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-2019-03487

April 23, 2020

Ms. Gina Owens
Forest Supervisor
Gifford Pinchot National Forest
501 E. 5th Street # 404
Vancouver, Washington 98661

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Kraus Ridge Vegetation Management and Restoration Project in the Cowlitz Valley Ranger District (Lewis County, Washington, Cispus River, HUC8: 17080004)

Dear Ms. Owens:

Thank you for your letter of November 14, 2019, 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 Kraus Ridge Vegetation Management and Restoration Project. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016).

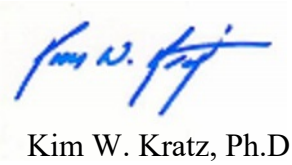
Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA)(16 U.S.C. 1855(b)) for this action.

In this opinion, we conclude that the proposed action is not likely to jeopardize the continued existence of Lower Columbia River (LCR) Chinook salmon (*Oncorhynchus tshawyscha*), LCR coho salmon (*O. keta*) or LCR steelhead (*O. mykiss*) or result in the destruction or adverse modification of their designated critical habitat.

As required by section 7 of the ESA, we are providing an incidental take statement with the opinion. The incidental take statement describes reasonable and prudent measures we consider necessary or appropriate to minimize incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements that the USFS and any person who performs the action must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA take prohibition.

Please contact Joshua Ashline of the NMFS Oregon Washington Coastal Office, located in Lacey, Washington, at 360-753-9456 or by email, Joshua.Ashline@noaa.gov, if you have any questions concerning this section 7 consultation or if you require additional information.

Sincerely,



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

cc: Greg Robertson
Ken Wieman
Dave Olson

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

Kraus Ridge Vegetation Management and Restoration Project
Cowlitz Valley Ranger District

NMFS Consultation Number: WCRO-2019-03487

Action Agency: United States Forest Service: Gifford Pinchot National Forest

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Lower Columbia River (LCR) Chinook salmon (*Oncorhynchus tshawyscha*)	Threatened	Yes	No	Yes	No
LCR coho salmon (*O. kisutch*)	Threatened	Yes	No	Yes	No
LCR steelhead trout (*O. mykiss*)	Threatened	Yes	No	Yes	No
Southern Resident killer whale (*Orcinus orca*)	Endangered	No	No	No	No

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

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

Issued By:

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

Date: April 23, 2020

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1. INTRODUCTION

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

1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et. seq.), 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 (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the Portland, Oregon office.

1.2 Consultation History

The action agency for the proposed timber sale is the United States Forest Service (USFS), which manages the Gifford Pinchot National Forest (GPNF). The proposed action takes place in the Lower Cispus River (HUC8: 17080004) watershed located in Lewis County, Washington. The Lower Cispus Rivers and its tributaries are spawning, rearing and migration critical habitat for Lower Columbia River (LCR) Chinook salmon, LCR coho salmon, and LCR steelhead, and are Essential Fish Habitat (EFH) for Chinook and coho salmon.

- The USFS and NMFS conducted a site visit on November 2, 2018.
- The USFS prepared the Biological Assessment (BA) and provided NMFS with a draft BA to review on July 17, 2019.
- The USFS hosted a Level 1 meeting with NMFS and the USFWS to review the BA on July 31, 2019.
- The USFS addressed NMFS and USFWS comments and provided the final BA with a request to initiate consultation to NMFS on November 14, 2019.
- NMFS requested no other additional information about or modifications to the proposed action and initiated consultation on December 16, 2019.

NMFS used the following information sources and documents from the action agency to make its determination; the BA provided by USFS, Status of Species summaries prepared by NMFS from papers and reports listed in the References section of this Opinion, the Washington

Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plan (NMFS, 2013b) and other scientific books, papers and reports listed in the References section of this opinion.

1.3 Proposed Federal 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). For the EFH response following this Opinion, Federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910).

The USFS proposes to award a contract under the Forest and Rangeland Renewable Resources Planning Act of 1974 (88 Stat 476) (16 U.S.C. 1600 et. seq.) to harvest timber within 120 units including: administratively withdrawn areas (AWA)[1]; matrix[2]; and, late successional reserves[3] (LSR) and private lands totaling 3,117 total acres in the Lower Cispus watershed and a small portion of the Middle Cispus watershed. Figure 1 represents the distribution of the harvest units relative to the major streams in these watersheds. The Kraus Ridge Vegetation and Restoration Project includes three primary project elements including: (1) Vegetation management (harvest), (2) Haul activities (transport from landing to mill) and (3) Transportation system management (construction and repair of roads for haul activities). Below each primary project element is described in detail, and includes a comprehensive list of Project Design Criteria (PDC) to minimize effects to ESA listed species and their designated critical habitats.

Vegetation Management

The commercial harvest contract includes three prescriptions including: (1) commercial thinning[4] of 2,911 acres; (2) even age regeneration harvest of 118 acres, and; (3) huckleberry enhancement on 105 acres.

Commercial thinning of trees with the lowest canopy position, to promote densities which optimize stand volume growth, is proposed on 2,911 acres of matrix LSR and outer riparian reserve forest. Even age regeneration with green tree regeneration on 118 acres of matrix will remove all but nine trees per acre greater than 6 inch diameter (at breast height), and leave 15 percent of the stand area unharvested. Harvested areas of stands will be planted with approximately 435 trees per acre using a mixture of Douglas-fir, noble fir, western red cedar, and western white pine. Huckleberry enhancement will occur on 105 acres of AWA to encourage huckleberry growth. Trees will be thinned from the understory until approximately 15-30 percent residual canopy cover remains.

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[1] Areas set aside from timber harvest production to protect fragile soils, watersheds, fish, wildlife, recreation or scenic values.

[2] Large, unfragmented patches of forest designated for timber production that represent all landscape types and that are resistant, resilient and persistent over time.

[3] The network of existing old-growth forests that are retained in their natural condition with natural processes, such as fire, allowed to function to the extent possible

[4] On Matrix, trees would be thinned from below, where the trees with the lowest canopy position are removed first; this would leave canopy cover over 40-60% of the stand. On LSR, trees would be thinned from below and utilize "skips", areas where no harvest would occur, and "gaps", areas where all trees are removed; this would leave canopy cover over 40-50% of the stand.

