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-2018-00029

May 28, 2019

Jamie Kingsbury
Forest Supervisor
Mt. Baker-Snoqualmie National Forest
2930 Wetmore Avenue, Suite 3A
Everett, Washington 98021

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the South Fork Stillaguamish Vegetation Management Project on the Mt. Baker-Snoqualmie National Forest, Snohomish County, Washington, Fifth Field HUC: 1711000802 – South Fork Stillaguamish River.

Dear Ms. Kingsbury:

Thank you for your letter of April 11, 2018, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the U.S. Forest Service's (USFS) South Fork Stillaguamish Vegetation Management Project on the Mt. Baker-Snoqualmie National Forest (MBSNF).

The enclosed document contains the biological opinion (Opinion) prepared by NMFS pursuant to section 7(a)(2) of the ESA to assess the effects of the proposed action. In the Opinion, NMFS concluded that the proposed action is likely to adversely affect but not likely to jeopardize the continued existence of Puget Sound (PS) Chinook salmon and PS Sound steelhead. NMFS also concluded that the proposed action is likely to adversely affect, but is not likely to result in the destruction or adverse modification of designated critical habitat for both of those species.

As required by section 7 of the ESA, NMFS has provided an incidental take statement (ITS) with the Opinion. The ITS describes reasonable and prudent measures (RPM) NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action, and sets forth nondiscretionary terms and conditions that the USFS 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.

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 (MSA) (16 U.S.C. 1855(b)), and concluded that the action would adversely affect the EFH of Pacific Coast Salmon. Therefore, we have included the results of that review in Section 3 of this document.

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: Richard Vacirca, USFS

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

for the

South Fork Stillaguamish Vegetation Management Project
on the Mt. Baker-Snoqualmie National Forest, Snohomish County, Washington,
Fifth Field HUC: 1711000802 – South Fork Stillaguamish River

NMFS Consultation Numbers: WCRO-2018-00029

Action Agency: U.S. Forest Service, Mt. Baker-Snoqualmie National Forest

Affected Species and 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

N/A = not applicable. The action area is outside designated critical habitat, or critical habitat has not been designated.

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: May 28, 2019

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LIST OF ACRONYMS and ABREVIATIONS

BA – Biological Assessment
BMP – Best Management Practices
CFR – Code of Federal Regulations
CWD - Coarse Woody Debris
DBH – Diameter at Breast Height
DIP – Demographically Independent Population
DPS – Distinct Population Segment
DQA – Data Quality Act
ECA – Equivalent Clearcut Area
EFH – Essential Fish Habitat
ESA – Endangered Species Act
ESU – Evolutionarily Significant Unit
FS – Forest Service
HUC – Hydrologic Unit Code
ITS – Incidental Take Statement
MBSNF – Mount Baker/Snoqualmie National Forest
mg/L – Milligrams per Liter
MOU – Memorandum of Understanding
MPG – Major Population Group
MSA – Magnuson-Stevens Fishery Conservation and Management Act
NMFS – National Marine Fisheries Service
NOS –Normal Operating Season (June 1 to October 15)
NTU – Nephlometric Turbidity Units
Opinion – Biological Opinion
OWCO – Oregon Washington Coastal Office
PAH – Polycyclic Aromatic Hydrocarbons
PBF – Physical or Biological Feature
PCE – Primary Constituent Element
PDC – Project Design Criteria
PFMC – Pacific Fishery Management Council
PS – Puget Sound
PSSTRT – Puget Sound Steelhead Technical Recovery Team
PSTRT – Puget Sound Technical Recovery Team
RPA – Reasonable and Prudent Alternative
RPM – Reasonable and Prudent Measure
SF – South Fork
TSS – Total Suspended Sediment
USFS – US Forest Service, US Department of Agriculture
USFWS – US Fish and Wildlife Service
VSP – Viable Salmonid Population
WCR – Westcoast 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 portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 *et seq*.), and implementing regulations at 50 CFR 402.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 *et seq*.) and implementing regulations at 50 CFR 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 (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). A complete record of this consultation is on file at the Oregon Washington Coastal Office (OWCO) in Lacey, Washington.

1.2 Consultation History

On March 1, 2016, the Mount Baker/Snoqualmie National Forest (MBSNF) released a public scoping notice to solicit comments for the South Fork (SF) Stillaguamish Vegetation Management Project. On June 3, 2016, staff from the USFS, US Fish and Wildlife Service (USFWS), and NMFS visited the project area. On October 11, 2017, the USFS provided USFWS and NMFS a draft biological assessment (BA) for the project and requested comments. NMFS provided comments on the draft BA on November 3, 2017. On April 12, 2018, NMFS received a letter from the USFS, requesting formal consultation for the SF Stillaguamish Vegetation Management Project, and the final draft of the BA for the proposed action (USFS 2018a and b). Formal consultation was initiated on that date.

USFS request for consultation re-prioritization: On June 11, 2018 NMFS received a separate request for formal consultation from the USFS for road repair projects that would be funded under the Emergency Relief for Federally Owned Roads (ERFO) program. Due to funding deadlines, the USFS requested that the ERFO project be given priority over the SF Stillaguamish project. On July 17, 2018, NMFS received an additional request for formal consultation from the USFS for other ERFO-funded road repair projects, with a similar request for high prioritization. The consultation for the first ERFO-funded project was completed on December 6, 2018. The second was delayed by the December 21, 2018 to January 28, 2019 partial shutdown of the federal government, and was completed on March 7, 2019.

This Opinion is based on the review of the information and project drawings in the BA; supplemental materials and responses to NMFS questions; 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 Action

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

The USFS's proposed SF Stillaguamish (SFS) Vegetation Project would take place in the Darrington Ranger District of the Mount Baker/Snoqualmie National Forest (MBSNF), in Snohomish County, Washington, about 10 miles east of Granite Falls. The overall project area encompasses about 65,000 acres of National Forest (NF) lands in the SF Stillaguamish River drainage (Figure 1).

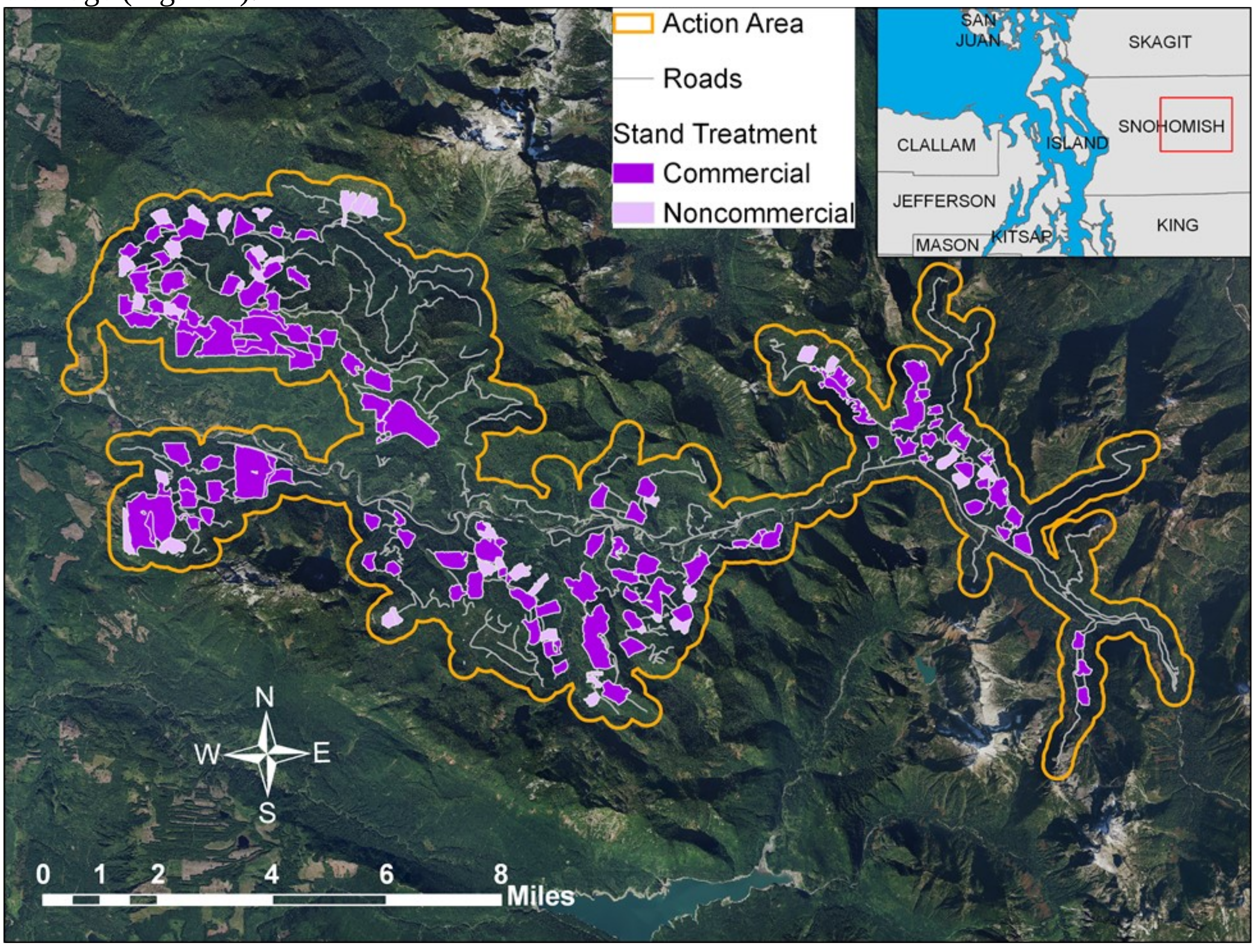

Figure 1. Google satellite photograph that shows the SF Stillaguamish Vegetation Project area in the Mount Baker/Snoqualmie National Forest, Snohomish County, Washington. Spada Lake is south of the area, at the lower center of the image.

The project includes two main components: 1) Thinning on about 8,400 acres of the MBSNF; and 2) Recreational facilities improvements. Work would begin within two years of the completion of this Opinion, and may last up to 15 years.

All project related work would be done in compliance with the Project Design Criteria (PDC) and Mitigation listed in Table 5 of the BA. Workers would also comply with all requirements of the Memorandum of Understanding (MOU) between the Washington State Department of Fish and Wildlife (WDFW) and the USFS for Hydraulic Permit Approval (HPA) 2017-2021 (USFS 2017a and b).

Thinning

Thinning would consist of three main elements: 1) Treatment; 2) Hauling; and 3) Support work. Treatment would include commercial logging on about 7,200 acres and non-commercial thinning on about 1,200 acres. Of the 7,200 acres to be commercially thinned, about 3,270 acres would be within riparian reserves, and 3,930 acres would be outside. Of the 1,200 acres to be non-commercially thinned, about 500 acres would be within riparian reserves, and about 700 acres would be outside. The 8,400 acres to be thinned represents about 13 percent (%) of the project area.

Riparian reserves make up about 82.5% of the project area. As such, the 3,770 acres of riparian reserves to be thinned represents about 6% of the total project area, and about 7% of the riparian reserves. A close-up view of three stands that would be thinned as part of this project (Figure 2) gives a good example of the high ratio of riparian reserves within specific stands. It also shows how USFS roads transect the stands, and gives a generally representative view of the relative size of the areas within the stands that would be commercially thinned.

Treatment: The thinning treatment is designed to create conditions within all treated stands, both within and outside of riparian reserves, to allow those stands to develop important characteristics of old growth forests, including multi-layered canopies, large down woody debris, as well as species and spatial heterogeneity. Due to the similarity in the thinning objectives for all treated stands, stands within and outside of riparian reserves generally would be treated the same, with the exception of certain limitations that are specifically established for work within the riparian reserves. Similarly, thinning would be identical in commercial and non-commercial stands, with the exception that merchantable trees that are cut within commercially thinned stands would be removed from the forest. Trees that are cut within non-commercial stands would be left on-site.

For thinning within riparian reserves: 1) No thinning would be allowed within 100 feet from the banks of any fish-bearing streams, 30 feet from perennial non-fish-bearing streams, and 15 feet from intermittent and ephemeral streams (no-thin buffers); 2) Trees will be directionally felled away from streams; 3) Ground based equipment and skid roads would be excluded from no-thin buffers, with the exclusion zone extended 25 feet beyond the 15-foot no-thin buffer around intermittent and ephemeral streams; and 4) Skyline yarding would be used where slopes exceed 35%, and full suspension cable yarding shall be used to cross all aquatic features.

