly affect the PBFs of designated critical habitats. The exact effects of climate change are both uncertain, and unlikely to be spatially homogeneous. However, climate change is reasonably likely to cause reduced instream flows in some systems, and may impact water quality through elevated in-stream water temperatures and reduced dissolved oxygen, as well as by causing more frequent and more intense flooding events.

Climate change may also impact coastal waters through elevated surface water temperature, increased and variable acidity, increasing storm frequency and magnitude, and rising sea levels. The adaptive ability of listed-species is uncertain, but is likely reduced due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. The proposed action will cause direct and indirect effects on the ESA-listed species and critical habitats considered in the Opinion well into the foreseeable future. However, the action's effects on water quality, substrate, and the biological environment are expected to be of such a small scale that no detectable effects on ESA-listed species or critical habitat through synergistic interactions with the impacts of climate change are expected.

2.7.1 ESA-listed Species

PS Chinook salmon and PS steelhead are both listed as threatened, based on declines from historic levels of abundance and productivity, loss of spatial structure and diversity, and an array of limiting factors as a baseline habitat condition. Both species will be affected over time by cumulative effects, some positive – as recovery plan implementation and regulatory revisions increase habitat protections and restoration, and some negative – as climate change and unregulated or difficult to regulate sources of environmental degradation persist or increase. Overall, to the degree that habitat trends are negative, as described below, effects on viability parameters of each species are also likely to be negative. In this context we consider the effects of the proposed action's effect on individuals of the listed species at the population scale.

PS Chinook salmon

The long-term abundance trend of the PS Chinook salmon ESU is slightly negative. Reduced or eliminated accessibility to historically important habitat, combined with degraded conditions in available habitat due to land use activities appear to be the greatest threats to the recovery of PS Chinook salmon. Commercial and recreational fisheries also continue to impact this species.

The PS Chinook salmon most likely to occur in the action area would be summer-run fish from the Upper Skagit River population. The total abundance trend this population has been has been flat to slightly positive.

The project area is located in the Upper Skagit River watershed. The environmental baseline within the action areas has been degraded by past forest management, as well as past and on-going hydropower developments, and relatively low levels of road construction and recreation, and restoration activities. Although the hydropower dams on the Skagit River are above natural barriers to anadromous fish migration, those dams affect flows in occupied habitats within the action area. Further, dams on the Baker River prevent historic upstream migration of PS Chinook salmon into the Baker River portion of action area.

The proposed action would cause a combination of impacts that would slightly reduce the functional levels of habitat features within small stream sections scattered across the action area. The effects would last over the 10-year life of the action. Both individually and collectively, those impacts would annually cause altered behaviors, reduced fitness, and mortality in very low numbers of juveniles and eggs, and may slightly reduce the migratory fitness and spawning success for very low numbers of adults.

The annual numbers of individual fish and eggs that are likely to be injured or killed by exposure to action-related stressors is unknown. However, the project's overlap with occupied habitat would be extremely small. Therefore, the numbers of fish and eggs that would be annually affected by the proposed action would represent a tiny fraction of any annual cohort, and their loss would have no detectable effect on any of the characteristics of a viable salmon population (abundance, productivity, distribution, or genetic diversity) for the affected populations. Therefore, the proposed action would not appreciably reduce the likelihood of survival and recovery of this listed species.

PS Steelhead:

The PS steelhead DPS is currently considered "not viable", and the extinction risk for most DIPs is estimated to be moderate to high. Long-term abundance trends have been predominantly negative or flat across the DPS, especially for natural spawners, and growth rates are currently declining at 3 to 10% annually for all but a few DIPs. The PS steelhead most likely to occur in the action area be summer- and winter-run fish from the Skagit River DIP. The abundance trend of this DIP is generally flat, and their viability is considered moderate. Reduced or eliminated accessibility to historically important habitat, combined with degraded conditions in available habitat due to land use activities appear to be the greatest threats to the recovery of PS steelhead. Fisheries activities also continue to impact this species.

The project area is located in the Upper Skagit River watershed. The environmental baseline within the action areas has been degraded by past forest management, as well as past and on-going hydropower developments, and relatively low levels of road construction and recreation, and restoration activities. Although the hydropower dams on the Skagit River are above natural barriers to anadromous fish migration, those dams affect flows in occupied habitats within the action area. Further, dams on the Baker River prevent historic upstream migration of PS steelhead into the Baker River portion of action area.