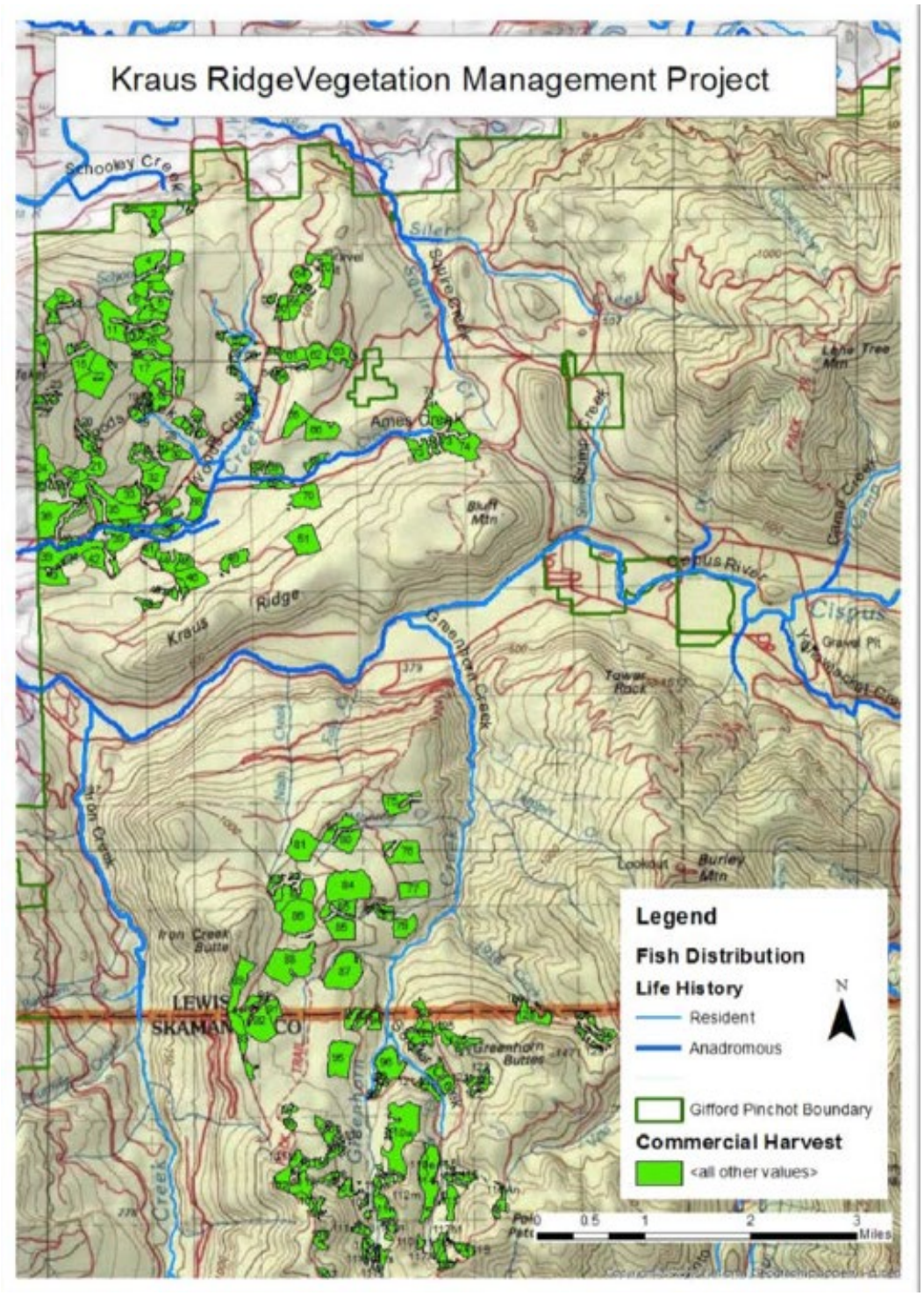

Figure 1. Location of harvest units in relation to streams for the Kraus Ridge Vegetation Management project (Figure produced by USFS).

Some commercial thinning units include outer riparian reserve buffers around streams and wetlands. The inner and outer riparian reserve widths for anadromous (Class I), resident fish bearing (Class II), perennial non fish bearing (Class III) and intermittent non fish bearing (Class IV) streams are shown in Table 1.

Table 1. Inner and outer riparian reserve widths for Class I, Class II, Class III and Class IV streams

Fish	Class	Limited by	Inner Riparian Reserve (feet)	Outer Riparian Reserve (feet)	Total Riparian Reserve (feet)
Anadromous	I		240	120	360
Resident	II		180	180	360
Permanent non fish bearing	III	Streambank Erosion	180	0	180
		High Temperature	90	90	180
		Lack of Large wood	120	60	180
Intermittent non fish bearing	IV	Erosion	180	0	180
		Large wood	120	60	180
		Connectivity	90	90	180
		Other	60	120	180

The inner riparian reserve of Class I and Class II streams will not be harvested. Skyline, ground based, and helicopter yarding methods will be used in outer riparian reserve selective thinning. Trees will be directionally felled to lead away from the stream. Ground based yarding equipment will only be allowed on predesignated skid roads at times when soils are not prone to compaction (see PDC below). Skid road soil productivity[5] loss will be limited to 20 percent or less of the activity area. No skid roads are allowed in the inner Riparian Reserve. Skyline yarding systems will be used in areas inaccessible to ground based yarding or high risk of surface erosion or mass wasting. Twelve-foot-wide cable corridors with full suspension will be allowed across riparian reserves where necessary so that no trees will be dragged through streams. Prior harvest skyline corridors will be reused if possible. A full list of PDCs for vegetation management are as follows:

1. Ground-based machinery will not be operated where soil water content is high enough to cause detrimental puddling, defined as when the depth of ruts or imprints is six inches or deeper, for 10 feet or longer. The objective is to limit the degree of detrimental soil rutting and puddling as well as reduce the potential for sediment delivery to streams.

2. Mechanical harvesters, when traveling away from approved skid trails or roads will operate on a slash mat of limbs and tops as thick and continuous as practical, and plan to make as few trips as possible. This equipment shall not travel while bearing weight of trees (i.e., skidding), except minimal amounts at ends of skid trails to reduce soil disturbance by skidders. The objective is to limit soil compaction and displacement in productive soils, protect the topsoil for vegetative growth, and provide water infiltration.

[5] The capacity of soil, in its normal environment, to support plant growth

3. Areas of gouging or soil displacement resulting from logging systems will be treated to prevent rill and gully erosion and potential sediment delivery to stream courses. Off road trails used for equipment fueling and servicing will be rehabilitated post use by moving soil back to natural hillslope contour (re-contour) and placing slash or vegetation on exposed mineral soils. Steep slopes will not be de-compacted to prevent further soil disturbance on steep slopes. Erosion control treatment may include, but is not limited to, repositioning displaced soil to restore the hillslope contour of disturbed sites, creating small ditches or diversions to redirect surface water movement, and scattering slash material to create flow disruption and surface soil stability. Erosion control measures will be implemented prior to onset of the wet season. The objective is to prevent surface soil erosion resulting from ground disturbance.

4. Forest Service will approve landings, skid trails, and skyline corridors prior to timber felling. Skid trails must be located outside of all no harvest buffers, unless otherwise specified in unit specific project design features, where resource specialists have approved and marked a crossing. Skid trails will be spaced approxmiately150 feet apart. Skid trails will be re- established at previous road or trail locations, except where existing trails from prior entry would cause detrimental soil or hydrologic conditions that could be further avoided with alternative skid trail location. Skid trails will be re-compacted after use where compaction related to the project remains, with exceptions identified by the Forest Service. The soil profile will be shattered to the depth of soil compactions, the surface soil (topsoil) will not be mixed with deep soil layers, and available logging slash will be placed across the de-compacted surface. This measure will be accomplished immediately following logging activities.

5. Temporary roads will be located where past logging roads were located. If a new location would cause less resource effects than using an existing temporary road, then the newer road with less resource effects will be used to harvest the unit with line officer approval, who will work with an aquatics or soils resource specialist. Rock will be applied only where needed to reduce erosion, puddling, and compaction. Rock will be removed, and road will be de-compacted following harvest activities (see mitigation measure below which requires de-compaction). The objective is to promote well loosened substrate for vegetative growth and water infiltration following logging and harvest activities.

6. Landings will be located where past landings were located, unless a new location would cause fewer resource effects, or if no past landings were used to harvest the unit. New landings will be located outside of all no harvest buffers. Landings will be limited to the area needed for safe and efficient yarding and loading operations and have proper drainage. Certified weed free erosion control catchments or silt fences will be used to avert sediment transport in road ditches and streams. The catchments will be located to intercept runoff from the landing prior to reaching any stream.