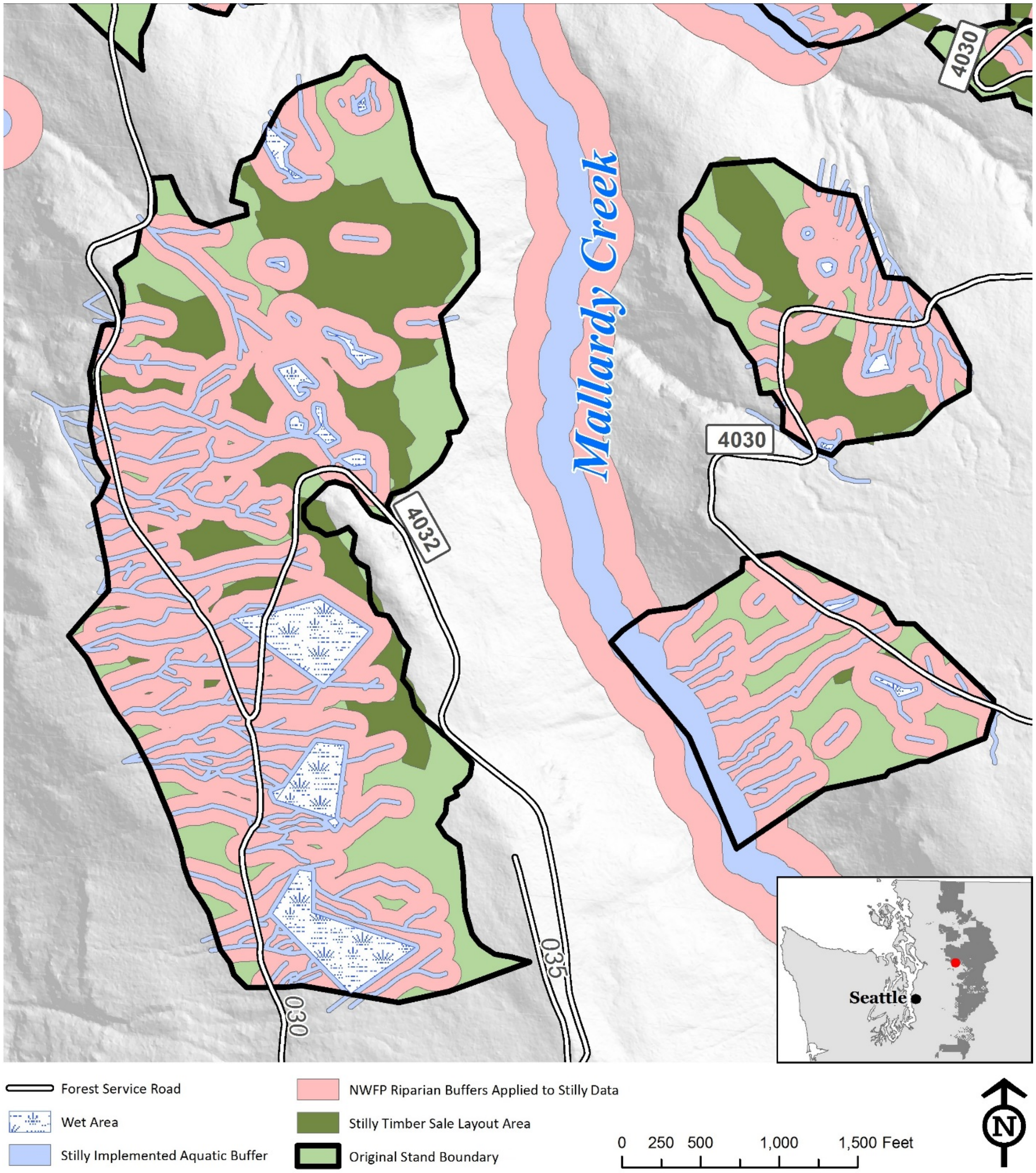

Figure 2. Example of typical stands and thinning activities. Three stands from the lower center of the SF Stillaguamish Vegetation Project area, showing aquatic features and their proposed no-cut buffers in blue. Riparian reserves are shown in pink, and FS roads are white lines outlined in black.

In general, thinning in all stands would primarily remove trees of the most abundant conifer species that are between 8 and 20 inches in diameter at breast height (DBH). It would leave less abundant conifers and all hardwoods, and all trees larger than 20 inches DBH, unless their cutting is required for safety or operational reasons. Any stands that are 80 years of age or older would also be excluded dropped from the proposed treatment. Any trees of 20 inches DBH or more that must be cut for safety or operational reasons such as temporary road building, landing clearing, or log yarding, would be left on site as coarse woody debris (CWD). Similarly, existing downed wood of 20 inches in diameter or more would be retained on site, and left undisturbed if possible. Any snags that must be felled for safety reasons would be left on site. Old large stumps would be left intact wherever possible.

All Pacific yew within treated stands would be retained. Western red cedars may be thinned to reduce competition where they are densely stocked. Alders and other hardwoods would be retained. Trees with characteristics favorable for marbled murrelet nesting, as well as old-growth legacy trees, would be left, and would be further protected by the retention of adjacent tree(s) with interlaced or interlocked branches. Other trees that would be left include damaged and diseased trees with the potential to increase structural diversity and to become snags and downed wood. Legacy snags found in treated stands would be surrounded by a no-cut buffer equal to or greater than the height of the snag. All other snags within the stand would be retained unless they pose a hazard to human safety.

Within individual stands, thinning would consist of some combination of four treatments: General Thinning; Gaps; Heavy Thinning; and Skipped Areas. All treatments would comply with the general limitations previously described.

General Thinning would limit cutting to trees of the most abundant conifer species that are between 8 and 20 inches DBH. It would create a variable density tree distribution that would retain canopy cover of no less than 55% within the thinned area. General Thinning could account for up to 90% of a thinned stand, depending on the size of the no-cut buffer and the amount of Gap and Heavy Thinning that would also be done in some stands (USFS 2019d).

Gaps would be 0.25- to 0.5-acre sized areas where all conifers between 8 and 20 inches DBH would be cut. All hardwoods and any trees greater than 20 inches DBH would be retained.

Heavy Thinning would cut the most abundant 8 to 20 inches DBH conifers within 0.5- to 3-acre sized areas to reduce tree density to about 20 to 50 trees per acre. Less abundant conifers, hardwoods, and trees greater than 20 inches DBH would be retained.

In combination, Gap and Heavy-thin areas would account for no more than 10% of any treated stand (USFS 2019e).

Skipped areas would remain uncut. Skipped areas within treated stands would include riparian no-cut buffers, hardwood and minor species areas, plant protection buffers, and areas otherwise unsuitable for thinning. Additional skips may be designed as needed in stands that lack these features. Where possible, skips would be placed in locations that incorporate snags. Skipped areas would account for a minimum of 10% of any treated stand.

<u>Hauling:</u> In commercially thinned stands, ground-based and skyline systems would be used to move merchantable trees to landing areas where they would be removed from the forest by truck.

Traditional ground-based logging systems would be used where slopes are less than 35%. Where slopes are steeper, some combination of self-leveling or tethered ground-based equipment, or skyline equipment would be used. The limitations described above for stands within riparian reserves apply to commercially thinned stands as well as to non-commercially thinned stands.

Ground-based systems use winches and cables to drag felled trees across the ground, creating what are known as skid roads. The primary difference between traditional and self-leveling or tethered ground-based equipment is that traditional systems rely largely on gravity to keep the heavy equipment in place, while the latter two systems are designed to prevent the equipment from sliding down-slope. Ground-based skidding and yarding operations shall be conducted with one-end suspension to minimize soil erosion. Skid roads would be limited to about 15-foot widths and 100-foot spacing. Skid roads are not allowed within no-thin buffers. Existing designated skid roads would be reused where possible. All new skid roads would be closed and returned to natural conditions after logging is complete.

Skyline systems also use winches and cables, but the cables are attached to trees at either end of the skyline corridor, and held well above the ground. Felled trees are attached to the cable and suspended above ground while being pulled to the landing area. In full suspension yarding, the entire tree is suspended above ground. In other cases, only one end of a tree is elevated and the other end is allowed to drag across the ground as the tree is pulled to the landing area. Full suspension would be required for yarding across all aquatic features, all no-cut buffers, and potentially unstable slopes.

Skyline corridors are gaps between standing trees through which felled trees would be moved by skyline systems. Where possible, existing skyline corridors would be reused, corridors would be limited to 15 to 20 feet in width and would be kept away from snags, and guy trees would be selected from among the trees that would be cut as part of the thinning. Skyline corridors will generally be about 120 feet apart at one end. If a guy tree is the largest tree in its vicinity and would otherwise have been left, the next largest tree would be left to replace it. Tail trees that are damaged during operations would be retained to contribute to snags or CWD in the stand. Any trees felled for corridors within riparian no-cut buffers will be left on the ground.

Landings are cleared areas where cut trees are gathered and limbed before being placed on trucks for removal. They would be between 0.25 and 1.25 acres in size. All planned landing locations must be approved by the Forest Service. Where possible, existing landing areas would be used, and/or be at least 150 feet away from all aquatic features. Where a 150-foot distance is not possible, landings would be at least 50 feet away from all aquatic features, and placed along an open road or at a pre-existing landing location. As needed, cross drains and grade breaks will be installed prior to expected seasonal precipitation, and at the end of the Project. Also, all new landings will be de-compacted, seeded with native seed, and mulched at the end of the Project.

The limbed trees would be loaded onto conventional log hauling trucks that would use about 123 miles of road to transport the logs to the mill. Truck hauling would be allowed year-round. However, when operating outside of the June 1 to October 15 Normal Operating Season (NOS), hauling would be done in compliance with a wet weather haul agreement (WWHA) intended to reduce erosion, sedimentation, and other environmental impacts (USFS 2018b).

Slash is the term used for the limbs and other tree parts that remain in the stand after the trees are removed. Some combination of four slash disposal options would be used as part of this project: 1) Redistribution of the slash within the stand; 2) Chipping and spreading the material to a depth of no more than 4 inches; 3) Issuance of firewood permits to allow the removal of larger pieces; and 4) Piling and burning slash at landings according to approved procedures.

After logging is complete within a stand, skid roads, landings, and other bare soil areas would be closed and revegetated. Invasive plants will be treated as per the direction in the Record of Decision for the MBSNF Invasive Plant FEIS (USDA 2015).

Support work: The project would require support work such as road construction, reconstruction, and maintenance. Road work would be done on about 123 miles of road that would be used to access the stands and remove logs from the forest. This includes about 59 miles of currently open FS road, 29 miles of administratively closed FS road (system roads), and up to about 35 miles of temporary road. No new permanent roads would be constructed as part of this project. Most road construction and maintenance would be scheduled to occur during the NOS. Any spot rocking or other work that may be required to keep roads in acceptable condition during wet season hauling, and would be done in compliance with the WWHA.

The system roads would receive routine road maintenance and reconstruction work as needed to maintain or to reopen them. Typical work would include some combination of asphalt repair, rock-resurfacing, blading and shaping road surfaces, fill, roadside brushing, ditch clearing, culvert replacements, and bridge repairs. As needed for safety along system roads, overhanging hardwoods within 30 feet of the road edge, and hazard trees up to 50 feet from the road edge (both conifers and hardwoods) would be removed to provide safe passage of heavy equipment (“daylighting”). The currently open system roads would remain open after the end of this project, but the currently closed system roads would be reclosed when no longer needed for this project.

The temporary roads used for this project would include about 30 miles of existing “legacy” logging roads, and 3 to 5 miles of new road. The legacy roads are old logging roads that were never decommissioned, so some infrastructure such as culverts and ditches are still present. They are also unmaintained because they were never officially adopted as FS roads. Those roads would be reconstructed as needed, using methods similar to those identified for system roads, minus asphalt repair, as well as “daylighting” as needed. After they are no longer needed, likely 1 to 4 years after reopening, the re-opened legacy roads would be water-barred and/or scarified, and hydro seeded, then closed (USFS 2019a).

The 3 to 5 miles of new temporary roads would be constructed, by removing trees, shrubs, and stumps (grubbing) as needed, then using road construction methods similar to those identified above, minus asphalt repair and “daylighting”. When no longer needed, likely 1 to 2 years after opening, they would be obliterated by some combination of culvert/ditch removal, installation of dips and water bars, de-compaction (i.e. scarification, ripping, etc.), and revegetation (USFS 2019a).

Rock used to resurface roads would be supplied either from off-site commercial sources or be extracted from sites located on NFS lands (16 existing and 1 new). Development of a new rock source site on Road 4210, at milepost 0.08, would require clearing of about 0.5 acre of second growth trees. None of the rock source sites are in proximity to streams, and work would be done with heavy equipment such as excavators, crushers, and dump trucks. No blasting is planned for this project (USFS 2019c).

Water drafting (removal of water from streams) would be done for roadwork-related dust abatement and for fire protection. Drafting sites would be identified during project implementation, but are expected to occur along the mainstem of the SF Stillaguamish River and in some of its major tributaries. Site selection and drafting methodology would comply with the MOU between USFS and WDFW (USFS 2017a and b), which includes required measures such as isolating and screening pump intakes, and maintaining adequate in-stream flows for fish.

Any culvert replacements that may be done incidental to project-related road repairs would done in compliance with the regional Programmatic Biological Opinions for Aquatic Restoration Activities (ARBO II) (NMFS 2013a; USFWS 2013). Because the culvert replacements would have independent utility, and because the potential effects of that work has been previously addressed through Section 7 consultation, that work is not considered part of this project.

Recreational facilities improvements

Following completion of stand treatments, the FS would improve recreation sites and amenities at six sites within the project area.

They would relocate the trailheads of the Sunrise Mine Trail and the Walt Bailey Trail. Both trailheads would be moved back along their access roads to about 0.5 and 1.0 mile, respectively from their current locations. The road sections between the current and new locations would be decommissioned and converted to trail at both sites. Up to 2 acres of vegetation would be removed from along both sides of the existing road to create a picnic site and parking space for about 75 cars at the new Sunrise Mine Trailhead. About 0.25 acre of vegetation would be removed from a 1-acre disturbance area to provide parking for about 30 cars at the new Walt Bailey Trailhead.

The FS would expand the Heather Lake parking lot from about 25 to 75 parking slots by removing the brush, rocks and most trees from about 1 acre along the north side of the existing parking lot. They would remove the culverts from sections of FS Road 4063 that is part of the Perry Creek Trail, and reconfigure the crossings for trail use. They would also upgrade the toilet facilities at the trailheads of the Boardman Lake and Coal Lake Trails.

As described above, the culvert removals that would be done incidental to project-related recreational facility improvement would done in compliance with the ARBO II Programmatic Biological Opinions. That work is not considered part of this proposed action because it would have independent utility, and its potential effects have been previously addressed through Section 7 consultation.

Further, all six sites are well removed from streams that could be reasonably expected to support Puget Sound (PS) Chinook salmon and PS steelhead, as well as from any designated critical habitat for either of those species. Therefore, it is extremely unlikely that the planned recreational facilities improvements would cause any detectable effects on either of those species or their critical habitats.

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 provides 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 USFS determined that the proposed action is likely to adversely affect PS steelhead and its designated critical habitat, but is not likely to adversely affect PS Chinook salmon and its designated critical habitat. NMFS did not concur that the proposed action is not likely to adversely affect PS Chinook salmon and its designated critical habitat, and therefore included PS Chinook salmon and its designated critical habitat in the formal consultation.

2.1 Analytical Approach

This biological opinion includes both a jeopardy analysis and/or an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of" a listed species, which is "to engage in an action that 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 for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features" (81 FR 7214).