The proposed action would cause a combination of impacts that would slightly reduce the functional levels of habitat features within small stream sections scattered across the action area. The effects would last over the 10-year life of the action. Both individually and collectively, those impacts would annually cause altered behaviors, reduced fitness, and mortality in very low numbers of juveniles and eggs, and may slightly reduce the migratory fitness and spawning success for very low numbers of adults.

The annual numbers of individual fish and eggs that are likely to be injured or killed by exposure to action-related stressors is unknown. However, the project's overlap with occupied habitat would be extremely small. Therefore, the numbers of fish and eggs that would be annually affected by the proposed action would represent a tiny fraction of any annual cohort, and their loss would have no detectable effect on any of the characteristics of a viable salmon population (abundance, productivity, distribution, or genetic diversity) for the affected populations. Therefore, the proposed action would not appreciably reduce the likelihood of survival and recovery of this listed species.

2.7.2 Critical Habitat

As described above at Section 2.5, the proposed action is likely to adversely affect designated critical habitat for PS Chinook salmon and PS steelhead. Past and ongoing land and water use practices have degraded salmonid critical habitat throughout the Puget Sound basin. Hydropower and water management activities have reduced or eliminated access to significant portions of historic spawning habitat. Timber harvests, agriculture, industry, urbanization, and shoreline development have adversely altered floodplain and stream morphology in many watersheds, diminished the availability and quality of estuarine and nearshore marine habitats, and reduced water quality across the region.

Global climate change is expected to increase in-stream water temperatures and alter stream flows, possibly exacerbating impacts on baseline conditions in freshwater habitats across the region. Rising sea levels are expected to increase coastal erosion and alter the composition of nearshore habitats, which could further reduce the availability and quality of estuarine habitats. Increased ocean acidification may also reduce the quality of estuarine habitats. In the future, non-federal land and water use practices and climate change are likely to increase. The intensity of those influences on salmonid habitats is uncertain, as is the degree to which those impacts may be tempered by adoption of more environmentally acceptable land use practices, by the implementation of non-federal plans that are intended to benefit salmonids, and by efforts to address the effects of climate change.

The PBFs of salmonid critical habitat that would be affected by the proposed action are freshwater spawning sites, rearing sites, and migration corridors free of obstruction and excessive predation. As described above, the proposed action would cause long-term minor adverse effects on water quality in very few and small stream sections scattered across the action area.

Based on the best available information, the scale of the proposed action's effects, when considered in combination with the environmental baseline, cumulative effects, and the impacts of climate change, would be too small to measurably reduce the quality or functionality of the freshwater PBFs from their current levels. Therefore, the critical habitat would maintain its current level of functionality, and retain its current ability for PBF to become functionally established, to serve the intended conservation role for PS Chinook salmon and PS steelhead.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and cumulative effects, it is the NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of PS Chinook salmon or PS steelhead, nor is it likely to destroy or adversely modify designated critical habitat for either of these species.

2.9 Incidental Take Statement

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

2.9.1 Amount or Extent of Take

In the Opinion, the NMFS has determined that incidental take of Puget Sound Chinook salmon and Puget Sound steelhead, in the form of harm, would occur from exposure to:

- Wood preservatives (i.e. copper), and
- Visitor in-water activities.

The NMFS cannot predict with meaningful accuracy the number of PS Chinook salmon and PS steelhead that are reasonably certain to be harmed by exposure to project-related impacts. The distribution and abundance of the fish that occur within an action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic, population, and environmental characteristics. These biotic and environmental processes interact in ways that may be random or directional, and may operate across far broader temporal and spatial scales than are affected by the proposed action. Thus, the distribution and abundance of fish within the action area cannot be attributed entirely to habitat conditions, nor can the NMFS precisely predict the number of fish that are reasonably certain to be injured or killed if their habitat is modified or degraded by the proposed action. Additionally, the NMFS knows of no device or practicable technique that would yield reliable counts of individuals that may experience these impacts. In such circumstances, the NMFS uses the causal link established between the activity and the likely extent and duration of changes in habitat conditions to describe the extent of take as a numerical level of habitat disturbance. The most appropriate surrogates for take are action-related parameters that are directly related to the magnitude of the expected take.