7. Temporary roads and landings will be closed and restored after harvest and related activities are complete. Temporary roads and landings that were established for the timber sale will be de- compacted to the entire depth of compaction, for an uneven, rough surface without furrows, and be accomplished immediately following logging activities. De-compaction will encompass the entire landing and the sight distance (to discourage a bypass) from the beginning of the road, no less than 200 feet. The rest of the road will have drainage reestablished. Available logging slash will be placed across the de-compacted surface. No ground-based equipment will be operated on de-compacted portions of roads and landings completed to prevent re-compacting them. Post-harvest motorized access to temporary roads will be prevented. Closure to vehicles will prevent restored areas from being re-compacted, allow vegetation to develop, and curb erosion and sediment delivery. The objective is to rehabilitate areas compacted during management activities, accelerate recovery of compacted soils, and facilitate water infiltration and re- vegetation disturbed areas. These measures will also provide ground cover for exposed soils in order to reduce the potential for offsite erosion and maintain soil organic matter to prevent nutrient and carbon cycle deficits.

8. Forest Service will periodically monitor ground-based activity on steep slopes to prevent or rectify resource damage that may occur by mechanical cutting and harvesting machines. Resource damage includes forming of ponds, ruts, or rills; culvert blockages, stream channel instability, and the occurrence of scour or sediment transport and deposition downstream of cross drains. Project activities will be suspended, and corrective action taken before work resumes if resource damage is occurring. The objective is to minimize erosion and potential sediment delivery to streams.

9. Mechanical harvesters and feller benchers shall be allowed on slopes up to 35 percent and approved on a unit by unit basis on slopes up to 45 percent prior to start of operation. Mechanical cutting and harvesting machines will not operate over erosive soils on slopes greater than 35 percent. The objective is to limit soil compaction and displacement, to protect the topsoil for vegetative growth, and provide water infiltration. Mechanical cutting and harvesting machines will:
    a. Not exceed limits on slope steepness, measured by percent slope (not grade of a trail/road). Slope maximum limit for harvesters is 45 percent, when approved on a unit by unit basis, including short steep pitches.
    b. Equipment traveling on forest soils greater than 35 percent must avoid uphill and across the slope travel. Only travel downhill on steep slopes, when traveling off approved skid trails or roads, and reduce or eliminate turning and traveling across the slope to minimize soil gouging.
    c. Operate on a slash mat of limbs and tops as thick and continuous as practical, as described above.
    d. Avoid carrying logs (skidding) as described above, if traveling on forest soils greater than 30 percent (steepness).

e. Do not enter riparian no harvest Riparian Management Zones (RMZ's) and unstable slopes.

10. Over the snow operations: Ground-based equipment can operate on snow which is at least 2 feet deep, or a combination of 3 to 4 inches of compacted snow and soil frozen to at least 6 inches in depth. Operations shall cease where snow or frozen conditions do not provide protection, for example, if it rains heavily and the soil and snow become saturated. As an indicator, overnight temperatures should be less than 25 F^0; afternoon daytime temperatures should not exceed 35 F^0. The objective is to limit the degree of detrimental soil rutting and puddling on wet soils as well as reduce the potential for sediment delivery to streams.

11. Temporary road construction will avoid unstable slopes identified in soil specialist report, unless otherwise specified in unit-specific project design features. Consultation with a soil scientist or geologist will allow some timber harvest in low to moderate risk areas using sale design, light to regular thin prescriptions that retain greater than 50 percent canopy cover, and careful road location. No-cut buffers encompassing the entire NW Forest Plan Riparian Reserves will exclude highest risk areas from road building and vegetation management. The objective is to identify and avoid highly unstable areas and implement timber harvesting techniques least damaging to natural slope stability.

12. Harvested trees will be felled away from streams, wetlands or other riparian reserve features. Exceptions would be trees which are leaning towards the creek, or when conditions would not allow safe felling. Any portion of a felled tree that lands in the no cut buffer will be left on the ground. The objective of this measure is to prevent damage to riparian vegetation and soils within Riparian Reserves.

13. One-end log suspension will be required for ground-based and cable yarding systems except during winching or lateral yarding. No yarding is permitted over class I, II, III, or IV streams. This will reduce the risk of soil compaction and displacement from dragging entire logs along the ground. The objective of this measure is to minimize erosion and potential sedimentation.

14. All ground-based equipment will be confined to pre-approved non-system roads, skid trails and landings during yarding and brush disposal operations. Non-system roads will not be constructed within the inner riparian reserves, and only on pre-approved skid trail in the outer riparian reserve. Skid trails will be spaced approximately of 150 feet apart for tractors and 400 feet apart for loaders. When possible, non-system roads and skid trails will be reestablished at previous skid trail locations rather than constructing new ones. Landings, non-system roads, skid trails and skyline corridors will be approved by the sale administrator prior to timber felling. The objective of this measure is to

minimize the extent and the degree of soil damage, displacement, and disturbance, and to allow sediment filtration.

15. Designated non-system roads and skid trails will not be permitted on slopes greater than 30 percent. Proposed exceptions to this restriction must be pre-approved by the sale administrator in consultation with the soil scientist or aquatic specialist and must be documented in project file. The objective of this measure is to limit the amount of erosion, soil compaction and displacement associated with use of equipment on steep slopes.

16. Upon completion of harvest, non-system roads will be treated with cross-drains (also called water bars), constructed to shed surface water and will be installed every 150 feet or more frequently where slopes exceed 5 percent, and installed every 100 feet when slopes exceed 15 percent. Available logging slash will be placed across the subsoiled road landing surface. (Acceptable seed mix; type of weed free mulch; and application rates will be specified by a qualified specialist). Post-harvest motorized access to non-system roads will be prevented by construction of an approved closure device (e.g., construction of a 4-foot high earth berm at the entrance to the road or landing and roughen road surface). Closure to vehicles is required to prevent treated areas from being re-compacted, reduce disturbance and to allow vegetative ground cover to develop. The objective of this measure is to facilitate water infiltration and revegetation on those disturbed areas.

17. Non-system road construction level will be kept to a minimum. Rock will be used only when necessary to reduce erosion, puddling and compaction on landings and non-system roads, and applied only where needed as "spot rocking". Rock will be removed and/or be incorporated into the roadbed by ripping or scarification following harvest activities (see mitigation measure which requires subsoiling). The objectives are to reduce the extent of soil damage and to allow suitable substrate for vegetative growth and water infiltration following logging and harvest activities.

18. Temporary culvert and bridge installation (applies to structures in place a single summer or less) shall meet WDFW MOU design criteria including provisions as follows:
    - All road drainage structures (e.g. culverts) in fish bearing streams will provide fish passage.
    - Designed to pass all anticipated flows, sediment and wood if left in place only during the dry season (July 1-Oct 1). See criteria for permanent structures if left in place during winter flows (Oct 1-July 1)
    - Imported fill removed upon completion unless it mimics the natural substrate
    - Affected streambed and banks resorted to pre-project condition
    - Construction sites dewatered and isolated

Temporary structure to remain in place only during the MOU prescribed work window. The objective of this measure is to provide temporary transport function and channel longitudinal connectivity.

19. Permanent culvert installation culvert and bridge installation (applies to structures in place a more than one year) shall meet WDFW MOU design criteria including provisions as follows:
    - All road drainage structures (e.g. culverts) in fish bearing streams will provide fish passage.
    - Designed and installed based on stream simulation standards which mimic natural channel characteristics.
    - Culverts designed to accommodate 100-year flood events (Q100).
    - Construction site dewatered and isolated
    - Culverts designed, installed and maintained to avoid negative channel changes (e.g. scour, and erosion)

    The objective of this measure is to provide temporary transport function and channel longitudinal connectivity.

20. All currently closed system roads used for the Project will be closed and stabilized or decommissioned after sale activities have been completed. The roads will be left in a self- maintaining condition with features as follows: place a barrier at the junction with the existing road system adequate to prevent off road vehicle use, construct cross-ditching on steep-gradient sections and at culverts or other drainage locations. The objective of this measure is to prevent chronic ground disturbance, reduce compaction and help restore hydrologic and biological process.