Past critical habitat designations have used the terms primary constituent element (PCE) or essential feature (EF) to identify important habitat qualities. However, the new critical habitat regulations (81 FR 7414; February 11, 2016) replace those terms with physical or biological features (PBF). This shift in terminology does not change the approach used in conducting our analysis, whether the original designation identified PCE, EF, or PBF. For simplicity, we universally apply the term PBF in this Opinion for all critical habitat, regardless of the term used in the specific critical habitat designation.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or to cause the destruction or adverse modification of designated critical habitat:

- Identify the range-wide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors by: (1) Reviewing the status of the species and critical habitat; and (2) adding the effects of the action, the environmental baseline, and cumulative effects to assess the risk that the proposed action poses to species and critical habitat.
- Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
- If necessary, suggest a reasonable and prudent alternative (RPA) to the proposed action.

2.2 Range-wide 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' current "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 current function of the essential PBFs that help to form that conservation value.

The project sites are located in freshwater streams that are occupied by the Puget Sound (PS) Chinook salmon (*Oncorhynchus tshawytscha*) Evolutionarily Significant Unit (ESU) and the PS steelhead (*O. mykiss*) Distinct Population Segment (DPS), which are both currently listed as threatened under the ESA. These streams are also designated as critical habitat for one or both species (70 FR 52630; September 2, 2005 and 81 FR 9252; February 24, 2016) (Table 1).

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 recovery plans and other sources at: http://www.nmfs.noaa.gov/pr/species/fish/ and, and in the listing regulations and critical habitat designations published in the Federal Register and are incorporated here by reference.

Table 1. ESA-listed species and critical habitat under NMFS jurisdiction that may be affected by the proposed action.

ESA-listed marine 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.

<u>Listed Species</u>

<u>Viable Salmonid Population (VSP) Criteria:</u> 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.

2.2.1 Puget Sound (PS) Chinook Salmon

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 a supplement by 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 (Table 2) 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 juveniles 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 types 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.

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

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 being 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).

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 wood
- 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: The PS Chinook salmon that occur in the action area are fall-run fish from the SF Stillaguamish River population (NWFSC 2015; WDFW 2019a; USFS 2018b). Between 1986 and 2018, the abundance within this population has fluctuated between about 15 and 353 spawners, with a negative general trend. About 39 total spawners were estimated in 2018 (WDFW 2019b). Prior to about 2008 to 2012, natural-origin fish accounted for nearly 100% of the population (NWFSC 2015; WDFW 2019b). Since then, hatchery-origin fish have accounted for an ever-increasing proportion of the population, and accounted for all of the return in 2018 (WDFW 2019b).

Chinook salmon presence is documented within the project area in the SF Stillaguamish River up to Silverton, and into Canyon Creek to a point just west of project area. They are also presumed to occupy the lower reaches of North Fork Canyon Creek, within the project area. WDFW reports that spawning occurs primarily in the mainstem of the SF Stillaguamish River and in the lower reaches of Canyon Creek, just north of Granite Falls, WA, downstream from the project area (WDFW 2019a), However, the USFS also reports that Chinook spawning has been documented in the SF Stillaguamish River near the center of the action area (USFS 2018c).

Adults of this population typically enter the river beginning in mid-June and spawn from late August through mid-September (Ruckelshause *et al*. 2006). Both ocean- and stream-type Chinook salmon are present, with the majority being ocean-types. Juvenile ocean-types typically migrate out of their natal streams beginning in early-March of their first year of life, rearing in estuarine waters between early April and mid-July, then transitioning into their marine life stage. Conversely, stream-types tend to rear in fresh water for a year or more, and are likely to be present in the system year-round.

2.2.2 Puget Sound (PS) Steelhead

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 major population groups (MPGs); Northern Cascades, Central and South Puget Sound; and Hood Canal and Strait de Fuca (Myers *et al.* 2015) (Table 3).

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).

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 Summer Run and 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

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 DIP 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 DIP. However, low productivity persists throughout the 32 DIP, 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 DIP. 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 DIP 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 2017).

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 wood
- 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: The PS steelhead that occur in the action area are most likely from the Stillaguamish River Winter Run and the Canyon Creek Summer Run populations (NWFSC 2015; WDFW 2019c). Total abundance for the winter run has fluctuated between about 120 and 2,226 individuals between 1985 and 2018, with a long-term negative trend and a severe short-term decline (WDFW 2019c). The total return in 2018 was 422 fish. WDFW rates this small population as depressed (WDFW 2019c). The 2015 status review rated this population's viability as low, with a 95% probability of extinction within 67 years (NWFSC 2015). The Canyon Creek Summer Run population is a mixed stock that consists of non-native hatchery-origin summer steelhead have commingled with the native stock (WDFW 2019c). We could find no specific information to describe total abundance and trends for this population.

WDFW reports the presence of Winter Run and Summer Run PS steelhead in Canyon Creek from its confluence with the SF Stillaguamish River to points about a mile upstream into the north and south forks of the creek. Spawning of Winter Run fish is documented in the creek to a point slightly downstream from the confluence of those forks. Winter Run PS steelhead are also documented within the project area in small areas of the mainstem of the SF Stillaguamish River and several of its tributaries up to Silverton (WDFW 2019a).

Winter Run adults typically enter the river between early November and the end of April, and spawn between March and June. Summer run fish typically enter the river between May and October, and spawn between February and April (Myers *et al*. 2015). Juveniles are present within the watershed year round. They likely utilize streams within the action area for rearing and migration for one to three years before smoltification and seaward migration between April and mid-May (Myers *et al*. 2015).

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.

Puget Sound Chinook Salmon Critical Habitat: 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.

PS steelhead critical habitat: 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 critical habitat for both PS Chinook salmon and PS steelhead 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 and PS steelhead critical habitat are listed in Table 4.

Major tributary river basins in the Puget Sound basin include the Nooksack, Samish, Skagit, Sauk, Stillaguamish, Snohomish, Lake Washington, Cedar, Sammamish, Green, Duwamish, Puyallup, White, Carbon, Nisqually, Deschutes, Skokomish, Duckabush, Dosewallips, Big Quilcene, Elwha, and Dungeness rivers and Soos Creek. 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 large wood recruitment (SSPS 2007).

Table 4. Physical or biological features (PBFs) of designated critical habitat for PS Chinook salmon and PS steelhead, and the corresponding life history events. Although nearshore and offshore marine areas were identified in both respective FR, 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

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 large wood. The loss of side-channels, oxbow lakes, and backwater habitats has resulted in a significant loss of juvenile salmonid rearing and refuge habitat.

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 large wood 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: For PS Chinook salmon, critical habitat has been designated in the mainstem SF Stillaguamish River to a point several miles past Silverton, which extends well into the project area. It is also designated in Canyon Creek to the end points in both the north and south forks. This also extend well into the project area. Based on WDFW information, this critical habitat supports provides the Freshwater Rearing and Migration PBFs for PS Chinook salmon (WDFW 2019a).

For PS steelhead, critical habitat has been designated in the mainstem SF Stillaguamish River to its end point, several miles past Silverton, which extends well into the project area. It is also designated to the end points in most of its tributaries, which also extend well into the project area. Based on WDFW information, this critical habitat supports provides the Freshwater Spawning, Rearing and Migration PBFs for PS steelhead (WDFW 2019a).

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 subsection 1.3, the thinning project would occur within the Upper SF Stillaguamish River watershed (Figure 1). As described in the Effects of the Action Section (2.5), in-water project-related effects would be limited to all stream reaches within about 2 miles downstream of any areas where thinning, road work, and any other project-related work would occur within 150 feet of streams. The exact locations where this would occur are not specifically identified, and the affected waters may consist of discontinuous stream segments in some areas. Further, the exact overlap with occupied habitat and/or designated critical habitat for either species is uncertain, but the likelihood of overlap increases with downstream movement. To be conservative, this opinion defines the action area as all stream reaches within the project area, affected stream reaches outside of the project area that are within 2 miles downstream of any project-related work done within 150 feet of those streams, to include the SF Stillaguamish River to its confluence with Cranberry Creek.

2.4 Environmental Baseline

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 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

<u>Environmental conditions in the SF Stillaguamish River watershed:</u> The project site is located in the SF Stillaguamish River sub-basin, along western slopes of the Cascade Mountains of Western Washington. The area is about 20 miles inland from the marine waters of Puget Sound (Figure 1), and about 39 miles northeast from Seattle. The area is characterized by rugged mountain terrain with V-shaped valleys and relatively high-gradient streams. The 117,596-acre SF Stillaguamish River sub-basin includes three fifth-field watersheds: lower SF Stillaguamish (33,815 acres); upper SF Stillaguamish (43,300 acres); and Canyon Creek (40,481 acres).

The climate in the area is temperate maritime. Annual precipitation ranges from 60 inches at lower elevations to 160 inches at the higher elevations. Most of the precipitation occurs between October and May, with heavy accumulations of snow above about 1,600 above mean sea level

(MSL). Much of the area lies in the rain-on-snow zone between 1,000 and 3,000 feet MSL. These areas are characterized by large accumulations of snow followed by rapid melting under heavy rains, resulting in large peak runoff flows (USFS 2018a).

The SF Stillaguamish River originates in snowfields near Barlow Pass, at about 6,600 feet MSL. Much of the upper mainstem and tributaries are high gradient, high energy systems that flow through ravines and small canyons, over steep mountainous terrain that is dominated by cobbles and boulders. The valley floor begins to flatten and widen slightly at about RM 67. Prior to 1954, when a fish ladder was constructed at about RM 34.5, Granite Falls formed a natural barrier to most anadromous fish migration into the upper SF Stillaguamish River. Since then, self-sustaining runs above the falls have been marginally successful. A combination of factors that include an inadequate entrance and heavy sediment build up at the mouth continue to limit fish passage through the ladder.

Aquatic habitats within the upper SF Stillaguamish River watershed have been degraded by historic land management activities that have included logging, mining, road building, and recreation. Logging has been the dominant land use within the action area. Timber harvest and other land clearing began in the early 1900’s. Large-scale railroad-supported logging began in the 1920’s. Logging was particularly intense in the 1960’s through 1980’s, and included clear-cutting of large areas, and the removal of riparian buffers along many stream channels within the watershed. About 57% (42,400 acres) of the lower SF Stillaguamish and Canyon Creek fifth-field watersheds have been cut at some time in the past. This includes about 35% of federally-owned lands and about 90% of non-federal lands. About 20% of the Upper SF Stillaguamish fifth-field watershed has been logged. Since the late 1980’s, timber harvest on federal lands within the area has been limited to pre-commercial thinning. Other land uses on non-federal lands include various outdoor recreation throughout the area, and minor agriculture and rural residential use in the lower SF Stillaguamish valley. Mining was a major land use in the late 19th and early 20th centuries, but is no longer a major activity in the watershed. Currently, the area is vegetated primarily by second growth western hemlock, Douglas-fir, red alder with occasional western red cedar, Sitka spruce, or big-leaf maple. Vine maple, huckleberries, and salmonberry are common shrubs.

The watershed has a history of rain-on-snow events that combined with reduced forest cover and riparian buffers described above, has caused landslides and bank erosion that has resulted in a relatively simple stream morphology, with a widened and aggraded channel, high levels of sedimentation, and low levels of large wood and pool habitat (SIRC 2005; USFS 2018a; USFWS 1998).

The SF Stillaguamish River is on the State’s 303(d) list for elevated stream temperatures. The Forest Service reports that in-stream temperatures near the river’s headwaters never exceeded 55.4° F (13° C) during monitoring in 2015 (USFS 2018a). However, summer in-stream temperatures near the center of the project area exceeded 60.8° F (16° C) on 46 days, and exceeded 64.4° F (18° C) on 20 of those days during the summer of 2001 (WDOE 2004).

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 action area continues to provide spawning and migratory habitat for both species, and likely provides some juvenile rearing habitat for both species as well.

Climate Change: 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 0.8 °C), and up to 2° F (1.1 °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 5.6° 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 3.5-5.3°C increases in Columbia Basin streams and a peak temperature of 26°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 foodwebs (Crozier *et al*. 2011; Tillmann and Siemann 2011; Winder and Schindler 2004). Higher stream temperatures will also cause decreases in dissolved oxygen and may also cause earlier onset of stratification and reduced mixing between layers in lakes and reservoirs, which can also result in reduced oxygen (Meyer *et al*. 1999; 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 these threatened and endangered species is depressed due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. Without these natural sources of resilience, systematic changes in local and regional climatic conditions due to anthropogenic global climate change will likely reduce long-term viability and sustainability of populations in many of these ESUs (NWFSC 2015). New stressors generated by climate change, or existing stressors with effects that have been amplified by climate change, may also have synergistic impacts on species and ecosystems (Doney *et al*. 2012). These conditions will possibly intensify the climate change stressors inhibiting recovery of ESA-listed species in the future.

2.5 Effects of the Action on Species and Designated Critical Habitat

Under the ESA, “effects of the action” means the direct and indirect effects of an action on the species, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Direct effects are caused by exposure to action-related stressors that occur at the time of the action. Indirect effects are effects caused by the proposed action that occur later in time but are still reasonably certain to occur.

As described in Section 1.3, the USFS would implement a 15-year project across about 65,000 acres of the SF Fork Stillaguamish River drainage, within the MBSNF (Figure 1). The project includes year-round commercial and non-commercial thinning on a maximum of 8,400 acres, as well as making improvements to recreational facilities at 6 locations within the project area. Because the recreational facility improvements are extremely unlikely to cause detectable effects on PS Chinook salmon, PS steelhead, or their critical habitats, this analysis focuses on the effects of the planned thinning and its related activities.

In summary, the proposed action includes forest thinning on about 110 stands, totaling about 8,400 acres, of which about 3,770 acres are within riparian reserves. The project also includes the repair, maintenance, and year-round use of about 123 miles of road, including about 35 miles of temporary road that would be constructed/reconstructed and then decommissioned when no longer needed for this project. Over overhanging limbs and hazard trees within 30 to 50 feet of some roads would be removed for safety (daylighting) along haul some routes.