For this action, the allowable wood treatments and the required construction procedures are the best available surrogates for the extent of take of PS Chinook salmon and PS steelhead from exposure to wood preservatives. Allowable treatments is an applicable surrogate because the allowable treatments were selected because of their low leaching rates and low toxicities compared to other treatments. Therefore, the use of other treatments is likely to increase in-water preservative concentrations, and could cause the introduction of more toxic chemicals, both of which would increase the intensity of the effects on exposed listed fish. Similarly, the construction guidelines are an applicable surrogate because they are designed to limit the potential for preservative entry to the water during construction and from the structure over time. Therefore, failure to comply with the guidelines is also likely to increase in-water preservative concentrations, and increase the intensity of the effects on exposed listed fish.

The configuration of existing trail system as it relates to the number of locations where it provides visitor access to streams is the best available surrogate for the extent of take of PS Chinook salmon and PS steelhead from exposure to visitor in-water activities. This is an applicable surrogate because increasing the number of trail/stream intersections would increase the amount of impacted habitat and increase the number of individuals that would be exposed to visitor in-water activities.

In summary, the extent of Puget Sound Chinook salmon and Puget Sound steelhead take for this action is defined as:

- The use of lumber that has been pressure treated with ACZA or ACQ, as described in the proposed action section of this opinion.
- The maintenance and repair of existing trail/stream intersections, as described in the proposed action section of this opinion.

Exceedance of either of the exposure limits described above would constitute an exceedance of authorized take that would trigger the need to reinitiate consultation. Although some of these take surrogates could be construed as partially coextensive with the proposed action, they nevertheless function as effective reinitiation triggers because the NPS has authority to conduct periodic compliance inspections and take actions to address non-compliance. Therefore, exceedance of the surrogates would be apparent in a timely manner, and consultation could be reinitiated well before the project is completed.

2.9.2 Effect of the Take

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

2.9.3 Reasonable and Prudent Measures

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

The NPS shall:

1. Implement monitoring and reporting to confirm that the take exemption for the proposed action is not exceeded.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the NPS and any project-related timber sale purchaser or contractor must comply with them in order to implement the RPMs (50 CFR 402.14). The NPS and project-related timber sale purchasers and contractors have 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 Number 1, implement a monitoring and reporting program to confirm that the take exemption for the proposed action is not exceeded, the NPS shall develop a plan to collect and report details about the take of listed fish. That plan shall:

    a. Require the NPS to maintain records and annually submit reports to verify that all take indicators are monitored and reported. When advantageous, the inclusion of maps, drawings, and photographs is encouraged. Minimally, the reports should include:
        i. Procurement records to confirm that treatment is limited to ACZA or ACQ, and compliance with post-treatment BMPs for all treated lumber used in this action;
        ii. Construction records that include:
            1. Inspection records to confirm inspection of treated lumber prior to its use in the field;

2. Construction records that identify the type and location of all structures that include treated lumber as a component, and include a description of the structure's proximity water; and
3. Demolition and disposal records to confirm the removal and proper disposal of decommissioned treated lumber.

iii. Trail maintenance records that detail trail work at trail/stream intersections, and confirm that no new or enlarged intersections occur.

b. Require the NPS to establish procedures for the annual submission of monitoring reports to NMFS.
c. Require the NPS to submit annual electronic monitoring reports to NMFS over the life of the project. Submit reports for each calendar year's work by February 15 of the following year. Send the reports to: projectreports.wcr@noaa.gov. Include the NMFS Tracking number for this project in the subject line: Attn: WCRO-2020-00156.

2.10 Conservation Recommendations

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

1. The NPS should limit all lumber use to untreated lumber from naturally rot-resistant species.

2. The NPS should identify all trail/stream intersections within the action area, determine what salmonid habitat resources are provided at each location, and determine the type and intensity of salmonid use of each location, with particular care given to identifying locations where the trails intersect with spawning and rearing habitat features.

3. The NPS should install signage at trail intersections with stream reaches that provide spawning and rearing habitat features to inform visitors of the importance of that location to endangered salmonids, and to prohibit harmful activities.