21. In units with ongoing harvest activities roads will be treated prior to the wet season (typically Sept 30- July 1). Wet season road treatment shall include, cross drains and grade breaks which will be installed on all non-system roads, skid trails, landings, and skyline corridors. Erosion control planting and mulch may be required where necessary. The objective of this measure is to reduce risk of soil displacement through rill, gully and splash erosion processes.

22. Spill containment and prevention will follow contract language specified standard timber sale contract language specified in GT.3.4 Sanitation and Servicing, GT.3.4.1 Prevention of Oil Spills and summarized as follows. The contractor shall be responsible for the following:
    - Take reasonable precautions to prevent pollution.
    - Restore any polluted site resulting from their operations Forest Service.
    - Maintain all equipment in good repair and free of abnormal leakage of lubricants, fuel, coolants, and hydraulic fluid.
    - Not service equipment where pollution to soil or water is likely.
    - Furnish oil-absorbing mats for use under all stationary equipment or equipment being serviced to prevent leaking or spilled petroleum-based products from contaminating soil and water resources.

- Remove from National Forest lands all contaminated soil, vegetation, debris, vehicle oil filters (drained of free-flowing oil), batteries, oily rags, and waste oil resulting from use, servicing, repair, or abandonment of equipment.
- Notify the proper authorities for hazardous substances caused as a result of Contractor's Operations, in accordance with 40 CFR 302.

23. During extended periods of dry weather between September 30 and July 1, logging operations may proceed only with the written approval of the project contract sale administrator in consultation with an aquatic resource specialist and providing there is regular monitoring to evaluate implementation and effectiveness of the prescribed Best Management Practices (BMP). The objective is to evaluate if active wet weather vegetation management operations are meeting project design criteria and mitigation measures. All effected haul routes, landings and skid trails conditions must be documented as per TSA inspection report standards and meet minimum standards as per BMP and FSH manual direction (see A and-B below).
    A. Implementation and effectiveness BMP monitoring needs to be documented in Contracting Officer Representative / Timber Sale Administrator inspection reports to assess ongoing conditions of haul routes, landings, and skid trails.
    B. Pre-approved activities occurring outside of the dry season, defined as July 1 to September 30, may proceed providing that the erosion control measures and road maintenance are in place, effective and adhered to as follows:

a. System Roads (BMP Road-4 Road Operation and Maintenance. FSH 7709.59)
    i. No scour or sediment deposition evident and extending more than 10 feet below outlet of cross drain.
    ii. No ponding present on road surface or road fill that may be causing fill subsidence or otherwise threatening integrity of fill.
        i. No rills (greater than 2-inches deep and 10-feet in length) or sediment deposition has extended more than 10 feet off the road prism.
    iii. No ruts formed that can channel water past erosion control structures (drain dips, water bars, cross drains).
    iv. No turbidity visible in ditch lines leading to stream courses
    v. The daily precipitation levels remain below the average daily maximum precipitation for the July1 through September 30 period as recorded at the nearest precipitation gauge; AND 2) two-week cumulative total precipitation of less than the average maximum two-week precipitation levels during the July 1 through September 30 period as measured at the nearest precipitation gauge. District Hydrologist will designate the gauge of record for this evaluation.

b. Culverts or drainage structure conditions (BMP Road-7 Stream Crossings FSM 7722 and FSH 7709.56b):
    i. All drainage features are clear of obstructions and properly functioning as designed.

ii. All culverts shall be at or nor near the elevation of the streambed to avoid erosion below the outlet.

c. Skid Trails, Temporary Roads, and Harvest Areas (BMP Veg-4. Ground based Skidding and Yarding. FSH 2409.15.):
   i. No rills or gullies present that are over 2 inches deep and more than 10 feet in length (6-inches deep over 5-feet length).
   ii. No rills, gullies or sediment deposition extending more than 10 feet below water bar or cross drains outlets on temporary roads.
   iii. Drainage control structures are functional on temporary roads.
   iv. No visible turbid water flowing from skid trail and temporary roads.
   v. No ruts (erosional features greater than 4-inches deep and 6-inches wide and 5-feet long).
   vi. The daily precipitation levels remain below the average daily maximum precipitation for the July1 through September 30 period as recorded at the nearest precipitation gauge; and 2) two-week cumulative total precipitation of less than the average maximum two-week precipitation levels during the July 1 through September 30 period as measured at the nearest precipitation gauge. District Hydrologist will designate the gauge of record for this evaluation.
   vii. Soil moisture is field measured at 20 percent of optimal compaction and soil displacement potential is low.

d. Landings (BMP Veg-6. Landings. FSH 2409.15)
   i. Rills (greater than 2" deep and 10' in length) or sediment deposition has extended more than 10 feet beyond the landing.
   ii. Functioning erosion control structures which are bypassed by any overland flow.

24. The silvicultural treatment in the riparian reserve will follow a prescription to maintain or restore slope stability, benefit water quality and old growth dependent fauna including native salmonids. The riparian reserve will be broken into two riparian management zones. For the purposes of this analysis, riparian silvicultural prescription and consequent effect from treatment of riparian reserves is distinguished fish presence and harvest prescription. This buffer uses a standardized buffer width prescribed on the Mt. Adams Ranger District and expanded across the Gifford Pinchot National Forest.
   a. Inner Zone**:** The inner zone is devoted solely to achieving ACS goals and buffer width vary by aquatic feature. Non-commercial treatment may be prescribed to actively promote or protect riparian features.
   b. Outer Zone**:** The outer zone is managed to achieve ACS goals as well as other management goals. Selective thinning will be used in the outer portion of the riparian reserve with average relative density targeted at 20-30 along LFH. If currently below this target riparian reserve canopy closure will remain at existing condition. Outer riparian zones treatment widths vary by riparian reserve feature.

25. Monitoring of the Kraus Ridge Project will be a qualitative evaluation to determine if stated Riparian Reserve Desired Future Conditions are met. Five riparian reserve sites will be randomly selected to evaluate whether the treatment was consistent with the DFC. Monitoring will take place immediately following three years post-treatment and will evaluate the following objectives:
    a. Objective 1: Evaluate whether the development of late successional habitat conditions have been accelerated.
    b. Objective 2: Determine whether instream conditions adjacent to and immediately downstream of timber sale unites benefited from treatments including:
        i. Is ground cover at least 90 percent? If not, did the project reduce ground cover?
        ii. Is bank stability at least 90 percent? If not, is the prescribed no cut buffer observed?
        iii. Is ground compaction present on less than 10 percent of the Riparian Reserve? If not, did the project increase compaction?
        iv. Is sediment being deliver to streams from anthropogenic sources? If so, are management features the prescribed distance from the stream? The monitoring will occur during 5 storms after the crossing has been constructed and restored.
        v. Are LW levels adequate to maintain or restore habitat elements? If not, was the source area for recruitment maintained?
        vi. Were there any mass wasting events generated within the unit or from a road? If so, could they have been avoided?
        vii. Were all isolated aquatic features protected as prescribed?

Haul Activities and Transportation System Management

Timber will be hauled from unit landings to the mill using conventional log trucks on asphalt, gravel and native surface Forest Service System Roads. The log haul route will bisect a total of 15 stream crossings with ESA listed fish within seven sub-watersheds. A majority (69 percent) of the log haul roads are paved the remaining are gravel. Sub-watershed with at least one stream crossing include: Kiona, Siler, Yellowjacket, Camp-Cispus, Greenhorn, Iron, and Woods. Haul will be timed to be concentrated during the dry field season months but winter haul may be allowed on designated haul routes.

The Kraus Ridge project will require the reconstruction and maintenance of previous roads, landings, and skid trails. Road reconstruction includes brushing, hazard tree removal, ditchline and culvert cleaning, cross drain installation, culvert replacement, road surface blading, road surface rock replacement, and pot hole patching on paved roads. No new permanent roads will be constructed for this action.