As described in Section 2.2, PS Chinook salmon and PS steelhead are present, and spawning has been documented within the action area for both species. Therefore, all life stages of both species may occur within the action area. Adult Chinook salmon are typically present in the system mid-June through mid-September. Ocean-type Juveniles would likely depart the area by early April, but low numbers of stream-type juveniles could be present year round. Adult and juvenile steelhead from the summer and winter runs could be present year round. Also, critical habitat has been designated for both species within the action area. That critical habitat provides Freshwater Spawning, Rearing, and Migratory PBFs for both species.

Stand-specific project information is not available at this time. Therefore, we will analyze the effects of the proposed action by considering how project elements are likely to impact important salmonid habitat indicators, and then consider how exposed individuals and the PBFs of their critical habitat 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.

2.5.1 Effects on Listed Species

Stream Temperature

Increased in-stream water temperature caused by the proposed action is likely to adversely affect PS Chinook salmon and PS steelhead. The proposed action components that are most likely to affect stream temperature are forest thinning, tree removal related to road work, and water drafting for roadwork and fire protection.

Forest Thinning: The planned forest thinning is described in more detail above in the description of the proposed action. In summary, it would include a mix of commercial and non-commercial thinning in and out of the riparian reserves. The planned thinning activities and limits would be the same in commercial and non-commercial stands, with the exception that felled trees would be left on the ground during non-commercial thinning. Therefore, the effects on stream shading would be the same for both activities, and no further distinction between commercial and non-commercial thinning is made here.

Project-related thinning would occur within 3,770 acres of riparian reserves, and could affect up to 20% of any stand, with a maximum of 10% each of gap and heavy thinning. This means that across the project area, up to about 377 acres of riparian reserves would be thinned such that all conifers less than 20-inch DBH could be felled within 0.25- to 0.5-acre sized patches (gaps). An additional 377 acres of riparian reserves would be thinned such that tree density could be reduced to 20 trees per acre within 0.5- to 3-acre sized patches (heavy thin areas). No thinning would be allowed within 100, 30, and 15 feet of perennial fish-bearing streams, perennial non-fish-bearing streams, and intermittent/ephemeral streams, respectively.

Also, in addition to the planned thinning, the project allows an unquantified number of 0.5- to 1.25-acre sized landings, and 15-foot wide skyline corridors. Where possible, the project would reuse existing landings at least 150 feet away from aquatic resources, as well as existing skyline corridors. However, some new landings and skyline corridors are likely, and landings may be as close as 50 feet from aquatic features if needed. The landings and skyline corridors are likely to require the felling of some trees within the no-cut buffer that would not count against the 20% of the stand to be thinned. Per the FS, the planned thinning would overlap with about 1.07 miles of PS steelhead-occupied stream that has also been designated critical habitat for that species. None of the planned thinning overlaps with PS Chinook salmon-occupied streams, or with any streams that have been designated critical habitat for that species (USFS 2019b).

Tree removal within and adjacent to riparian areas in upper watersheds can elevated in-stream water temperatures of the adjacent streams. It can also influence water temperatures at a sub-reach or reach scale, and in some cases may affect water temperature at a watershed scale. The effect reduced riparian vegetation may have on in-stream temperature varies by stream size, season of the year, and the amount of lost vegetation. Water temperatures in small streams are strongly influenced by riparian forest conditions and canopy cover over the stream, especially during summer months. Conversely, the water temperature of large rivers is less affected by riparian vegetation adjacent to the river because most available solar radiation normally reaches the surface of the river, and diel temperature variations are reduced by stream depth and volume of flow (Everest and Reeves 2007).

The primary factors that influence stream shade are the height and density of riparian vegetation (Groom *et al*. 2011a) and the surrounding terrain, with riparian vegetation typically providing most of the shade (Allen *et al*. 2007; Allen 2008). Removing trees from riparian areas reduces the amount of shade, which can increase thermal loading to the adjacent streams (Moore and Wondzell 2005). No-cut buffers have been found to reduce stream shade impacts from forest thinning and logging actions. Although the exact relationship between no-cut buffer widths and stream shade impacts is difficult to predict, in general wider no-cut buffers result in lower levels of lost stream shade (Anderson *et al*. 2007; Park *et al*. 2008; Science Review Team 2008).

During studies of clearcutting, no-cut buffers between 66 and 99 feet wide (20 to 30 m) were insufficient to prevent substantial loss of shade (Brosofske *et al*. 1997; Groom *et al*. 2011b; Kiffney *et al*. 2003). Sweeney and Newbold (2014, p. 576) concluded that riparian buffer widths of 66 feet can increase stream temperatures by about 3.6°F (2°C) as compared to a fully forested watershed. Conversely, no-cut buffers that were 151 feet wide (46 m) caused very small effects on stream shade (Groom *et al*. 2011a; Science Team Review 2008), and the effects on shade and temperature were minimal to undetectable for no-cut buffer widths of 151 to 227 feet wide (46-69 m) (Anderson *et al*. 2007; Groom *et al*. 2011a and b; Science Team Review 2008). The reduced shade impacts that were observed for the wider no-cut buffers were likely due to the incapability of the trees outside of those buffers to cast shadows beyond the respective buffers' widths (Leinenbach 2011). Although these studies focused on clearcutting, the results demonstrate that trees as far as 150 feet away from a stream can to contribute to the stream's shade. In addition to width, increased canopy density within the no-cut buffer appeared to reduce shading impacts, as did increased residual tree density outside of the no-cut buffers (Leinenbach *et al*. 2013).

Therefore, post-thinning stream shade is highly correlated with the width of no-cut buffers. However, the relationship between no-cut buffers and in-stream temperatures is quite variable, and can be affected by site-specific factors (Caissie 2006). Complicating factors include riparian forest structure and species composition, topography and channel aspect, stream size, substrate type, and discharge. The density of riparian vegetation also affects shade and thermal loading to a stream because the penetration of solar radiation is positively correlated with the number and the size of the gaps in the canopy and between the branches and stems (Brazier and Brown 1973, DeWalle 2010). In some instances, such as narrow streams with dense, overhanging streamside vegetation, or in stands where tree shadows fall away from the stream (i.e. along the north sides of northern latitude streams with an east-west orientation), no-cut buffers as narrow as 30 feet can maintain stream shade (Brazier and Brown 1973). Additionally, inputs of cold water from the streambed, seepage areas along the stream bank, and tributaries can help cool an affected stream if they are sufficiently large relative to the subject stream's discharge (Wondzell 2012).

The FS's proposed 100-foot no-cut buffer width for fish-bearing streams would provide only about 2/3 of the shade needed to protect against increased in-stream temperatures. Therefore, thinning done to within 100 feet of a stream would likely allow enough solar radiation to slightly increase the water temperatures in the adjacent streams, especially during the summer in stands where gap treatments abut buffers that are situated along the southern banks of east-west flowing streams. The amount of increase is uncertain. However, the information above supports the understanding that thinning within 100 to 150 feet of streams would cause detectable increases, and thinning within 66 feet of streams may increase in-stream temperatures by as much as 3.6°F (2°C), and thinning within 30 and 15 feet of a stream would likely increase temperatures above that.

In areas where thinning reduces the up-sun riparian buffer to 100 feet adjacent to listed fish habitat (LFH), elevated in-stream temperatures are likely to impact listed fish. The 30-foot buffer for non-fish bearing perennial streams would likely cause greater temperature increases. When those streams are in close upstream proximity to LFH, the increased in-stream temperatures may transfer downstream to LFH. Increased stream temperatures resulting from the 15-foot buffer for intermittent streams is less certain because some or all of those streams may be dry during the summer when the effects of solar radiation would be greatest. However, intermittent streams that are wet during the summer would likely experience relatively high increases in water temperatures, which depending on their distance upstream from LFH, may elevate the in-stream temperatures in downstream LFH. Further, project-related elevated in-stream temperatures would continue for decades after thinning, until the riparian vegetation recovers.

The downstream extent of detectable elevated water temperatures that would be attributable to the proposed action is uncertain, and is likely to be spatially and temporally highly variable. The issue is complicated by the high levels of uncertainty about stream reach specifics such as the amount of lost shade for exposed stream reaches, the existing temperatures and flow volumes in those stream reaches, and the temperatures and the flow volumes of downstream tributaries and receiving waters. In the absence of site-specific information, and/or information to the contrary, we estimate that elevated water temperatures that could be attributable to the project may extend as far as 2 miles downstream from any stream reach where thinning occurs within 150 feet of its banks. We acknowledge that this may slightly over-estimate the intensity of effects, but believe this estimate to be both reasonable and unlikely to underestimate the potential effects on listed species and critical habitats in the action area.

Road Work: In addition to thinning, project-related roadwork would cause the removal of some trees and understory vegetation. Tree and understory removal may occur during maintenance work on existing FS roads, and is likely to occur during the planned construction and/or reconstruction of 35 miles of temporary roads. Some tree and understory removal is also likely to occur during the construction and/or reconstruction of turnarounds, and during clearing work (daylighting) done to provide safe passage of logging trucks and other heavy equipment. It is likely that at least some of the tree and understory removal would occur within 150 feet of streams. Per the FS, about 200 yards of project-related road that is within 150 feet of streams overlaps with PS Chinook salmon-occupied habitat, about half of which is designated as critical habitat. About 0.89 miles of project-related road within 150 feet of streams overlaps with designated critical habitat for PS steelhead, about 0.74 miles of that is thought to be occupied.

As with thinning, roadwork-related tree removal that is done adjacent to streams may decrease stream shade. Because roadwork-related tree removal would occur in relatively small and widely scattered areas, the magnitude of its effect on stream temperatures would likely be smaller than thinning. However, it may cause slight, localized increased in-stream temperatures that could be additive to the effects of thinning, especially in areas where thinning and roadwork tree removals overlap. As with thinning, temperature impacts from this work would continue for decades until the vegetation recovers.

Water Drafting: Water drafting would be done at multiple unidentified locations along the mainstem of the SF Stillaguamish River and in some of its major tributaries. Because most roadwork would occur during the NOS, those withdrawals would most likely occur during summer low-flow periods. However, site selection and drafting work would comply with the protective measures detailed in the MOU between USFS and WDFW (USFS 2017a and b), which includes required measures such as isolating and screening pump intakes, and maintaining adequate in-stream flows for fish.

Water drafting would cause periodic temporarily reduced in-stream flows downstream from the withdrawal points. Reduced flows could increase the affected stream's susceptibility to solar-induced temperature increases, or reduce the stream's ability to cool downstream reaches that are exposed to the sun. The intensity of any flow reduction would depend largely on the existing stream flow, the withdrawal rate and volume, and the duration of the withdrawal. The predicted impacts of drafting on stream flows are undescribed by the FS. However, as described in a recent opinion for a similar action (NMFS 2018), the water trucks commonly used for this type of work hold about 500 gallons of water, and have maximum pump rates of about 7.5 gal/sec. At maximum speed, a drafting event would last about 67 seconds. However, at the lower rates that are commonly used, a drafting event would last a bit under 5 minutes. Given the expectation that water withdrawals would be relatively small, and both spatially and temporally separated, detectable flow reductions would be brief (about 5 minutes at most), quickly lost with downstream movement from the site, and of a magnitude too low to cause any detectable effect on in-stream temperatures.

Required In-stream Temperatures: Chinook salmon and steelhead require cool, well-oxygenated water within a relatively narrow range of temperatures. In general, juvenile and adult salmonids prefer water temperatures under 63º F (17º C). At temperature between about 64 and 72º F (18 and 22º C) ecological dominance transitions from salmonids to other species, and salmonids are typically eliminated from locations at temperatures above about 72 to 75º F (22 to 24°C) (Carter 2005). Chronic exposure (more than 7 days) to temperatures above 77º F (25º C) is considered the upper lethal limit for juvenile Chinook salmon. Exposure to temperatures between 70 and 75º F (21 and 23.9º C) is reported as being lethal for steelhead, including adults (Carter 2005).

Adult fall Chinook salmon typically migrate at temperatures between about 51 and 67º F (10.6 and 19.6º C). However, reduce migratory fitness occurs with prolonged exposure to temperatures above about 63º F (17º C), and temperatures above 70º F (21º C) cause avoidance behaviors that create a thermal barrier against migration for adult Chinook salmon and steelhead (Carter 2005).

The majority of Chinook salmon spawn at temperatures between 42 and 55º F (5.6 and 12.8º C). Pronounced pre-spawn adult mortality is reported in adult female spring run Chinook salmon when temperatures exceed 55 to 60º F (13 to 15.5º C), and decreased egg survival and inhibited alevin development is reported from females that spawned after exposure to those temperatures. Chinook salmon egg survival is highest between 39 and 54º F (4 and 12º C) (Carter 2005), with a sharp decrease in egg survival above 61º F (16°C) (Jager 2011). The preferred temperature range for steelhead spawning is between 40 and 55º F (4.4 and 12.8º C), with egg survival being highest between 41 and 50º F (5 and 10º C).

Optimal freshwater rearing and growth in juvenile Chinook salmon occurs at temperatures between about 50 and 60º F (10 to 15.6º C). Optimal freshwater rearing and growth in juvenile steelhead occurs at mean weekly average temperatures between about 55 and 63º F (13 to 17º C).

<u>Expected Effects:</u> During the summer, when project-related elevated in-water temperatures are most likely to occur, migrating adult Chinook salmon are likely to be present within the action area, and some individuals may spawn in the mainstem of the SF Stillaguamish River near the center of the project area. Also, rearing stream-type juvenile Chinook salmon and rearing juvenile steelhead may be present within portions of the action area year-round.

As described in the environmental baseline, summer in-stream temperatures near the center of the project area can already exceed 64.4° F (18° C). This temperature exceeds the threshold for decreased migratory fitness in adult Chinook salmon. It is above the thresholds for sharply decreased Chinook salmon egg survival, and it exceeds the ideal temperatures for optimal freshwater rearing of juvenile Chinook salmon and steelhead. Project-related tree loss is likely to cause slight but detectable temperature increases in occupied LFH where existing temperatures can already exceed thresholds for adverse effects. Therefore, project-related elevated temperature would adversely affect PS Chinook salmon and PS steelhead, and would likely continue to do so for decades until the vegetation recovers.