2.11 Reinitiation of Consultation

This concludes formal consultation for Routine Trail Maintenance 2020 through 2030 in the North Cascades National Park Service Complex, in Whatcom, Skagit, and Chelan Counties, Washington. As 50 CFR 402.16 states, 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 if: (1) The amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

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

Section 305(b) of the MSA directs Federal agencies to consult with the NMFS on all actions or proposed actions that may adversely affect essential fish habitat (EFH). The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires the NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based on the description of EFH for Pacific Coast Salmon (Pacific Fishery Management Council [PFMC] 2014) contained in the fishery management plan developed by the PFMC and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The stream waters and substrates of the action area is designated as freshwater EFH for Pacific Coast Salmon, which include Chinook, coho, and pink salmon. Freshwater EFH for Pacific Coast Salmon is identified and described in Appendix A to the Pacific Coast salmon fishery management plan (PFMC 2014), and consists of four major components: (1) spawning and incubation; (2) juvenile rearing; (3) juvenile migration corridors; and (4) adult migration corridors and holding habitat. The action area provides migratory, spawning, and rearing habitat for all three species.

Those components of freshwater EFH for Pacific Coast Salmon depend on habitat conditions for spawning, rearing, and migration that include: (1) water quality (e.g., dissolved oxygen, nutrients, temperature, etc.); (2) water quantity, depth, and velocity; (3) riparian-stream-marine energy exchanges; (4) channel gradient and stability; (5) prey availability; (6) cover and habitat complexity (e.g., LWD, pools, aquatic and terrestrial vegetation, etc.); (7) space; (8) habitat connectivity from headwaters to the ocean (e.g., dispersal corridors); (9) groundwater-stream interactions; and (10) substrate composition.

As part of Pacific Coast Salmon EFH, five Habitat Areas of Particular Concern (HAPCs) have been defined: 1) complex channels and floodplain habitats; 2) thermal refugia; 3) spawning habitat; 4) estuaries; and 5) marine and estuarine submerged aquatic vegetation. Therefore the action area includes the spawning HAPC. It also likely includes the complex channels and floodplain habitats HAPC.

3.2 Adverse Effects on Essential Fish Habitat

The ESA portion of this document (Sections 1 and 2) describes the proposed action and its adverse effects on ESA-listed species and critical habitat, and is relevant to the effects on EFH. Based on the analysis of effects presented in Section 2.5 the proposed action would cause minor long-term adverse effects on EFH for Pacific Coast Salmon as summarized below.

1. Water quality: – The proposed action would cause long term minor adverse effects on water quality. The use of treated wood in near- and over-water trail structures would introduce low levels of copper and other preservative chemicals at scattered locations across the action are.

2. Water quantity, depth, and velocity: – No changes expected.

3. Riparian-stream-marine energy exchanges: – No changes expected.

4. Channel gradient and stability: – No changes expected.

5. Prey availability: – No changes expected.

6. Cover and habitat complexity: – No changes expected.

7. Space: – No changes expected.

8. Habitat connectivity from headwaters to the ocean: – No changes expected.

9. Groundwater-stream interactions: – No changes expected.

10. Connectivity with terrestrial ecosystems: – No changes expected.

11. Substrate composition: – The proposed action would cause long term minor adverse effects on substrate composition. Stormwater runoff would transport small amounts of trail-related sediments to streams, where the sediments would cause low levels of gravel embeddedness in the areas very close to sediment input locations (likely within 10s of feet). These effects would occur in at scattered localized areas across the action area, but would persist for decades.

All effects on the spawning and complex channels and floodplain habitats HAPCs for Pacific Coast Salmon are identified above at 1 and 11.

3.3 Essential Fish Habitat Conservation Recommendations

The proposed action includes conservation measures, BMP, and design features to reduce project-related impacts on the quantity and quality of EFH for Pacific Coast Salmon. With the exception of the following conservation recommendation to reduce impacts on water quality, the NMFS knows of no other reasonable measures to further reduce effects on EFH.

1. The NPS should limit all lumber use to untreated lumber from naturally rot-resistant species.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the NPS must provide a detailed written response in to the NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of the NMFS' EFH Conservation Recommendations unless the NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with the NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, the NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5 Supplemental Consultation

The NPS must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR 600.920(l)).