Approximately 42 miles of new temporary (non-system) roads will be constructed. These roads will be designed with USFS criteria to minimize sediment production and transport to streams. Temporary roads used for more than one season of log hauling will be weatherized prior to wet weather in the fall. When harvest is complete all temporary roads and skid trails will be blocked,

have their culverts removed and be out-sloped with cross drains and grade breaks for drainage. The road surface will be de-compacted, mulched and seeded with native plants.

Seven crossings within the Wood Creek sub-watershed will be constructed with temporary roads on geologically hazardous slopes (unstable soils), to access six harvest units. The geohazard crossings will only be constructed within streams not classified as anadromous (Class II – IV), using an estimated 2,071 cubic yards of road fill within the stream channels to stabilize the temporary crossings.

Reconstruction of approximately 44 miles of paved system roads will occur within three sub-watersheds including: Camp-Cispus (6 miles), Greenhorn (17 miles), and Woods (22 miles). Of which, 28 miles are within proximity to ESA listed streams. Additionally, 105 miles of system roads will receive maintenance including: ditch maintenance, structure maintenance, grading, and rocking and resurfacing. Only 25 miles (within the Woods Creek sub-watershed) of system roads requiring maintenance are within proximity to Class I anadromous streams. Four temporary stream crossings will be constructed, all within the Woods Creek sub-watershed, including one bridge and three culverts. The temporary bridge will require no in-water work, and the three culverts will require approximately 850 cubic yards of fill.

A full list of PDCs for haul activities and transportation system management are as follows:

1. Road segments treated within riparian affected areas should be recontoured to mimic natural floodplain contours and gradients to the greatest degree possible. The objective is to restore natural channel function and process.

2. For those road segments immediately adjacent to the stream or where the road fill is near the wetted perimeter or active channel, install sediment control barriers between the project and the stream. Examples include straw bales or erosion control matting, or silt fencing.

3. Drainage features (drain dips) should be spaced to hydrologically disconnect road surface runoff from stream channels. Project design should be reviewed with an aquatic specialist. The objective is to reduce road related sediment sources to live streams.

4. Dispose of excavated waste material in stable sites out of the flood prone area. Waste material other than hardened surface material may be used to restore natural or near-natural contours. The objective is to reduce source of sediment delivery.

5. Minimize disturbance of existing vegetation in ditches and at stream crossings to the greatest extent possible. The objective is to reduce sediment delivery.

6. Conduct activities during dry-field conditions – low to moderate soil moisture levels. For the Woods Creek and Greenhorn Creek drainages the allowable work period in, or near fish-bearing waters is August 1 to August 15. If a non-fish bearing stream is less than 0.25 miles from a fish-bearing stream, the allowable work period is July 1 to September 30. Non- fish bearing streams more than 0.25 miles from fish-bearing waters

are not required to adhere to these work periods unless a WDFW or USFS fish biologist determines they are likely to adversely affect aquatic life, channel processes, or function. High Risk Stability and Geo Hazards sites are included in this normal operating seasonal provision.

7. Evaluate channel incision risk (e.g. headcutting) and construct in-channel grade control structures in accordance with ARBO II and State MOU. The objective is to maintain channel connectivity, reduce sediment loads by reducing the risk of unwanted headcutting upstream of road work.

8. Road repairs associated with high risk stability stream segments which are within proximity to fish bearing streams should use special provisions to reduce risk of future failure including: headcut, debris slide, surface erosion or mass movement. Road repair design should incorporate Geo Technical solutions and Aquatic resources special provisions to reduce risk of sediment delivery. Special Provisions should include but not limited to one or more of the following: Grade Control (GC), Toe Slope Stabilization (TS) or Surface Drainage (SD). High risk road segments should receive a Level I Stability Assessment (LISA) or similar site stability assessment as per Gifford Pinchot Nation Forest Cumulative Effects Protocol.

9. When working in fish bearing streams the project should follow the Fish Isolation Plan. The objective is to protect fish including threatened and endangered species.

10. The Kraus Ridge Project stream crossing projects should restore natural drainage patterns (e.g. channel geometry, substrate and flow) and when possible promote passage of all fish species and life stages present in the area. The objective is to promote fish habitat including critical habitat for listed species.

11. All applicable Northwest Forest Plan Standards and Guidelines will be followed, as well as applicable administrative unit Best Management Practices and WA state findings and recommendations (Washington State Hydraulic Codes). The objective is to protect waterways and aquatic organisms.

12. Road stabilization and decommission will retain Large Woody Material (LWM) typically accumulated on culvert structures and channel margins. Material should be repositioned on-site or integrated into stream restoration projects as identified by a Forest Service Fish Biologist to the benefit of aquatic species. The objective is to maintain channel function and process.

13. Remove rip-rap or other hard structures currently used in culvert protection (e.g. rock armoring at the inlet and outlet of the culvert) on decommissioning and close / stabilize crossings. The objective is to maintain natural channel function and process.

14. Any streambank stabilization deemed necessary following culvert removal shall use bioengineered solutions (such as root wads, log toes, coir logs, woody and herbaceous plantings). The objective is to maintain natural channel function and process.

15. Use effective and appropriate erosion controls as necessary to ensure that the likelihood of sediment delivery to streams or other water bodies is negligible (See BMPs). The objective is to maintain water quality and aquatic habitat.

16. Develop and carry an approved spill containment plan that includes having spill containment kit on-site and previously identified containment locations. The objective is to maintain water quality and aquatic habitat.

17. The long-term parking or staging area for construction vehicles and heavy equipment should be located outside of the flood plain and a minimum of 100 feet from any streams bankfull channel to reduce risk of contamination. The objective is to maintain water quality and aquatic habitat

18. Refuel power equipment (or use absorbent pads for immobile equipment) at a location remote from water bodies (at least 150 feet distant) to prevent direct delivery of contaminants into a water body. The objective is to maintain water quality and aquatic habitat.

We considered whether or not the proposed action would cause any other activities and determined, based on the USFS's statements, that one associated activity would also occur.

The USFS identified one associated activity with road reconstruction for the proposed action: sourcing fill material from local quarries. Crushed aggregate to replace fill material and to provide road surface material will be processed from three local quarries including: Judd, Iron Mountain, and Ames. Aggregate production methods include explosive blasting. Ames quarry is within proximity to a Class I anadromous stream (770 feet). PDCs for quarry sourcing are as follows:

1) State and Federal guidelines
   a. All applicable Northwest Forest Plan Standards & Guidelines will be followed as well as applicable administrative unit Best Management Practices related to quarry production.
   b. Best Management Practices: State requirements shall be complied with in accordance with the Clean Water Act for protection of waters of the State of Washington (Washington Administrative Code [Chapter 173-201 and 202], Department of Ecology, which contains water quality requirements for protection of various classes of surface waters) through planning, application, and monitoring of Best Management Practices (BMPs) in conformance with the Clean Water Act, regulations, and Federal guidance issued thereto (Chapter 2, page 60 - Land and Resource Management Plan (Amendment Eleven).

2) Control sediment deliver and fine particulates
   a. Minimize any displacement of fines, soil that may be transmitted offsite or outside of the active area of the quarry via surface runoffs during rainstorm events.
   b. Minimize the displacement or transport of sediment from access road into drainage ditches. When necessary the installation of straw bales (weed free) in drain ditches will be required if excessive sedimentation of runoffs can be seen in the drainage ditches. The installation of straw bales into ditches will help mitigate/limit the amount of sediment into stream channels.