For both species, exposure to project-related elevated water temperatures is likely to reduce adult migratory fitness, which may also reduce spawning success (Carter 2005). Rearing juveniles may experience elevated stress, reduced growth, and increased susceptibility to disease that could reduce their likelihood of long-term survival (Marine 1992; Marine and Cech 2004; McCullough et al. 2001; Reeves *et al*. 1987). Exposed eggs and alevin may also experience reduced fitness and increased mortality (Jager 2011). The annual numbers of individuals of either species that may be adversely affected by project-related elevated temperature is unquantifiable with any degree of certainty. However, the action area is only sparsely populated by either species, the project overlaps with a very small amount of the occupied habitat within the action area, and detectable effects are not expected to extend more than 2 miles downstream from the impacted reaches. Therefore, the numbers of affected fish would comprise such small subsets of their respective cohorts, that their loss is unlikely to cause detectable population-level effects.

Suspended Sediment and Substrate Embeddedness

Increased in-stream suspended sediment and substrate embeddedness is likely to adversely affect PS Chinook salmon and PS steelhead. The proposed action components that are most likely to affect suspended sediment and substrate embeddedness are forest thinning and roads.

Suspended sediments in small streams is often highly variable, being strongly influenced by the underlying geology of a site. However, studies have documented increased sediment delivery following timber harvest and road work. Ground disturbance and subsequent erosion associated with timber harvesting, road work, and road use (timber hauling) can cause increased sediment transport to streams (Beschta 1978; Furniss *et al*. 1991; Gomi *et al*. 2005; Haupt 1959; Megahan 1987; McClelland *et al*. 1997; Robison *et al*. 1999; Swanson and Dryness 1975; Swanston and Swanson 1976). The increased sediments can degrade water quality and aquatic habitat conditions at multiple scales, including up to the watershed scale. The effects increase with increased road area and length of unbuffered stream reaches in headwater streams, and may persist for several years to decades following harvest (Gomi *et al*. 2005).

Forest Thinning: The planned forest thinning is described in the description of the proposed action and above under Stream Temperature. In summary, it would include the cutting of trees within about 3,770 acres of riparian reserves. Living tree roots help stabilize soil. Cutting trees kills the roots, which increases the probability of slope failure as those root decompose, particularly on steep slopes (Robison *et al*. 1999; Swanston and Swanson 1976). Depending on the intensity of the failure and its proximity to streams, slope failure can deliver large quantities of sediment to stream networks. The occurrence probability is related to the harvest type and intensity, soil properties, geology, unit slope, and precipitation level. When large areas are clearcut, the slope will become less stable over time as the tree roots decompose and their effectiveness in stabilizing the soils decreases. This effect may be reduced, and eventually offset in areas where enough trees are left scattered across the stand, because the remaining trees are likely to experience rapid growth from decreased competition and their increased root mass would improve their ability to stabilize the soils.

Timber felling and yarding disturbs soils and increases the potential for sediment transport to area stream channels. Logging alone does not appear to increase surface erosion significantly (Likens *et al*. 1970, Megahan *et al*. 1995). However, the use of heavy machinery to transport cut logs causes soil compaction, leading to increased surface erosion and increased fine sediment delivery to streams (Williamson and Neilson 2000). Yarding activities can disturb soils when the trees are dragged across the ground (Hassan *et al*. 2005; Rashin *et al*. 2006). Yarding practices that limit the damage to shrub and herbaceous ground cover, and reduce the exposure of bare soil can reduce sediment transport to streams. Full suspension skyline yarding is very effective because the logs are suspended above the ground throughout much or all of the yarding process. Lifting the heavy end of trees being yarded, and protecting skid trails with slash can also reduce soil impacts.

Sediment delivery to streams typically begins as overland sheet flow. Conduits such as skid trails, roads, ditches, rills, and/or gullies increase the probability of delivery by channelizing the flow (Bilby *et al*. 1989; Croke and Mocker 2001), particularly if riparian buffer strips are not left between disturbed areas and stream channels (Gomi *et al*. 2005; Rashin *et al*. 2006). Several studies document the importance of streamside buffer strips to reduce sediment delivery, and show that their effectiveness increases with the presence herbaceous vegetation and slash (Belt *et al*. 1992), and with increased width. Vegetated buffers of 40 to 100 feet wide are very effective against sediment transport (Burroughs and King 1989, Corbett and Lynch 1985, Gomi *et al*. 2005). Lakel *et al*. (2010) report that buffer widths of as little as 25 feet can reduce sediment transport to streams, and Rashin *et al*. (2006) concluded that a 33-foot wide vegetated buffer is likely to prevent sediment delivery to streams from about 95% of harvest-related erosion features. However, it is important to note that although buffer strips are generally less effective against channelized flows.

The 100-ft no-cut buffer for perennial fish-bearing streams would be very likely to prevent timber harvest-related sediment transport to those streams. The 30-foot wide no-cut buffer for non-fish bearing perennial streams would very likely be sufficient to prevent most timber harvest-related sediment transport to those streams, such that no detectable sediment transport to fish-bearing streams is expected.

The 15-foot wide no-cut buffer for intermittent streams would very likely be insufficient to prevent sediment transport to those streams. It is uncertain whether or not any increased sediment loading to intermittent streams would be transported downstream to LFH. However, no information has been provided to demonstrate sufficient spatial separation between LFH and intermittent streams that run through treatment stands, particularly those that are lower in the watershed where LFH occurs. Therefore, timber harvest-related sediment transport to intermittent streams may be sufficient to affect PS Chinook salmon and PS steelhead in downstream LFH.

<u>Roads:</u> The planned roadwork is described in the description of the proposed action, but in summary, it would include maintenance roadwork on about 59 miles of currently open FS road, reopening of about 29 miles of administratively closed FS road, and the reconstruction and/or construction of about 35 miles of temporary roads. Much of the 123 miles of project-related road is unpaved, and some or all of the roads would require some level of on-going maintenance work over the life of the project. Additionally, an unquantified number of landings would be reopened and/or constructed adjacent to these roads. Typical road work would include some combination of asphalt repair, rock-resurfacing, blading and shaping road surfaces, fill, roadside brushing, ditch clearing, bridge repairs, dust abatement, and tree removal. Most roadwork would be limited to the June 1 to October 15 NOS, but some maintenance work and hauling is expected to occur year round on some subset of these roads for about 15 years.

The currently open FS roads would remain open at the end of this project. The reopened FS roads would be administratively closed when no longer needed, but would remain on the landscape. The temporary roads would likely be open for no longer than two seasons, and would be reclosed/decommissioned when no longer needed for the project. Decommissioning of the 30 miles of temporary road that would be constructed on abandoned historic roads would include decompaction and/or outsloping of the road surface, application of mulch or slash over the surface, and seeding. The 3 to 5 miles of temporary road that would be constructed away from abandoned historic roads would be obliterated by some combination of culvert/ditch removal, installation of dips and water bars, de-compaction (i.e. scarification, ripping, etc.), and revegetation. In a review of sediment transport studies within recently-logged subbasins, Gomi *et al*. (2005) report that it may take 3 to 6 years after roads are closed before sediment loading from those roads return to baseline levels, and that landslides triggered by failed roads may occur as much as 20 years after harvest.

Sediment delivery to streams from the erosion of unpaved roads, cut-banks, and ditches is well documented (Gucinski *et al*. 2001; Croke and Mockler 2001; Johnson and Bestcha 1980; Madej 2001; Montogomery 1994; Reid *et al*.1981), ranging from chronic input of small amounts of fine sediments to catastrophic mass failures of roads during large storms (Gucinski *et al*. 2001). A road's design and placement on the landscape heavily influence its potential for sediment delivery to adjacent streams (Gucinski *et al*. 2001). Sediment delivery from surface erosion typically occurs through direct connections such as ditches, rills, or gullies (Bilby *et al*. 1989; Croke and Mockler 2001). Erosion rates can vary greatly, based primarily on surface material, traffic levels, storm intensity, and road slope (Bilby *et al*. 1989; MacDonald *et al*. 2001; Reid *et al*. 1981; Ziegler *et al*. 2001). Reid and Dunne (1984) reported that surface erosion of relatively well-maintained gravel forest roads on the Olympic Peninsula was heavily influenced by the intensity of traffic, especially by logging trucks. The authors reported that heavily used gravel roads generated up to 300 tons of sediment/mile/year, whereas lightly used gravel roads averaged about 6 tons, and abandoned roads averaged about 0.8 tons.

In a review of several sediment transport studies, Dube *et al*. (2004) found that sediment transport distances from forest roads ranged between 30 and 550 feet, with sediment moving less than 150 feet in most cases. To be conservative, they use an assumed sediment transport distance of 200 feet in the road surface erosion model they developed for the State of Washington. Based on the information in Dube *et al*. (2004), we believe that an estimated average sediment transport distance of 150 feet would be appropriate for this action, and protective of listed fish.

Therefore, where project-related roads are within 150 feet of streams, project-related roadwork and traffic (especially hauling) is likely to cause increased sediment loading in those streams every year of this 15-year project, and for years beyond. In a review of sediment transport studies within recently-logged subbasins, Gomi et al. (2005) report that it can take 3 to 6 years after roads are closed before sediment loading from those roads return to baseline levels, and that landslides triggered by failed roads may occur as much as 20 years after harvest.

The downstream extent to which elevated suspended sediments that would be attributable to the proposed action are likely flow is uncertain, and is likely to be highly variable, both spatially and temporally. The issue is complicated by high levels of uncertainty about road and stream reach specifics such as roadbed conditions, traffic type and volumes, the distance between the road and the stream, the existence of water control structures, and the type and density of vegetation that may separate the road from the stream. It is further complicated by variability in the amounts of precipitation that would mobilize the sediments and the adjacent stream's volume and flow rates.

In general, once mobilized, fine sediments tend to stay suspended for long distances within the relatively fast flowing waters of upper watershed streams. However, they eventually they settle to the streambed in areas where flows are sufficiently slow, or they may be diluted by the influx of additional water sources. Conversely, the influx of water from a tributary with high sediment loading may increase the suspended sediment concentration within a given stream. Without site- and storm-specific information, and/or information to the contrary, we estimate that elevated suspended sediments that could be attributable to the project may extend as far as 2 miles downstream from any stream reach that is within 150 feet of any project-related road. We acknowledge that this may slightly over-estimate the intensity of effects, but believe this estimate to be both reasonable and unlikely to underestimate the potential effects on listed species and critical habitats in the action area.

Per the FS, project-related FS roads cross streams at over 700 locations within the action area, and about 36 miles of project-related road is within 150 feet of streams (USFS 2019b). Of those roads, about 200 yards is adjacent to streams that are occupied by PS Chinook salmon, and about 1,300 yards is adjacent to streams that are thought to be occupied by PS steelhead. Additionally, about 5.8 miles of Chinook salmon-occupied/critical habitat, and about 5.5 miles of steelhead-occupied/critical habitat is within 2 miles downstream of areas where roads are within 150 feet of streams. Based on the information presented above, it is very likely that PS Chinook salmon and PS steelhead would be exposed to elevated suspended sediments that would be attributable to the proposed action.

<u>Expected Effects:</u> Exposure to action-related elevated suspended sediment and substrate embeddedness is reasonably certain to affect juvenile and adult Chinook and steelhead that occupy the action area. Exposure is most likely to occur annually over several months during the wet season, which overlaps with spawning, egg incubation, fry emergence, and rearing by stream-type juveniles. Exposure to elevated suspended sediment would likely include behavioral disturbances and possible injury, while substrate embeddedness may reduce spawning success and could reduce available forage for juveniles (Newcombe and MacDonald 1991).

Suspended sediments are often measured by the opacity it causes (turbidity) and/or by its concentration (total suspended sediments (TSS)). Turbidity is typically expressed in Nephlometric Turbidity Units (NTU), and TSS is typically expressed in milligrams per liter (mg/L). (mg/L). Depending on the particle sizes, NTU values roughly equal the number of mg/L (i.e. 10 NTU = ~ 10 mg/L TSS, and 1,000 NTU = ~ 1,000 mg/L TSS) (Campbell Scientific Inc. 2008; Ellison et al. 2010). Therefore, the two units of measure can be easily compared.

Water quality is considered adversely affected by suspended sediments when turbidity is increased by 20 NTU for a period of 4 hours or more (Berg and Northcote 1985; Robertson et al. 2006). The effects on fish exposed to suspended sediments are somewhat species and size dependent. In general, severity typically increases with sediment concentration and duration of exposure, and decreases with the increasing size of the fish.

Bjornn and Reiser (1991) report that adult and larger juvenile salmonids appear to be little affected by the high concentrations of suspended sediments that may be experienced during storm and snowmelt runoff episodes. However, empirical data from numerous studies report the onset of minor physiological stress in juvenile and adult salmon after one hour of continuous exposure to suspended sediment concentration levels between about 1,100 and 3,000 mg/l, or to three hours of exposure to 400 mg/l, and seven hours of exposure to concentration levels as low as 55 mg/l (Newcombe and Jensen 1996). The authors reported that serious non-lethal effects such as major physiological stress and reduced growth were reported for seven hours of continuous exposure to 400 mg/l and 24 hours of continuous exposures to concentration levels as low as about 150 mg/l.

No specific information is available to describe the intensity and duration of the turbidity plumes that are likely to be caused by the proposed forest thinning and runoff from project-related roads. However, over the life of this project, action-related elevated turbidity in occupied LFH is very likely to periodically exceed the lower thresholds identified by Newcombe and Jensen (1996), and occasionally also exceed higher thresholds. Further, the sediments would increase substrate embeddedness in areas where they settle out of the water. Again, no specific information is available to describe the intensity of the substrate embeddedness that is likely to be caused by the proposed actions. The distance of sediment travel, and the locations where sediments would settle out and accumulate would vary based largely on the relationship between stream morphology and in-stream flows that would be driven by the intensity of storm events. Embeddedness would likely be relatively high in stream reaches where flows tend to slow downstream of input points. Depending on the intensity of subsequent storm events, sediments may continue to accumulate in certain areas, or become remobilized and move farther downstream. Therefore, sediments that enter intermittent and perennial streams upstream from LFH, may eventually, if not immediately, reach that habitat including the steelhead spawning habitat in the lower portion of the action area.