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this Opinion is the NPS. Other users could include WDFW, the government and citizens of Whatcom, Skagit, and Chelan Counties, and Native American tribes. Copies of this Opinion were provided to the NPS. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

5. REFERENCES

Abatzoglou, J.T., Rupp, D.E. and Mote, P.W. 2014. Seasonal climate variability and change in the Pacific Northwest of the United States. *Journal of Climate* 27(5): 2125-2142.

Bax, N. J., E. O. Salo, B. P. Snyder, C. A. Simenstad, and W. J. Kinney. 1978. Salmonid outmigration studies in Hood Canal. Final Report, Phase III. January - July 1977, to U.S. Navy, Wash. Dep. Fish., and Wash. Sea Grant. Fish. Res. Inst., Univ. Wash., Seattle, WA. FRI-UW-7819. 128 pp.

Brennan, J. S., K. F. Higgins, J. R. Cordell, and V. A. Stamatiou. 2004. Juvenile Salmon Composition, Timing, Distribution, and Diet in Marine Nearshore Waters of Central Puget Sound, 2001-2002. Prepared for the King County Department of Natural Resources and Parks, Seattle, WA.

Burroughs, E.R. and J.G. King. 1989. Surface erosion control on roads in granitic soils. In, Proceedings: ASCE Committee on Watershed Management, Denver, CO. Pg. 183-190.

Corbett, E.S. and J.A. Lynch. 1985. Management of Streamside Zones on Municipal Watersheds. pp. 187-190. In: R.R. Johnson, C.D. Ziebell, D.R. Patton, P.F. Folliott, and R.H. Hamre (eds.), Riparian Ecosystems and their Management: Reconciling Conflicting Uses. First North American Riparian Conference, April 16-18, 1985, Tucson, Arizona.

Crozier, L.G., Hendry, A.P., Lawson, P.W., Quinn, T.P., Mantua, N.J., Battin, J., Shaw, R.G. and Huey, R.B., 2008. Potential responses to climate change in organisms with complex life histories: evolution and plasticity in Pacific salmon. *Evolutionary Applications* 1(2): 252-270.

Crozier, L. G., M. D. Scheuerell, and E. W. Zabel. 2011. Using Time Series Analysis to Characterize Evolutionary and Plastic Responses to Environmental Change: A Case Study of a Shift Toward Earlier Migration Date in Sockeye Salmon. *The American Naturalist* 178 (6): 755-773.

Dominguez, F., E. Rivera, D. P. Lettenmaier, and C. L. Castro. 2012. Changes in Winter Precipitation Extremes for the Western United States under a Warmer Climate as Simulated by Regional Climate Models. *Geophysical Research Letters* 39(5).

Doney, S. C., M. Ruckelshaus, J. E. Duffy, J. P. Barry, F. Chan, C. A. English, H. M. Galindo, J. M. Grebmeier, A. B. Hollowed, N. Knowlton, J. Polovina, N. N. Rabalais, W. J. Sydeman, and L. D. Talley. 2012. Climate Change Impacts on Marine Ecosystems. *Annual Review of Marine Science* 4: 11-37.

Feist, B.E., E.R. Buhle, P. Arnold, J.W. Davis, and N.L. Scholz. 2011. Landscape ecotoxicology of coho salmon spawner mortality in urban streams. Plos One 6(8):e23424.

Forest Ecosystem Management Assessment Team (FEMAT). 1993. Forest ecosystem management: An ecological, economic, and social assessment. Report of the Forest Ecosystem Management Assessment Team. 1993-793-071. U.S. Gov. Printing Office.

Giattina, J.D., Garton, R.R., Stevens, D.G., 1982. Avoidance of copper and nickel by rainbow trout as monitored by a computer-based data acquisition-system. Trans. Am. Fish. Soc. 111, 491–504.

Gomi, T., R.D. Moore, and M.A. Hassan. 2005. Suspended sediment dynamics in small forest streams of the Pacific Northwest. J. Am. Water Res. Association. August 2005. Pg. 877-898.