3) Control incidental hazardous spill associated with blasting activity
   a. Develop and carry an approved spill containment plan that includes having a spill containment kit on-site and previously identified containment location.
   b. Develop a spill plan for approval before operations begin. Carry approved spill containment plan. Containment plan should include but not limited to: possess a spill containment kit on-site, and pre- identified containment locations. Hydraulic/oil/fuel leaks will be repaired prior to operating on National Forest System lands. Equipment will be checked daily for leaks and any necessary repairs shall be completed prior to commencing work activities in or near stream channels. Equipment storage locations will need to be away from any live streams by at least 100 feet. Avoid using access road for storage locations if in close proximity (<100 feet) to waterbodies. Equipment will not be stored adjacent to or in stream channels when not in use to avoid/minimize any potential effects of vandals, accidents, or natural disasters. Any accidental spills of a hazardous material (e.g. oil, fuel, transmission fluid) from any operating equipment or in place of storage on land or in water must be immediately reported to the Gifford Pinchot National Forest.
   c. Service and refueling areas need to be located at least 100 ft. away from any stream channels at a pre-designated location. Refueling or oil change for mechanized equipment and vehicles must be done at a designated service and refueling areas.

4) Moderate timing, intensity, duration and magnitude of explosive charges to control effects to local fish population including:
   a. Cease all project operations, except efforts to minimize storm or high flow erosion, under unexpected high flow conditions that result accumulation of one (1) inch or more rain in a 24-hour period as measured at local USGS weather station (Randle, WA).
   b. Shock wave transmission to fish bearing streams from blasting shall comply with safe operating levels as defined by Alaska Department of Fish and Game (1991). Overpressure transmission to the fish bearing streams shall not exceed 2.7 pound per square inch (psi) instantaneous hydroacoustic pressure change in LFH. As such, each explosive charge weight shall not exceed 400 pounds per blast to maintain prescribed fish-safe operating level.
   c. Shock wave transmission to fish spawning sites from blasting shall comply with safe operating levels as defined by Alaska Department of Fish and Game. Overpressure transmission to the fish bearing streams shall not exceed 0.5 inches per second (ips) instantaneous hydroacoustic pressure change at spawning sites. Calculations of overpressures should be gauged to relative risk and consider physical character including: distance to fish, geologic material, and topography defined in Figure 2. As per Ames Creek setback (approx. 700 ft) a charge weight not to exceed 400 pounds should be used to maintain a safe operating transmission level of 0.5 inches per second.
   d. Explosive blast will be confined within the bedrock material (drilled holes)
   e. Explosive blasts will be detonated as a single shot. Multiple charge shots may be detonated if separated by an eight (8) millisecond (ms) or longer delay.
   f. The blasting activity should not exceed ten (20) shots per day over a period of five (5) consecutive work days for a total of fifty (100) shots per quarry site to minimize cumulative effects of disturbance.
   g. When high risk conditions are present, quarry blasting should be limited to a Safe Operating Season to ensure fish larva have reached a stage of development (eyed egg) to

resist shock and vibration. The safe operating season for each location is dependent on fish presence and scheduled as per Insert 1.

h. Safe Operating Season for blasting operation prescribed to avoid disturbance of fish including Proposed, Endangered, Threatened and Sensitive (PETS) fish species at the Flood Repair Quarry Production project site. Assumes explosive charge of less than 500 pounds

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

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

The USFS determined the proposed action is not likely to adversely affect Southern Resident Killer Whale or their critical habitat. Our concurrence is documented in the "Not Likely to Adversely Affect" Determinations section (Section 2.13).

2.1 Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

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

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The 2016 critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a ''destruction or adverse modification'' analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

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

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

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

2.2 Rangewide Status of the Species and Critical Habitat

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

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

During the last century, average regional air temperatures in the Pacific Northwest increased by 1-1.4 degrees Fahrenheit as an annual average, and up to 2 degrees Fahrenheit 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 degrees Fahrenheit, with the largest increases predicted to occur in the summer (Abatzoglou et al., 2014).

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

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 degree Celsius increases in Columbia Basin streams and a peak temperature of 26 degrees Celsius 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 and Hamlet, 2010). Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic foodwebs (Crozier et al., 2008; 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).

In addition to changes in freshwater conditions, predicted changes for coastal waters in the Pacific Northwest as a result of climate change include increasing surface water temperature, increasing but highly variable acidity, and increasing storm frequency and magnitude (Mote et al., 2014). Elevated ocean temperatures already documented for the Pacific Northwest are highly likely to

continue during the next century, with sea surface temperature projected to increase by 1.0-3.7 degrees Celsius by the end of the century (IPCC, 2014). Habitat loss, shifts in species' ranges and abundances, and altered marine food webs could have substantial consequences to anadromous, coastal, and marine species in the Pacific Northwest (Reeder et al., 2013; Tillmann and Siemann, 2011).

Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. A 38 percent to 109 percent increase in acidity is projected by the end of this century in all but the most stringent CO2 mitigation scenarios, and is essentially irreversible over a time scale of centuries (IPCC, 2014). Regional factors appear to be amplifying acidification in Northwest ocean waters, which is occurring earlier and more acutely than in other regions and is already impacting important local marine species (Barton et al., 2012; Feely et al., 2012). Acidification also affects sensitive estuary habitats, where organic matter and nutrient inputs further reduce pH and produce conditions more corrosive than those in offshore waters (Feely et al., 2012; Sunda and Cai, 2012).

Global sea levels are expected to continue rising throughout this century, reaching likely predicted increases of 10-32 inches by 2081-2100 (IPCC, 2014). These changes will likely result in increased erosion and more frequent and severe coastal flooding, and shifts in the composition of nearshore habitats (Reeder et al., 2013; Tillmann and Siemann, 2011). Estuarine-dependent salmonids such as chum and Chinook salmon are predicted to be impacted by significant reductions in rearing habitat in some Pacific Northwest coastal areas (Glick et al., 2007). Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances, and therefore these species are predicted to fare poorly in warming ocean conditions (Scheuerell and Williams, 2005; Zabel et al., 2006). This is supported by the recent observation that anomalously warm sea surface temperatures off the coast of Washington from 2013 to 2016 resulted in poor coho and Chinook salmon body condition for juveniles caught in those waters (NWFSC, 2015). Changes to estuarine and coastal conditions, as well as the timing of seasonal shifts in these habitats, have the potential to impact a wide range of listed aquatic species (Reeder et al., 2013; Tillmann and Siemann, 2011).

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.

2.2.1 Status of the Species

Table 1, below, provides a summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in recovery

plans and status reviews for these species. These documents are available on the NMFS West Coast Region website (http://www.westcoast.fisheries.noaa.gov/).