Behavioral disturbance: Most exposed individuals would likely first respond to increased suspended sediments by attempted avoidance of the turbidity plume. For juveniles, the avoidance behavior may cause abandonment of preferred shelter and forage resources. Displaced juveniles may experience decreased growth and fitness and reduced likelihood of survival due to increased energetic costs caused by foraging in suboptimal habitat and increase intra-species competition. Displaced individuals may also experience increased exposure to predators. Juveniles that remain within the area of increased turbidity may experience reduced feeding efficiency due to reduced visibility. Depending on the intensity and duration of the elevated turbidity, the exposure could cause decreased growth and fitness and reduced likelihood of survival in some individuals.
Injury: Prolonged exposure to relatively low levels of suspended sediments can cause physiological stress in fish that may reduce growth rates and increase the susceptibility to disease exposed in exposed individuals. Exposure to high levels of suspended sediment can cause gill irritation or abrasion that can reduce respiratory efficiency or lead to infection. Compromised gill function would reduce fitness and may increase mortality. At very high levels, suspended sediments can clog gills, which may cause direct mortality. Although it is not likely that

suspended sediment concentrations would reach levels sufficient to kill or permanently injure exposed individuals, some rearing and migrating juveniles are likely to experience some level of reduced fitness that may reduce their likelihood of survival.

Reduced spawning success: Sediment-free rocks and gravel are critically important habitat for salmon spawning. Salmon eggs and alevins depend on a steady supply of well-oxygenated water flowing through the interstitial spaces between sediment-free gravels during the months-long period between spawning and the emergence of the fry from those gravels. Suspended sediments are likely to settle into the interstitial spaces between rocks and gravel when they eventually settle out of the water. High levels of sediment settling onto existing salmonid redds (nests), has the potential to fill-in the interstitial spaces between the gravel and smother the eggs or alevin within those redds. If sedimentation concentrations and/or persistence are high enough, the gravels may become embedded enough that the spawning habitat may be unavailable for future generations of returning adults.

Reduced forage: Small aquatic invertebrates, that are important forage resources for juvenile salmon, live in the well-oxygenated interstitial spaces between the rocks and gravel. Gravel embeddedness is likely to kill aquatic invertebrates in the areas where suspended sediments settle out of the water, and reduce forage availability within the affected reach. Reduced forage availability is likely to increase competition, and may reduce growth and likelihood of survival for some of the individuals that rear in the impacted reaches. Over time, gravel embeddedness may significantly reduce the affected reach's ability to support rearing juvenile salmonids.

It is most likely that the effects on adult Chinook salmon and steelhead that would be exposed to project-related elevated suspended sediments would be limited relatively mild behavioral effects such as avoidance of the plume and mild gill flaring (coughing) that would affect the fitness of the exposed individuals. Given their small size and relatively high sensitivity to the stressors described above, some of the rearing and migrating juvenile Chinook salmon and steelhead that would be exposed to project-related elevated suspended sediments are likely to experience behavioral and physiological effects that would reduce their overall fitness and may reduce their likelihood of survival. Additionally, it is reasonably likely, that some eggs and interstitial juveniles of both species may be injured or killed by sedimentation of gravels.

The annual numbers of individuals of either species that would be impacted by suspended sediments and substrate embeddedness is unquantifiable with any degree of certainty. However, given the relatively small amount of occupied habitat that would be affected, and the expectation that the density of either species within the action area is very low, the numbers of fish that would be annually affected by this stressor would comprise such small subsets of their respective cohorts, that their loss would cause no detectable population-level effects.

Chemicals and Nutrients

Exposure to project-related chemicals and nutrients is likely to adversely affect PS Chinook salmon and PS steelhead. Most project components, particularly forest thinning, road work, and timber hauling, involve the use of heavy equipment near streams. Many of the fuels, lubricants, and other fluids used by that equipment are petroleum-based fluids that contain Polycyclic

Aromatic Hydrocarbons (PAHs) and other substances that are known to be injurious to fish. Although the project includes PDCs intended to reduce the risk and intensity of discharges and spills, those measures would not eliminate the risk. Therefore, it is very likely that some contaminants would be leaked or spilled onto forest roads and landings by log trucks and other equipment, and onto the forest floor by the saws and other equipment used to cut and yard trees. Although direct discharge to the streams is relatively unlikely, toxic fluids are likely to enter the streams when the dusts and sediments that have absorbed the myriad drips and small spills are eventually carried to streams by runoff during the wet season.

Chinook salmon and steelhead can uptake contaminants directly through their gills, and through dietary exposure (Karrow *et al*. 1999; Lee and Dobbs 1972; McCain *et al*. 1990; Meador *et al*. 2006; Neff 1982; Varanasi *et al*. 1993). Many of the pollutants that may enter the water column due to project activities can cause effects in exposed fish that range from avoidance of an affected area, to reduced growth, altered immune function, and immediate mortality in exposed individuals. The intensity of effects depends largely on the pollutant, its concentration, and/or the duration of exposure (Brette *et al*. 2014; Feist *et al*. 2011; Gobel *et al*. 2007; Incardona *et al*. 2004, 2005, and 2006; Mcintyre *et al*. 2012; Meadore *et al*. 2006; Sandahl *et al*. 2007; Spromberg *et al*. 2015). Over the years-long life of this project, some juvenile Chinook salmon and/or steelhead are likely to be directly exposed to petroleum-based pollutants, and/or contaminated prey resources, at concentrations capable of causing reduced growth, increased susceptibility to infection, and increased mortality.

Timber harvest can cause a release of carbon, nitrogen, phosphorus, and sulfur through burning of slash and decomposition that may also reach stream through erosion and runoff (Vitousek 1983). Riparian buffers as small as 62 feet wide can decrease nutrient flow to streams by 48 to 95% (Jordan *et al*. 1993; Lowrance *et al*. 1984; Snyder *et al*. 1995). Based on this information, the planned 30-foot and 15-foot no-cut buffers will likely be inadequate to capture all project-related nutrient flow, and a small increase in nutrient flow to the streams is likely to occur.

The annual numbers of individuals that would be affected by exposure to chemical and nutrients is unquantifiable with any degree of certainty. However, based on the expected infrequency and small volumes of discharge, the relatively small amount of occupied habitat that may be affected, and the expectation that the density of either species within the action area is very low, the numbers of fish that would be annually affected by this stressor would comprise such small subsets of their respective cohorts, that their loss would cause no detectable population-level effects.

<u>Woody Material</u>

Reduced in-stream wood recruitment due to the proposed commercial thinning is likely to adversely affect PS Chinook salmon and PS steelhead. In-stream wood (tree trunks and root wads) enhances the habitat quality for salmonids. Riparian trees that die and fall into streams and/or their floodplains and wetlands influence stream channel complexity and stability. They help retain sediments, and create pools, undercut banks, and off-channel habitat. They deflect and slow stream flows and increase hydraulic complexity. They also stabilize stream channels, improve productivity, and provide cover for fish (Bilby and Bisson 1998; Bisson *et al*. 1987; Gregory *et al*. 1987; Hicks *et al*. 1991; Murphy 1995; Ralph *et al*. 1994).

Streamside wood recruitment to streams tends to be relatively even throughout a drainage network, whereas episodic landslides tend to create large concentrations of wood at tributary junctions. Streamside-derived wood can provide the largest key pieces to streams, and contribute to gravel storage that converts bedrock reaches to alluvial reaches, creates smaller, more numerous pools, and increases habitat complexity (Bigelow *et al*. 2007; Montgomery *et al*. 1996). Large wood in episodic landslides also contributes to habitat complexity and ecological productivity (Bigelow *et al*. 2007). It also reduces the speed and run-out distance of debris flows on valley floors (Lancaster *et al*. 2003). Both types of wood delivery are necessary for functioning and productive stream ecosystems.

Coarse sediment retention by wood is also important because it helps to create and maintain alluvial aquifers that help moderate stream temperatures through hyporheic exchange. Also, sediment storage in upstream reaches reduces the downstream transport of fine sediments that can embed gravels and smother redds. Wood and other obstructions attenuate peak flows, which reduces the movement of spawning substrate and bed scour that can destroy redds.

Empirical data and modeling studies suggest that streamside riparian wood input rates vary by stand type and age, but rates decline exponentially with distance from the stream (Gregory *et al*. 2003; McDade *et al*. 1990; Van Sickle and Gregory 1990). Studies indicate that about 95% of instream wood from streamside sources typically comes from distances within about 150 feet of the stream. Shorter distances may occur in young, short stands, while longer distances may occur in older and taller stands (Spies *et al*. 2013). Studies suggest that the 100-foot no-cut buffer would likely protect about 80 to 90% of existing wood recruitment. However, the 30-foot and 15-foot no-cut buffers would protect only about 40 to 50% and 20 to 30% of existing wood recruitment, respectively (McDade *et al*. 1990; Spies *et al*. 2013). Although the planned thinning may accelerate the growth of large diameter trees over the long term (Spies *et al*. 2013), it is likely to reduce wood recruitment to action area streams for the next 20 years or so.

The loss of in-stream wood is a primary limiting factor for salmonid production in almost all watersheds west of the Cascade Mountains (NMFS 2013b; ODFW and NMFS 2011). The FS BA reports that in-stream woody debris is currently "functioning at unacceptable risk" within the project area, and that the planned thinning would cause a "detectable and significant reduction in the number of trees available to be recruited to perennial and intermittent streams", which is supported by the information described above. The FS and NMFS both agree that it is likely that a proportion of those trees would have naturally transported downstream to occupied and/or designated critical habitat. The trees that would be removed would be 8 to 20 inches DBH. Although trees of this size may be too small to be retained in larger streams and rivers, they would likely have contributed positively to salmonid habitat quality within the action area.

The reduced wood recruitment of to the streams within the action area is likely to sufficiently reduce habitat quality for rearing juveniles such that some individuals would experience fitness impacts that may reduce their likelihood of survival. The reduced wood recruitment is also likely to reduce spawning habitat quality sufficiently enough to reduce the spawning success for some adults, and/or to cause the loss of some eggs and alevin. The annual numbers of individuals that would be affected by reduced wood recruitment is unquantifiable with any degree of certainty. However, based on the relatively small amount of occupied habitat that may be affected, and the expectation that the density of either species within the action area is very low, the numbers of fish and eggs that would be annually affected by this stressor would comprise such small subsets of their respective cohorts, that their loss would cause no detectable population-level effects.

Pool Frequency and Quality

Reduced pool frequency and quality due to the proposed action is likely to adversely affect PS Chinook salmon and PS steelhead. Pools are important habitat features for juvenile and adult salmonids because they often provide deep cool water that act as thermal refugia during periods of high in-stream temperatures. They also often provide pockets of reduced flow velocity that can provide shelter during high flow events.

The FS BA reports that the large pool habitat indicator is currently "functioning at risk" and that pool frequency and quality is "functioning at unacceptable risk" within the project area. Pool formation and quality, and stream width to depth ratios are directly related to the presence of in-stream wood and in-stream sediment distribution and flow. Both of these features are currently functioning "at risk" or "at unacceptable risk" within the project area, and the proposed action is expected to slightly worsen both features.

Reduced wood recruitment would negatively impact hydrological functions involved with pool formation as well as with the retention of sediments. Increased input of fine sediments would act synergistically with reduced in-stream wood, and would likely reduce pool depths due to in-filling. In areas where excessive sediment aggradation occurs, the stream channels could become wider and shallower. NMFS believes that these effects would be manifested across the watershed over several years as increased sediment loading continues to enter the streams, and the removed trees that may have eventually recruited to the streams would fail to enter the water to replace the current in-stream wood that is likely to migrated downstream over time.

The resulting reduction in pool frequency and quality within the action area is likely to sufficiently reduce habitat quality for rearing juveniles such that some individuals would experience fitness impacts that may reduce their likelihood of survival. The reduced pool frequency and quality may also sufficiently reduce habitat quality for migrating adults such that some individuals may experience reduced spawning success. The annual numbers of individuals that would be affected by reduced pool frequency and quality is unquantifiable with any degree of certainty. However, based on the relatively small amount of occupied habitat that may be affected, and the expectation that the density of either species within the action area is very low, the numbers of fish that would be annually affected by this stressor would comprise such small subsets of their respective cohorts, that their loss would cause no detectable population-level effects.

Changes in Peak and Base Flows

Changes in peak and base flows due to the proposed action is likely to adversely affect PS Chinook salmon and PS steelhead. Forest management activities, particularly timber thinning and forest roads, can affect the rate that water is stored or discharged within a watershed. They can increase both peak and base in-stream flows, and may also 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).

The intensity of flow change tends to diminish over time (Grant *et al*. 2008; Jones 2000; Jones and Grant 1996). Jones and Post (2004) report that the greatest flow increases due to thinning generally occur in the first 1 to 5 years after cutting. Moore and Wondzell (2005) estimate that flows generally recover to pre-harvest conditions after about 10 to 20 years, but Jones and Post (2004) report that significant flow changes have been detected in some Pacific Northwest forests up to 35 years afterward. Thinning typically increases total water yield due to reduced evapotranspiration (Duncan 1986; Harr 1976; Harr *et al*. 1975; Hetherington 1982; Jones 2000; Keppler and Zeimer 1990) and decreased water interception (Reid and Lewis 2007). Flow increases appear to be proportional to the amount of timber that is cut within the watershed (Bosch and Hewlett 1982; Grant *et al*. 2008; Keppler and Zeimer 1990).

Changes in peak flows are highly variable, but typically undetectable until about 20% of a basin is harvested. Grant *et al*. (2008) report no measurable flow changes when less than 19% of the watershed is clearcut. Stednick (1996) suggests that flow changes are not measurable when less than 25% of the watershed is clearcut. In catchments where 20 to 40 %of the trees were cut, peak flows increased 20 to 90% (King 1989; Troendle and King 1985). In another study, Van Haveren (1988) reported that 100% clearcutting resulted in a 50% increase in peak flow. Spence *et al*. (1996) recommend that for salmonid conservation, no more than 15 to 20% of a watershed be in a hydrologically immature state at any given time.