Goode, J.R., Buffington, J.M., Tonina, D., Isaak, D.J., Thurow, R.F., Wenger, S., Nagel, D., Luce, C., Tetzlaff, D. and Soulsby, C., 2013. Potential effects of climate change on streambed scour and risks to salmonid survival in snow-dominated mountain basins. *Hydrological Processes* 27(5): 750-765.

Grant, G.E., S.L Lewis, F.J Swanson, J.H Cissel, and J.J. McDonnell. 2008. Effects of forest practices on peak flows and consequent channel response: a state-of-science report for Western Oregon and Washington. Gen. Tech. Rep. PNW-GTR-760. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 76pp.

Hard, J.J., J.M. Myers, E.J. Connor, R.A. Hayman, R.G. Kope, G. Lucchetti, A.R. Marshall, G.R. Pess, and B.E. Thompson. 2015. Viability criteria for steelhead within the Puget Sound distinct population segment. U.S. Dept. of Commerce, NOAA Tech. Memo. NMFS-NWFSC-129. May 2015. 367 pp.

Hecht, S.A., D.H. Baldwin, C.A. Mebane, T. Hawkes, S.J. Gross, and N.L. Scholz. 2007. An overview of sensory effects on juvenile salmonids exposed to dissolved copper: Applying a benchmark concentration approach to evaluate sublethal neurobehavioral toxicity. In U.S. Dept. Commer., NOAA Technical White Paper. March 2007. 45 pp.

Hood Canal Coordinating Council (HCCC). 2005. Hood Canal & Eastern Strait of Juan de Fuca summer chum salmon recovery plan. Version November 15, 2005. 339 pp.

Hunter, M.A. 1992. Hydropower flow fluctuations and salmonids: A review of the biological effects, mechanical causes, and options for mitigation. Washington Department of Fisheries. Technical Report No. 119. Olympia, Washington.

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

Isaak, D.J., Wollrab, S., Horan, D. and Chandler, G., 2012. Climate change effects on stream and river temperatures across the northwest US from 1980–2009 and implications for salmonid fishes. *Climatic Change* 113(2): 499-524.

Jones, J.A., and G.E. Grant. 1996. Peak flow responses to clear-cutting and roads in small and large basins, western Cascades, Oregon. Water Resour. Res. 32: 959-974.

Kondolf, G.M. 1997. Hungry water: Effects of dams and gravel mining on river channels. Environmental Management 21(4):533-551.

Kunkel, K. E., L. E. Stevens, S. E. Stevens, L. Sun, E. Janssen, D. Wuebbles, K. T. Redmond, and J. G. Dobson. 2013. Regional Climate Trends and Scenarios for the U.S. National Climate Assessment: Part 6. *Climate of the Northwest U.S. NOAA Technical Report NESDIS 142-6*. 83 pp. National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, Washington, D.C.

Lawson, P. W., Logerwell, E. A., Mantua, N. J., Francis, R. C., & Agostini, V. N. 2004. Environmental factors influencing freshwater survival and smolt production in Pacific Northwest coho salmon (*Oncorhynchus kisutch*). *Canadian Journal of Fisheries and Aquatic Sciences* 61(3): 360-373

Mantua, N., I. Tohver, and A. Hamlet. 2009. Impacts of Climate Change on Key Aspects of Freshwater Salmon Habitat in Washington State. *In* The Washington Climate Change Impacts Assessment: Evaluating Washington's Future in a Changing Climate, edited by

Mantua, N., I. Tohver, and A. Hamlet. 2010. Climate change impacts on streamflow extremes and summertime stream temperature and their possible consequences for freshwater salmon habitat in Washington State. *Climatic Change* 102(1): 187-223.

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. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-42. June 2000. 156 pp.

McIntyre, J.K, D.H. Baldwin, D.A. Beauchamp, and N.L. Scholz. 2012. Low-level copper exposures increase visibility and vulnerability of juvenile coho salmon to cutthroat trout predators. Ecological Applications, 22(5), 2012, pp. 1460–1471.

McMahon, T.E., and G.F. Hartman. 1989. Influence of cover complexity and current velocity on winter habitat use by juvenile coho salmon (*Oncorhynchus kisutch*). *Canadian Journal of Fisheries and Aquatic Sciences* 46: 1551–1557.