Table 2. Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this opinion

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River Chinook salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	This ESU comprises 32 independent populations. Twenty-seven populations are at very high risk, 2 populations are at high risk, one population is at moderate risk, and 2 populations are at very low risk Overall, there was little change since the last status review in the biological status of this ESU, although there are some positive trends. Increases in abundance were noted in about 70% of the fall-run populations and decreases in hatchery contribution were noted for several populations. Relative to baseline VSP levels identified in the recovery plan, there has been an overall improvement in the status of a number of fall-run populations, although most are still far from the recovery plan goals.	• Reduced access to spawning and rearing habitat • Hatchery-related effects • Harvest-related effects on fall Chinook salmon • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River coho salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	Of the 24 populations that make up this ESU, 21 populations are at very high risk, 1 population is at high risk, and 2 populations are at moderate risk. Recent recovery efforts may have contributed to the observed natural production, but in the absence of longer term data sets it is not possible to parse out these effects. Populations with longer term data sets exhibit stable or slightly positive abundance trends. Some trap and haul programs appear to be operating at or near replacement, although other programs still are far from that threshold and require supplementation with additional hatchery-origin spawners. Initiation of or improvement in the downstream juvenile facilities at Cowlitz Falls, Merwin, and North Fork Dam are likely to further improve the status of the associated upstream populations. While these and other recovery efforts have likely improved the status of a number of coho salmon populations, abundances are still at low levels and the majority of the populations remain at moderate or high risk. For the Lower Columbia River region land development and increasing human population pressures will likely continue to degrade habitat, especially in lowland areas. Although populations in this ESU have generally improved, especially in the 2013/14 and 2014/15 return years, recent poor ocean conditions suggest that population declines might occur in the upcoming return years.	• Degraded estuarine and near-shore marine habitat • Fish passage barriers • Degraded freshwater habitat: Hatchery-related effects • Harvest-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River steelhead	Threatened 1/5/06	NMFS 2013	NWFSC 2015	This DPS comprises 23 historical populations, 17 winter-run populations and six summer-run populations. Nine populations are at very high risk, 7 populations are at high risk, 6 populations are at moderate risk, and 1 population is at low risk. The majority of winter-run steelhead populations in this DPS continue to persist at low abundances. Hatchery interactions remain a concern in select basins, but the overall situation is somewhat improved compared to prior reviews. Summer-run steelhead populations were similarly stable, but at low abundance levels. The decline in the Wind River summer-run population is a source of concern, given that this population has been considered one of the healthiest of the summer-runs; however, the most recent abundance estimates suggest that the decline was a single year aberration. Passage programs in the Cowlitz and Lewis basins have the potential to provide considerable improvements in abundance and spatial structure, but have not produced self-sustaining populations to date. Even with modest improvements in the status of several winter-run DIPs, none of the populations appear to be at fully viable status, and similarly none of the MPGs meet the criteria for viability.	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Reduced access to spawning and rearing habitat • Avian and marine mammal predation • Hatchery-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants

2.2.2 Status of the Critical Habitat

This section describes the status of designated critical habitat affected by the proposed action by examining the condition and trends of the essential physical and biological features of that habitat throughout the designated areas. These features are essential to the conservation of the ESA-listed species because they support one or more of the species' life stages (*e.g.*, sites with conditions that support spawning, rearing, migration and foraging). Table 2, below, summarizes the general status of critical habitat, range-wide, for each species considered in this analysis.

Physical and Biological Features of Salmon and Steelhead Critical Habitat

The NMFS designated critical habitat (CH) for three different groups of salmonids that occupy the LCR, on three different dates. For each designation, NMFS used slightly different descriptions of the physical and biological features (PBFs) of critical habitat. In addition, NMFS identified the essential elements of the PBFs using slightly different terminology. For convenience, many of the PBFs and their essential elements actually overlap from designation to designation and NMFS uses "PBFs" for each in the rest of this document.

NMFS designated CH for 10 ESUs and DPSs of Columbia River salmon and steelhead on September 2, 2005 (70 FR 52630), and lower Columbia River coho salmon on February 24, 2016 (81 FR 9252) as shown in Table 2. The PBFs are referred to as Primary Constituent Elements (PCE) in 70 FR 52630 and in 81 FR 9252, and those terms are used interchangeably in this document. Specific PCEs, and the essential features associated with the PCEs for salmonids designated in 2005 include:

1. Freshwater spawning sites with water quantity and quality conditions and substrate that support spawning, incubation, and larval development;

2. Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility, water quality and forage that support juvenile development, and natural cover such as shade, submerged and overhanging large wood, logjams 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 that support juvenile and adult mobility and survival;

4. Estuarine areas free of obstruction and excessive predation with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation;

5. Nearshore marine areas free of obstruction and excessive predation with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and 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.

For most salmon and steelhead, NMFS's critical habitat analytical review teams (CHARTs) ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC5) in terms of the conservation value they provide to each ESA-listed species that they support (NMFS 2005). The conservation rankings were high, medium, or low. To determine the conservation value of each watershed to species viability, the CHARTs evaluated the quantity and quality of habitat features, the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area. Even if a location had poor habitat quality, it could be ranked with a high conservation value if it were essential due to factors such as limited availability, a unique contribution of the population it served, or is serving another important role.

Table 3. Critical habitat, designation date, federal register citation, and status summary for critical habitat considered in this opinion.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Lower Columbia River Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 47 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some, or high potential for improvement. We rated conservation value of HUC5 watersheds as high for 30 watersheds, medium for 13 watersheds, and low for four watersheds.
Lower Columbia River coho salmon	2/24/16 81 FR 9252	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 55 occupied watersheds, as well as the lower Columbia River and estuary rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 34 watersheds, medium for 18 watersheds, and low for three watersheds.
Lower Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses nine subbasins in Oregon and Washington containing 41 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 28 watersheds, medium for 11 watersheds, and low for two watersheds.

2.3 Action Area

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

The proposed Kraus Ridge Vegetation Management projects treatment of 3,015 acres, will occur within three sub-watersheds of the Middle and Lower Cispus watersheds. The sub-watersheds (tributaries) include: Woods Creek, Greenhorn Creek, and Schooley Creek (Figure 2.). Schooley Creek does not support anadromous fish. Transportation of harvested vegetation will occur along Forest Service roads 25, 28, and 76, which are located within the Lower Cispus watershed, and specifically the Iron Creek and Yellowjacket Creek sub-watersheds.

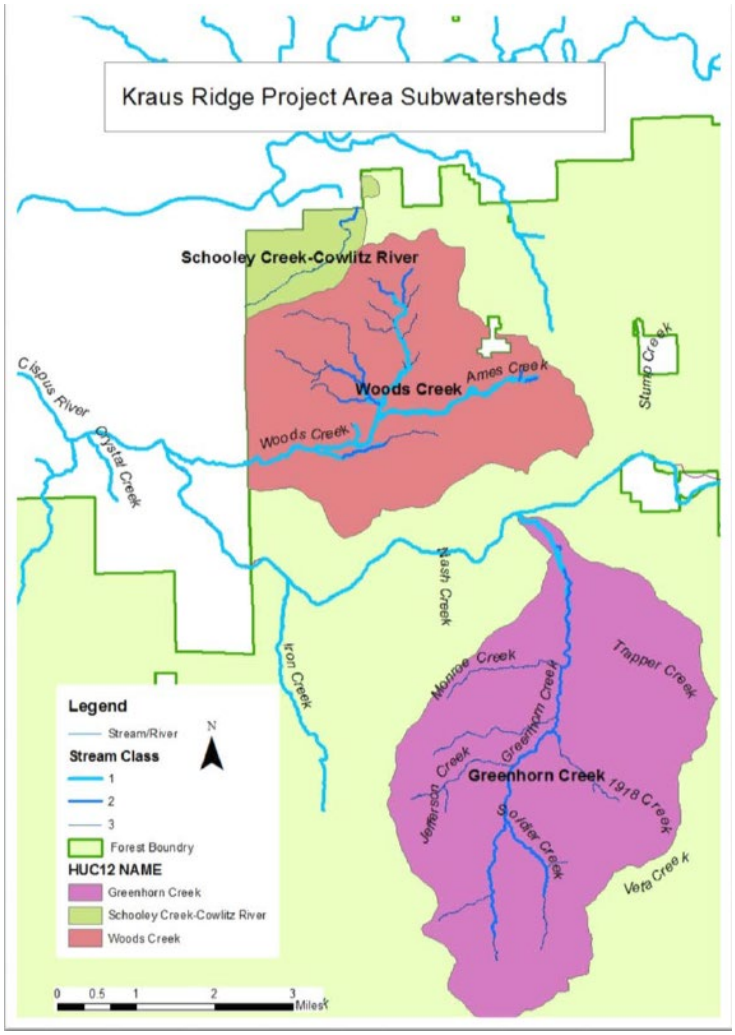

Figure 2. Kraus Ridge Vegetation Management Project action area (Figure produced by USFS)

2.4 Environmental Baseline

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

The environmental baseline of the action area has largely been established by past timber harvest and road construction actions. The USFS monitors fish habitat indicators correlated with effects from timber harvest and roads to describe the baseline including; suspended sediment and substrate sediment, temperature, chemical contamination, peak to base flow ratio.