Much of the action area is located in the transient snow zone where rain-on-snow events are common in the winter months. Grant *et al*. (2008) concludes that watersheds located within the transient snow zone are the most sensitive to peak flow changes. The authors also report that altered flows are most detectable within small drainage areas (up to about 2,470 acres), with the ability to detect changes diminishing as the size of the drainage area approaches the sub-watershed scale because the magnitude of increase is typically less than the inter-annual variability. Grant *et al*. (2008) recommend using the equivalent clearcut area (ECA) within a sub-watershed as an index to determine if timber harvest may cause increased peak flows. Based on the information presented by Moore and Wondzell (2005), NMFS has used forested areas within the action area that were less than 20 years old as the index for ECA (i.e. hydrologically immature) to help assess expected impacts on peak and base flows.

Due to past timber harvests, about 10,900 acres of the 65,000-acre project area is covered by forest that are younger than 20 years (USFWS 2019), which equates to an existing ECA of about 17%. The FS BA reports that about 11% of the project area is hydrologically immature. The planned 840 acres of gap-thinning (roughly equivalent to clearcutting) could increase the ECA in the project area by about 1%. The remaining 7,560 acres of thinning may increase the ECA in the action area by an additional 12%. However the heavy and variable density thinning in those areas would retain up to 55% of the canopy cover. Therefore, the ECA increase from thinning in those acres would likely be less than 12%. Further, it is uncertain how much, if any, of the 8,400 acres to be thinned overlaps with the existing 17% ECA acreage. Based on the available information, and assuming no overlap, the planned thinning is likely to increase the ECA within the action area by about 7 to 13%.

In addition to ECA, forest roads can cause hydrologic effects that can increase in-stream flows. Roads that are directly connected to streams by drainage ditches, and overland flow from cross-drain culverts and stream crossings increase the amount of runoff directly to routed stream channels (Wemple et al. 1996). The existing road network within the action area is estimated at about 241 miles, with a road density of about 2.8 miles per square mile. The 35 miles of temporary road that would be constructed and/or reconstructed for this project would increase total road length and density by about 14 and 15%, respectively. Only a subset of the temporary roads would be located in areas where they might increase stream flows. Further, temporary road sections would be constructed only when needed, and then be decommissioned or obliterated afterward, likely after 1 or 2 seasons. As such, temporary roads are expected to only minimally increased in-stream flows. However, the ones that do affect in-stream flows may continue to do so for years after they are decommissioned, while the native vegetation regrows and natural hydraulic processes return to pre-project levels.

As described earlier, water drafting for road construction and fire protection would episodically cause very short-term and isolated minor decreases in in-stream flows. The magnitude of those withdrawals is not expected to cause any measurable effect on either of the mechanisms considered above that may cause changes in peak and base flows.

In summary, thinning coupled with the slightly increased drainage network associated with roads, could bring the project area ECA total to somewhere between about 24 and 30%. Because this would be above the 20% ECA threshold, the proposed action is likely to cause detectable increases in base and peak flows within the action area.

The degree to which increased flows would act independently and/or synergistically with increased suspended sediments and reduced in-stream wood to reduce habitat quality for Chinook salmon and steelhead is unknown. Exposure to the increased flows is likely to cause fitness impacts in rearing juvenile salmonids that must expend more energy to remain in within the action. It may displace some juveniles from preferred habitat, including forcing premature downstream migration at times that are suboptimal for growth and survival. Increased flows can cause fitness impacts in migrating adults that must swim against the flow, and it may increase in-channel substrate movement and scour that injure or kill developing eggs and alevins in redds (Hicks *et al*. 1991; Hooper 1973). The annual numbers of individuals that would be affected by increased flows is unquantifiable with any degree of certainty. However, based on the relatively small amount of occupied habitat that may be affected, and the expectation that the density of either species within the action area is very low, the numbers of fish and eggs that would be annually affected by this stressor would comprise such small subsets of their respective cohorts, that their loss would cause no detectable population-level effects.

Drainage Network Increase

The proposed action would slightly increase the drainage network within the action area through thinning, as well as by the construction or reconstruction of temporary roads, landings, and yarding corridors. As described above, particularly under the assessments of Suspended Sediment and Substrate Embeddedness and Changes in Peak and Base Flows, those project components, both individually and in combination, would increase the drainage network. That being said, any effects that the drainage network increase would have on listed species have already been captured and described in the assessments above, and they are not restated here.

Road Density and Location

The proposed action would temporarily increase the road density within the action area through the construction or reconstruction of 35 miles of temporary roads. No new permanent roads would be constructed as part of this project. As described under the assessment of Changes in Peak and Base Flows, the temporary roads would increase total road length and density within the action area by about 14 and 15%, respectively. Further, only a subset of those roads would be located in areas where they might affect aquatic habitat, and all temporary roads would be decommissioned or obliterated after about 1 or 2 seasons. As such, temporary roads would only contribute slightly to aquatic impacts. However, while the native vegetation regrows and natural hydraulic processes return to pre-project levels, their hydrological effects would continue at diminishing levels for years after they are decommissioned. As above, any effects that increased road density would have on listed species have already been captured and described in the assessments above, and they are not restated here.

Disturbance History and Regime

The proposed action would thin forest stands and conduct related work that would cause new disturbances that would add slightly to the disturbance history and regime within the project area. As described in the environmental baseline section above, the project area has a long history of disturbance from forestry and other land management activities, and the FS BA reports that the disturbance history and regime indicator is currently functioning at risk.

The effects of the proposed action on the disturbance indicators would be minor because: (1) The project is designed to reduce over-all canopy cover within thinned stands to no more than about 60%, which is considered the lower limit of hydrologically mature conditions; (2) Thinning would target relatively immature trees that are within previously disturbed stands; and (3) All new roads would be temporary, designed to minimize hydrological connections to the stream network, and they would be decommissioned or obliterated when no longer needed. Additionally, to the extent that the proposed action is successful in promoting future tree growth, the treated stands are expected to develop more late-seral characteristics that are more similar to historic forest conditions than the current environmental baseline.

As above, any effects that increased disturbance would have on listed species have already been captured and described in the assessments above, and they are not restated here.

Riparian Reserves

The proposed action would thin about 3,770 acres of riparian reserves that represent about 7% of the riparian reserves within project area. Over the near to midterm, the proposed action would adversely affect those riparian reserves by thinning within 100, 30, and 15 feet of stream banks, as well as by the construction or reconstruction of temporary roads, landings, and yarding corridors within some riparian areas. Over the long term, to the extent that the proposed action is successful in promoting future tree growth, the riparian reserves within treated stands are expected to develop more late-seral characteristics that are more similar to historic forest conditions than the current environmental baseline, including a general increase in the height and diameter of the trees within the riparian reserves.

As described above, under the assessments of Stream Temperature, Woody Material, Pool Frequency and Quality; Suspended Sediment and Substrate Embeddedness, and Changes in Peak and Base Flows, those project components, both individually and in combination, would reduce the amount and the quality of the riparian reserves within the project area. As above, any effects that the impacts on riparian reserves would have on listed species have already been captured and described in the assessments above, and they are not restated here.

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 Primary 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 is likely to adversely affect critical habitat that has been designated for PS Chinook salmon and PS steelhead. The essential PBFs of critical habitat for both species are listed below. The expected effects on those PBFs from completion of the planned project, including full application of the conservation measures and BMPs, would be limited to the impacts on freshwater PBFs as described below.

1. Freshwater spawning sites:
    a. Water quantity – The proposed action would cause long term minor adverse effects on water quantity. Forest thinning and road work would increase the ECA sufficiently to cause relatively small and localized increases in base and peak flows during the winter. Increased flows would be undetectable beyond project area boundaries, but may persist for up to 20 years after project completion. Water drafting during the NOS would cause very small, episodic, and very brief temporary decreases in water quantity that would be undetectable within yards downstream of the drafting site.

b. Water quality – The proposed action would cause long term minor adverse effects on water quality. Forest thinning and road work would cause slightly increased summer water temperatures that can already exceed 64.4° F (18° C) in some areas. Forest thinning, roads, and hauling would cause slightly increased input of fine sediments, and equipment leaks and spills would introduce low levels of petrochemicals into stream waters. Detectable effects are not expected to exceed 2 miles downstream of locations where thinning or roads are within 150 feet of streams, but may persist for up to 20 years after project completion.
c. Substrate – The proposed action would cause long term minor adverse effects on substrate. Project-related sediment increases may cause localized low-level substrate in-filling and embedment. Increased flows, combined with reduced woody debris may increase substrate movement and scour. Some of these effects may extend up to 2 miles downstream from locations where thinning or roads are within 150 feet of streams, persist for up to 20 years after project completion.

2. <u>Freshwater rearing sites</u>:
   a. Floodplain connectivity – The proposed action would cause long term minor adverse effects on floodplain connectivity. The roads that would be maintained and used as part of the proposed action, including some of the 35 miles of temporary road that would be opened, would prevent natural channel migration past them where they border and/or cross streams. Although not specifically identified or quantified by the FS, some of these locations are likely to be within designated salmonid critical habitat. Streambank armoring that protects those roads locks the physical conditions at the sites in a simplified state with reduced edge habitat features such as undercut banks and alcoves. It also prevents the formation of off-channel habitat at those locations. The altered hydrology at the site may also impact bank habitat forming processes within the nearest bends in the affected streams. Reduced wood recruitment due to the planned riparian thinning would also cause some deleterious effects on bank habitat forming processes and flood plain connectivity. The effects from reduced wood recruitment are likely to persist for up to 20 years past the end of the project. Road-related impacts would persist for the life of the roads, most of which are considered permanent.
   b. Forage – The proposed action would cause long term minor adverse effects on forage. Increased suspended sediment input would cause minor reductions in the production of aquatic macroinvertebrate prey organisms. Conversely, increased solar radiation reaching streams, and concurrent increased streamside understory vegetation, may increase the availability of macroinvertebrate prey organisms in some areas. Detectable effects would likely be minor and largely limited to in-stream areas immediately adjacent to sites where roads or thinning are within 150 of the stream, and no more than 2 miles downstream. However, the effects would persist for decades.
   c. Natural cover – The proposed action would cause long term minor adverse effects on natural cover. The maintenance of roadside bank armoring would permanently prevent the formation of edge habitat features such as undercut banks along their lengths. Reduced wood recruitment would slightly reduce the availability of in-stream wood, and the removal of bankside riparian vegetation in some areas would remove overhanging vegetation and in-stream leaf litter that can provide in-water cover. These effects would persist for decades.

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 long term minor adverse effects on obstruction and predation. Increased suspended sediments and increased summer water temperatures may delay or alter migration for some adults. Increased in-stream flows during the winter may prematurely displace some rearing juveniles. The forced early migration would, in effect, obstruct their continued rearing within the affected area. The maintenance of roadside bank armoring, especially if riprap is used, would provide conditions that are preferred by predatory species such as sculpins and trout, which would increase the risk of predation for juvenile salmonids. These effects would persist for decades.
   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 the consultation (50 CFR 402.02). 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.

The current condition of ESA-listed species and designated critical habitats within the action area are described in the Status of the Species and Critical Habitats and Environmental Baseline sections above. The contribution of non-federal activities to those conditions include past and on-going forest management, agriculture, urbanization, road construction, water development, 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 majority of the action area is within federal lands at the upstream end of the affected watershed catchment areas. However, the action area also includes a 1- to 1.5-mile wide strip of non-federal land that extends about 5 miles into the project area from the west, and includes a stretch of the SF Stillaguamish River and several small tributaries (Figure 1). Within the federal lands, the most common private activity likely to occur within the action area is unmanaged recreation, including fishing. Although the FS manages recreational activities to some degree (i.e., campgrounds, trailheads, off-road-vehicle trails), a considerable amount of dispersed unmanaged recreation 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.

Within the non-federal lands, future non-federal activities agriculture, forest management, mining, road construction, urbanization, water development, and recreation are all likely to continue and increase in the future as the human population continues to grow across the region.

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, agriculture, forest management, and urbanization 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 watersheds of 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.

Additionally, some continuing and future non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, all relevant future climate-related environmental conditions in the action area are described in the Environmental Baseline section (Section 2.4) because it is virtually 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.

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 (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 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 PBF 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 DO, 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 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 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. The PS Chinook salmon in the action area are fall-run fish from the SF Stillaguamish MPG. The abundance trend of this MPG is negative, and hatchery-origin spawners account for an ever-increasing proportion of the population such that they accounted for over half of the spawners in 2017, and all of the return in 2018 (WDFW 2019b). 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 project site is located in the SF Stillaguamish River sub-basin. The environmental baseline within the action areas has been degraded by the effects of past and on-going forest management, road building and maintenance, and recreational activities. However, the majority of the action area is within the SF Stillaguamish River watershed above Granite Falls, which was a natural barrier to upstream migration for PS Chinook salmon and most other anadromous fish until 1954 when a fish ladder was built. Therefore, the action area above the falls is not a historic source of production for this MPG, and upstream migration past the ladder has been marginal at best, due to persistent design problems that limit restrict fish passage. As such, the action area overlaps with a very small amount occupied habitat, near its extreme upstream end where the density of PS Chinook salmon is very low.