Meyer, J.L., M.J. Sale, P.J. Mulholland, and N.L. Poff. 1999. Impacts of climate change on aquatic ecosystem functioning and health. *JAWRA Journal of the American Water Resources Association* 35(6): 1373-1386.

Moore, M. E., F. A. Goetz, D. M. Van Doornik, E. P. Tezak, T. P. Quinn, J. J. Reyes-Tomassini, and B. A. Berejikian. 2010. Early marine migration patterns of wild coastal cutthroat trout (Oncorhynchus clarki clarki), steelhead trout (Oncorhynchus mykiss), and their hybrids. PLoS ONE 5(9):e12881. Doi:10.1371/journal.pone.0012881. 10 pp.

Mote, P.W., J.T. Abatzglou, and K.E. Kunkel. 2013. Climate: Variability and Change in the Past and the Future. In Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities, edited by M.M. Dalton, P.W. Mote, and A.K. Snover, 41-58. Island Press, Washington, DC.

Mote, P.W, A. K. Snover, S. Capalbo, S.D. Eigenbrode, P. Glick, J. Littell, R.R. Raymondi, and W.S. Reeder. 2014. Ch. 21: Northwest. *In* Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, T.C. Richmond, and G.W. Yohe, Eds., U.S. Global Change Research Program, 487-513.

Myers, J.M., J.J. Hard, E.J. Connor, R.A. Hayman, R.G. Kope, G. Lucchetti, A.R. Marshall, G.R. Pess, and B.E. Thompson. 2015. Identifying historical populations of steelhead within the Puget Sound distinct population segment U.S. Department of Commerce. NOAA Technical Memorandum NMFS-NWFSC-128. 149 p.

National Marine Fisheries Service (NMFS). 2006. Final Supplement to the Shared Strategy's Puget Sound Salmon Recovery Plan. Prepared by NMFS Northwest Region. November 17, 2006. 47 pp.

NMFS. 2017. 2016 5-Year Review: Summary and Evaluation of Puget Sound Chinook Salmon, Hood Canal Summer-run Chum Salmon, and Puget Sound Steelhead. NMFS West Coast Region, Portland, Oregon. April 6, 2017. 98 pp.

National Park Service (NPS). 2020a. 1.A.2. Request for formal consultation with the NMFS for Routine Trail Maintenance 2020-2030 at North Cascades National Park Service Complex. North Cascades National Park, Lake Chelan National Recreation Area, Ross Lake National Recreation Area 810 SR 20, Sedro-Woolley, WA 98284. Undated letter sent electronically February 6, 2020. 1 p.

NPS. 2020b. Programmatic Biological Assessment - Routine Trail Maintenance 2020 - 2030 - North Cascades National Park Service Complex. Prepared by: North Cascades National Park Service Complex, National Park Service, Department of the Interior, Sedro-Woolley, WA 98284. January 2020. 101 pp.

NPS. 2020c. Re: [EXTERNAL] Re: Treated Wood, NCNP Complex Trails Maintenance Program. Electronic mail with an attachment sent to reply to NMFS questions. April 22, 2020. 1 p.

NPS. 2020d. NPSreply NMFS Draft Proposed Action 2020-04-22. Undated MS Word document sent as an attachment to NPS 2020c. 11 pp.

NPS. 2020e. Re: Treated Wood and Hazard Trees: NCNP Complex Trails Maintenance Program. Electronic mail string concerning the use of treated wood for routine trail maintenance. May 21, 2020. 10 pp.

Northwest Fisheries Science Center (NWFSC). 2015. Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest. December 21, 2015. 356 pp.

Pacific Fishery Management Council (PFMC). 2014. Appendix A to the Pacific Coast salmon fishery management plan, as modified by amendment 18 to the pacific coast salmon plan: identification and description of essential fish habitat, adverse impacts, and recommended conservation measures for salmon. PFMC, Portland, OR. September 2014. 196 p. + appendices.

Poston, Ted. 2001. Treated Wood Issues Associated with Overwater Structures in Marine and Freshwater Environments. White Paper Submitted to WDFW, WDOE, and WDOT. Prepared by Ted Poston, Battelle. April 5, 2001. 95 pp.

Rashin, E.B., C.J. Clishe, A.T. Loch, and J.M. Bell. 2006. Effectiveness of timber harvest practices for controlling sediment related water quality impacts. Journal of the American Water Resources Association (JAWRA) 42(5):1307-1327.