The proposed action would cause a combination of impacts that would slightly reduce the functional levels of habitat features within small stream sections across the action area. The effects would last over the 15-year life of the action, and are likely to persist at diminishing levels for up to about 20 years after the project is complete. 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 number of individuals that are likely to be injured or killed by the exposure to action-related stressors is unknown. However, the overlap with occupied habitat would be very small, and in locations where the density of PS Chinook salmon is very low. Therefore, the numbers of fish and eggs that would be annually affected by the proposed action would represent a very small 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 this MPG. 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 within the action area would most likely be from the SF Stillaguamish River Winter Run and the Canyon Creek Summer Run DIPs. The abundance trend of the SF Stillaguamish DIP is negative, and its viability is considered low. The likelihood of extinction within 100 years is considered high. The Canyon Creek DIP is a mixed stock of uncertain abundance. 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 site is located in the SF Stillaguamish River sub-basin. The environmental baseline within the action areas has been degraded by the effects of past and on-going forest management, road building and maintenance, and recreational activities. However, the majority of the action area is within the SF Stillaguamish River watershed above Granite Falls, which was a natural barrier to upstream migration for PS steelhead and most other anadromous fish until 1954 when a fish ladder was built. Therefore, the action area above the falls is not a historic source of production for the SF Stillaguamish River Winter Run DIP, and upstream migration past the ladder has been marginal at best, due to persistent design problems that limit restrict fish passage. As such, the majority of the action area overlaps with a very small amount occupied habitat, near its extreme upstream end where the density of PS steelhead is very low. However, because Canyon Creek joins the SF Stillaguamish River below the falls, it is a historic source of production for both DIPs. However, occupied habitat within Canyon Creek, including spawning, extends only slightly past the split between the creek's north and south forks.

The proposed action would cause a combination of impacts that would slightly reduce the functional levels of habitat features within small stream sections across the action area. The effects would last over the 15-year life of the action, and are likely to persist at diminishing levels for up to about 20 years after the project is complete. 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 number of individuals that are likely to be injured or killed by the exposure to action-related stressors is unknown. However, the overlap with occupied habitat would be very small, and in locations where the density of PS steelhead is very low. Therefore, the numbers of fish and eggs that would be annually affected by the proposed action would represent a very small 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 these DIPs. Therefore, the proposed action would not appreciably reduce the likelihood of survival and recovery of this listed species.

2.7.2 Critical Habitat

Critical Habitat for PS Chinook Salmon and PS Steelhead:

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, substrate, floodplain connectivity, forage, natural cover, and freedom from obstruction and excessive predation within about no more than 2 miles of locations where thinning or roads are within 150 feet of streams.

Based on the best available information, the scale of the proposed action's effects, when considered in combination with the degraded 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, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent actions, and cumulative effects, it is NMFS' 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

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 the following habitat impacts:

- Elevated water temperature,
- Increased suspended sediment and substrate embeddedness,
- Introduction of chemicals and increased nutrients,
- Reduced in-stream woody material,
- Reduced pool frequency and quality, and
- Increased peak and base flows.

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 habitat impacts. The distribution and abundance of 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. Therefore, the distribution and abundance of fish within the action area cannot be attributed entirely to habitat conditions. As such, NMFS cannot 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, NMFS knows of no device or practicable technique that would yield reliable counts of individuals that experience these impacts. In such circumstances, 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 acreage of riparian reserves to be thinned, the planned treatment limits, and the number of miles of road to be used in support of the project are the best available surrogates for the extent of take of PS Chinook salmon and PS steelhead from exposure to habitat impacts. These surrogates are applicable because an increase in any of them is likely to increase the amount of habitat that would be exposed to project-related impacts on the habitat indicators that were discussed in the Effects of the Action section and identified at the beginning of this subsection, and/or to increase the intensity of the impacts on those habitat indicators.

Increased riparian thinning acreage would cause thinning to occur in additional riparian areas, and/or reduced no-cut buffer widths. Thinning additional riparian areas would increase the amount of stream that would be exposed. Reducing the no-cut buffer widths would increase the intensity of the impacts, as would increasing the amount of gap and heavy-thin treatment within a stand. Increased road mileage, especially within riparian reserves, would likely increase the amount of stream that would be exposed. Exposing more habitat would likely expose more individuals, while increasing the intensity of the impacts would increase the severity of the effects on the exposed individuals, and it many also increase the number of exposed individuals because the downstream extent of effects may also be increased.

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

- Thinning of 3,770 acres within riparian reserves.

- Treatment within individual stands that consists of a combined total of no more than 10% Gap and Heavy Thinning, and a minimum of 10% Skipped area. The remaining area may be treated with General Thinning that would retain a minimum canopy cover of 55%. Minimum No-Cut buffers of 100 feet, 30 feet, and 15 feet would be applied to perennial fish-bearing streams, perennial non-fish-bearing streams, and intermittent streams, respectively.
- Maintenance and use of no more than 123 miles of road, to include the construction and/or reconstruction of no more than 35 miles of temporary road.

Exceedance of any 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 USFS has authority to conduct periodic compliance inspections and to 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, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to jeopardize the continued existence of PS Chinook salmon and PS steelhead, nor is it likely to destroy or adversely modify designated critical habitat for either of these species (Section 2.8).

2.9.3 Reasonable and Prudent Measures (RPM)

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

The USFS shall:

1. Minimize incidental take of PS Chinook salmon and PS steelhead from exposure to thinning-related habitat impacts.

2. Minimize incidental take of PS Chinook salmon and PS steelhead from exposure to road-related habitat impacts.

3. 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. The USFS or any applicant must comply with them in order to implement the RPM (50 CFR 402.14). The USFS or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. To implement RPM Number 1, Minimize incidental take of PS Chinook salmon and PS steelhead from exposure to thinning-related habitat impacts, the USFS shall require the timber sale purchaser to:
   a. Comply with the PDCs and mitigation identified in the USFS BA as well as all requirements of the MOU between WDFW and the USFS for the 2017-2021 HPA,
   b. Develop and comply with USFS-approved spill prevention and control measures commensurate with both equipment and oil and petroleum-based products that are used on-site. Measures shall include at a minimum:
      i. Maintaining all equipment operating on the project to conditions free of abnormal leakage of lubricants, fuel, coolants, and hydraulic fluid;
      ii. The timber sale purchaser shall not service tractors, trucks, or other equipment on National Forest lands where servicing is likely to result in pollution delivery to soil or water resources;
      iii. The timber sale purchaser shall furnish oil-absorbing mats and other certified containment and pollution prevention equipment and materials for application on-site for all stationary equipment or equipment being lightly serviced to prevent leaking or spilled petroleum-based products from contaminating soil and water resources;
      iv. The timber sale purchaser will confirm via USFS timber sale inspection use of spill prevention and control measures; and
      v. The timber sale purchaser shall remove from National Forest lands all contaminated soil, vegetation, debris or equipment or equipment generated product resulting from use, servicing, repair, or abandonment of equipment.
   c. Preform no Gap or Heavy-Thin treatments within 150 feet of any stream, and
   d. Maintain at least 100-foot spacing for skyline corridors over no-cut buffers.

2. To implement RPM Number 2, Minimize incidental take of PS Chinook salmon and PS steelhead from exposure to road-related habitat impacts, the USFS shall require the timber sale purchaser to:
   a. Comply with the PDCs and mitigation identified in the USFS BA as well as all requirements of the MOU between WDFW and the USFS for the 2017-2021 HPA,
   b. Develop and comply with USFS-approved spill prevention and control measures commensurate with both equipment and oil and petroleum-based products that are used on-site. Measures shall include at a minimum:
      i. Maintaining all equipment operating on the project to conditions free of abnormal leakage of lubricants, fuel, coolants, and hydraulic fluid;
      ii. The timber sale purchaser shall not service tractors, trucks, or other equipment on National Forest lands where servicing is likely to result in pollution delivery to soil or water resources;
      iii. The timber sale purchaser shall furnish oil-absorbing mats and other certified containment and pollution prevention equipment and materials for application on-site for all stationary equipment or equipment being lightly serviced to prevent leaking or spilled petroleum-based products from contaminating soil

and water resources;

   iv. The timber sale purchaser will confirm via USFS timber sale inspection use of spill prevention and control measures; and
   v. The timber sale purchaser shall remove from National Forest lands all contaminated soil, vegetation, debris or equipment or equipment generated product resulting from use, servicing, repair, or abandonment of equipment.

c. Construct no new landings or turnarounds within 150 feet of perennial streams or within 100 feet of intermittent streams,
d. Reconstruct no existing landings or turnarounds that are within 150 feet of perennial streams or 100 feet of intermittent streams without prior verification by a USFS hydrologist, soil scientist, or fisheries biologist, and
e. Limit road daylighting within 150 feet of any stream to the removal of problem braches and hazard trees, with prior verification by a USFS hydrologist or fisheries biologist required for any hazard tree removal. Brushing as part of both daylighting and reconstruction in road shoulder regions will be kept to the minimum needed for safe haul operations within 150 feet of any stream.

3. To implement RPM Number 3, implement a monitoring and reporting program to confirm that the take exemption for the proposed action is not exceeded, the USFS shall collect and report details about the take of listed fish. That plan shall:

a. Require the USFS to maintain and submit work logs commensurate with normal timber sale administration to verify that all take indicators are monitored and reported. When advantageous, the inclusion of maps, drawings, and photographs is encouraged. Minimally, the logs should include:
   i. A chronological record of work that identifies and/or describes the dates, location(s) (i.e. road number and mile marker(s), stand number(s)), and general type(s) of work (i.e. road construction/maintenance, cutting, yarding, hauling, etc.). It is assumed that some dates would include multiple types of work at multiple locations. Each should be appropriately described.
   ii. The nearest stream. Give its name if applicable, and describe it (perennial/intermittent, fish-bearing, expected/confirmed listed fish, critical habitat, etc.) and its distance from the work.
   iii. For road-related work (roads, turnarounds, bridges, etc.):
      1. Briefly identify/describe the work (i.e. daylighting, grubbing, grading, rocking, paving, bridge repair, embankment repair, etc.);
      2. Document USFS site inspections and/or condition verifications;
      3. Identify the BMP and conservation measures that were applied and describe their efficacy; and
      4. Summarize discrete projects when work is completed (i.e. when construction/obliteration of a specific temporary road segment is complete, at the end of resurfacing a system road segment, when a turnaround is complete, etc.). Include total road length and briefly describe the end conditions.
   iv. For thinning-related work:
      1. Briefly identify/describe the work (landing construction, treatment type, yarding type, loading, hauling, slash management, etc.);

2. Identify the no-cut buffer(s), BMP, and conservation measures that were applied and describe their efficacy;
3. Summarize the thinning within each stand when treatment is complete. Quantify the number and size(s) of the Gap and Heavy Thin areas;
4. Describe the locations of the Gap and Heavy Thin areas relative to the nearest stream and to each other;
5. Quantify the total acreage and percentage of each treatment type relative to the stand size; and
6. Describe the retained canopy cover within the General- and Heavy-Thin areas, and for the stand overall.

b. Require the USFS to establish procedures for the submission of logs, maps, photographs, and other pertinent documentation, which will be submitted in annual monitoring reports to NMFS.

c. Require the USFS to implement an inspection plan commensurate with normal timber sale administration verify compliance with the terms and conditions of this opinion. Minimally:
   i. The USFS shall conduct a monthly average of 4 work site inspections, that will include the spectrum of stand treatments, roadwork, and associated hauling actions;
   ii. The USFS shall verify, as needed, any near-stream landing and/or turnaround reconstruction or hazard tree removal; and
   iii. The USFS shall document the date, type of inspection, location, type of work site, and the results of the inspection.

d. Require the USFS 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-2018-00029.

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 USFS should implement a water quality monitoring plan for the Upper SF Stillaguamish watershed that would be designed to detect the intensity and downstream extent of project-related in-stream increased temperature, suspended sediment and substrate embeddedness, and petrochemicals.

2.11 Reinitiation of Consultation

This concludes formal consultation for the U.S Forest Service' South Fork Stillaguamish Vegetation Management Project in Snohomish County, Washington. As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat that was not considered in this Opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

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

Section 305(b) of the MSA directs Federal agencies to consult with 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 NMFS to recommend measures that can be taken by the action agency to conserve EFH. The analysis that follows is based, in part, on the description of EFH contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The waters and substrates of the South Fork Stillaguamish Vegetation Management Project's action area are designated as freshwater EFH for Pacific Coast Salmon, which include Chinook, coho, and pink salmon. This EFH is identified and described in Appendix A to the Pacific Coast salmon fishery management plan (PFMC 2014).

3.2 Adverse Effects on Essential Fish Habitat

The ESA portion of this document (Sections 1 and 2) describes the adverse effects of the proposed action on ESA-listed species and critical habitats, and is relevant to the effects on EFH for Pacific Coast Salmon. Based on the analysis of effects presented in Section 2.5, the proposed action will cause small scale long-term adverse effects on EFH for Pacific salmon through direct or indirect physical and chemical alteration of the water and substrate. It would also alter habitat conditions at the sites in a manner that slightly alters migratory behaviors and reduces natural cover and forage resources for juvenile salmonids. It may also increase the risk of predation.

3.3 Essential Fish Habitat Conservation Recommendations

Implementation of the following conservation recommendation would minimize adverse effects on EFH for Pacific Coast Salmon that are likely to result from the proposed action.

1. The USFS should require the timber sale purchaser to develop and comply with Spill Prevention Control and Countermeasure Plan (SPCCP) regardless of the total volume of the material they would have on-site, and to obtain a USFS approval of that plan prior to the commencement of any work on the national forest.
2. The USFS should prohibit the timber sale purchaser from conducting Gap and Heavy-Thin treatments within 150 feet of any stream.
3. The USFS should require the timber sale purchaser to maintain at least 100-foot spacing for skyline corridors over no-cut buffers.
4. The USFS should prohibit the timber sale purchaser from constructing new landings or turnarounds within 150 feet of perennial streams or within 100 feet of intermittent streams.
5. The USFS should prohibit the timber sale purchaser from reconstructing previous landings or turnarounds that are within 150 feet of perennial streams or 100 feet of intermittent streams without prior verification by a USFS hydrologist, soil scientist, or fisheries biologist.
6. The USFS should require the timber sale purchaser to limit road daylighting within 150 feet of any stream to the removal of problem braches and hazard trees, with prior verification by a USFS hydrologist or fisheries biologist required for any hazard tree removal.

3.4 Statutory Response Requirement

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

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

3.5 Supplemental Consultation

The USFS 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 user of this Opinion is the USFS. Other users could include WDFW, the government and citizens of Snohomish County, and Native American tribes. Individual copies of this Opinion were provided to the USFS. 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.

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