Raymondi, R.R., J.E. Cuhaciyan, P. Glick, S.M. Capalbo, L.L. Houston, S.L. Shafer, and O. Grah. 2013. Water Resources: Implications of Changes in Temperature and Precipitation. *In* Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities, edited by M.M. Dalton, P.W. Mote, and A.K. Snover, 41-58. Island Press, Washington, DC.

Ruckelshaus, M., K. Currens, W. Graeber, R. Fuerstenberg, K. Rawson, N. Sands, and J. Scott. 2002. Planning ranges and preliminary guidelines for the delisting and recovery of the Puget Sound Chinook salmon evolutionarily significant unit. Puget Sound Technical Recovery Team. National Marine Fisheries Service, Northwest Fisheries Science Center. Seattle.

Satterlund, D.R. and P.W. Adams. 1992. Wildland Watershed Management. John Wiley & Sons, Inc., New York. 436 pp.

Schreiner, J. U., E. O. Salo, B. P. Snyder, and C. A. Simenstad. 1977. Salmonid outmigration studies in Hood Canal. Final Report, Phase II, to U.S. Navy, Fish. Res. Inst., Univ. Wash., Seattle, WA. FRI-UW-7715. 64 pp.

Seattle City Light. 2020. Pre-Application Document – Skagit River Hydroelectric Project – FERC No. 553. Early-Release Draft. April 2020. 898 pp.

Shared Strategy for Puget Sound (SSPS). 2007. Puget Sound Salmon Recovery Plan – Volume 1. Shared Strategy for Puget Sound, 1411 4th Ave., Ste. 1015, Seattle, WA 98101. Adopted by NMFS January 19, 2007. 503 pp.

Sommers, F., E. Mudrock, J. Labenia, and D. Baldwin. 2016. Effects of salinity on olfactory toxicity and behavioral responses of juvenile salmonids from copper. Aquatic Toxicology. 175:260-268.

Spence, B.C., G.A. Lomnicky, R.M. Hughes, and R.P. Novitzki. 1996. An ecosystem approach to salmonid conservation. ManTech Environmental Research Services, Inc. Corvallis, Oregon. National Marine Fisheries Service, Portland, Oregon.

Tierney, K.B., D.H. Baldwin, T.J. Hara, P.S. Ross, N.L. Scholz, and C.J. Kennedy. 2010. Olfactory toxicity in fishes. Aquatic Toxicology. 96:2-26.Toft, J.D., J.R. Cordell, C.A. Simenstad, and L.A. Stamatiou. 2007. Fish Distribution, Abundance, and Behavior along City Shoreline Types in Puget Sound. North American Journal of Fisheries Management. 27:465-480.

Tillmann, P. and D. Siemann. 2011. Climate Change Effects and Adaptation Approaches in Marine and Coastal Ecosystems of the North Pacific Landscape Conservation Cooperative Region. National Wildlife Federation.

U.S. Department of Commerce (USDC). 2014. Endangered and threatened wildlife; Final rule to revise the Code of Federal Regulations for species under the jurisdiction of the National Marine Fisheries Service. U.S Department of Commerce. Federal Register 79(71):20802-20817.

Wainwright, T. C., and L. A. Weitkamp. 2013. Effects of climate change on Oregon Coast coho salmon: habitat and life-cycle interactions. *Northwest Science* 87(3): 219-242.

Washington State Department of Fish and Wildlife (WDFW). 2020a. SalmonScape. Accessed on April 7, 2020 at: http://apps.wdfw.wa.gov/salmonscape/map.html.

WDFW. 2020b. WDFW Conservation Website – Species – Salmon in Washington – Chinook. Accessed on April 7, 2020 at: https://fortress.wa.gov/dfw/score/score/species/chinook.jsp?species=Chinook

WDFW. 2020c. WDFW Conservation Website – Species – Salmon in Washington – Steelhead. Accessed on May 21, 2020 at: https://fortress.wa.gov/dfw/score/score/species/steelhead.jsp?species=Steelhead

Winder, M. and D. E. Schindler. 2004. Climate change uncouples trophic interactions in an aquatic ecosystem. *Ecology* 85: 2100–2106.