Suspended sediment and substrate sediment

The natural sediment regime has been modified by timber harvest practices and road construction, causing streams to process more sediment than normal flows can handle, resulting in an increased percentage of fine sediments and higher turbidity in spawning areas, which reduces spawning success, and rearing areas, which can cause responses ranging from avoidance to injury among juveniles. Increased sediment delivery to streams within the action area is caused by timber harvest related landslides and roads. The most recent landslide occurred during the 2006 flood, which impacted 43 acres of the Lower Cispus watershed. Landslides over 14 acres of the Greenhorn Creek sub-watershed and 1.2 miles of roads have contributed to increased sediment delivery. Zero acres have been impacted due to landslides within the Woods Creek sub-watershed, but 5.3 miles of roads contribute increased sediment.

Temperature

Four stream segments within the action area are currently listed as impaired on the Washington State 303(d) list of streams which exceed temperatures tolerable to salmonids over a seven day period, within the Woods and Greenhorn Creeks sub-watersheds. The specific stream segments are as follows: Lower Greenhorn Creek, Upper Greenhorn Creek (above the confluence with 1918 Creek), 1918 Creek, and the entirety of Woods Creek. Additionally the main-stem Cispus River between Greenhorn Creek and Iron Creek is also listed as a 303(d) stream. Temperature may directly affect salmonids in obvious ways, or indirectly through interaction with other important variables. For example, given sufficient magnitude and time, high temperatures can cause weight loss, disease, competitive displacement by species better adapted to the prevailing temperature, or death (Richter and Kolmes 2005).

Water Quality – Contaminants

Herbicides are a component of Pacific Northwest Region non-native plant management program, on average Gifford Pinchot National Forest treats 2,636 acres annually across the entire forest. Typical herbicide applicants on the Gifford Pinchot use spot spray or injection methods which target, high-priority areas around gravel pits, road corridors, areas of ground disturbance associated with land management activities, specific riparian corridors and high value meadows. All application methods and rates comply with the USFS Region 6 Invasive Plant Program (USDA 2005).

Water Quantity - Peak Flows

Aggregate Recovery Percentage (ARP) is an index of the fraction of a watershed that is in a hydrologically mature condition. As timber harvest removes forest cover, the ARP for the watershed is reduced from 100. With decreased forest cover, rain on snow events in the transient snow zone between 1,500 to 3500 feet increase snowmelt rates and cause higher peak flows (Harr and Coffin, 1992). Peak flow frequency and magnitude is exacerbated by road density. During rain events, road surfaces retard rain water infiltration and road cut-banks intercept surface and subsurface flows. Road ditchlines deliver this intercepted water directly to the watershed drainage network. The Greenhorn Creek sub-watershed has a road density of 2.4 miles per square mile with 14 stream crossings that increase the drainage network by 2.5 miles. The Woods Creek sub-watershed has a road density of 3.9 miles per square mile with 18 stream crossings increasing the drainage network by 2.9 miles or 0.85 percent. Nine 10-year-plus peak flow events have been recorded in the action area since 1970.

Peak flows are sorted into flows with a lower than one year return interval (intra-annual) and flows with a higher than one year return interval (inter-annual). Inter-annual peak flows move bedload and scour salmon and steelhead redds (Grant et al., 2008). Intra-annual peak flows generally don't move bedload so abruptly increasing the magnitude of intra-annual peak flows could result in flows that move bedload and scour redds each year until the channel substrate particle size distribution equilibrates to the new flow regime (Grant et al., 2008). This transient period temporarily decreases the productivity of salmon and steelhead populations. ARP less than 0.7 indicates a high risk of increased peak flows and ARP less than 0.85 indicates a moderate risk of increased peak flows. The Greenhorn Creek sub-watershed drainage area ARP ranged between 0.91 - 0.99 (low risk) in 2006. The Woods Creek sub-watersheds ARP in 2006 was 0.78 (moderate risk).

ESA listed Salmonid Populations in the Action Area

Cispus spring Chinook salmon are a primary population with a very low recovery status and a high recovery objective. The current abundance is approximately 150 spawners per year and the target abundance is 1800 spawners per year (NMFS, 2013b). Annually, 300,000 sub-yearling spring Chinook are released above Cowlitz Falls Dam into the upper Cowlitz and Cispus rivers as part of the reintroduction program. Hatchery strays account for most spring Chinook currently returning to the Cowlitz River. Trends for natural production in the Upper Cowlitz basin have

remained relatively low. High hatchery production continues to pose genetic risks to natural populations as hatchery origin fish outnumber there natural origin kin.

Spring Chinook enter the Cowlitz River from March through June. Natural spawners are transported by truck to the Cispus River to spawn between late August and early October, peaking in mid-September, between Iron Creek and East Canyon Creeks. Spring Chinook salmon have not been documented using Greenhorn or Woods Creeks during all freshwater life stages, however the main-stem Cispus River (receiving body) does support Chinook salmon during all freshwater life stages.

Cispus Winter steelhead are a primary population with a very low recovery status and a high recovery objective. The current natural abundance is less than 50 spawners per year and the target abundance is 500 spawners per year (NMFS, 2013b). Annually, 287,500 hatchery winter steelhead juveniles are planted in the Upper Cowlitz to supplement natural winter steelhead. Returning hatchery origin steelhead pose a genetic risk to native steelhead. Spawning occurs in the Cispus River from March to June. Greenhorn Creek and Woods Creek have suitable spawning habitat and known distributions of spawning fish. The upper spawning distribution on Greenhorn Creek (RM 1.8) and Woods Creek (RM 4.6) is limited by channel gradient, stream velocity and substrate. Juveniles rear for one to two years before migrating in the spring. The Greenhorn Creek and Woods Creek sub-watersheds have suitable rearing habitat and known distribution of rearing fish but within both sub-watersheds rearing habitat generally lacks cover, quality pools, large wood and off channel habitat. The lowest and uppermost reaches of Greenhorn Creek have high summer water temperatures, while the entirety of Woods Creek also has high summer water temperature.

Cispus River coho salmon are a primary population with a very low recovery status and a high recovery objective. The current abundance is less than 50 natural spawners, with a target abundance of 2,000 spawners per year (NMFS, 2013b). Cowlitz hatchery coho are released upstream of the dams to spawn in the Upper Cowlitz and Cispus Rivers. Upper Cowlitz/Cispus River Type N[6] coho return to spawn from late November to March. Greenhorn Creek and Woods Creek have suitable spawning habitat and known distributions of spawning fish. The upper spawning distribution on Greenhorn Creek (RM 1.8) and Woods Creek (RM 4.6) is limited by channel gradient, stream velocity and substrate. Juveniles rear for a full year before migrating as yearlings in the spring. Fry emerge from January through April, spend one year rearing in freshwater and emigrate as age-1 smolts in the spring. The Greenhorn Creek and Woods Creek sub-watersheds have suitable rearing habitat and known distribution of rearing fish but both rearing habitat generally lacks cover, quality pools, large wood and off channel habitat. The lowest and uppermost reaches of Greenhorn Creek have high summer water temperatures, while the entirety of Woods Creek also has high summer water temperature.

Both Greenhorn Creek and Woods Creeks have limited actual or potential spawning habitat compared to other Cispus River tributaries and showed very marginal EDT changes in abundance and productivity if restored to historical conditions (template). Both Greenhorn Creek and Woods Creek transport sediment into the Cispus River. The most important reach in the action area for Spring and Fall Chinook is Cispus 1C. Cispus 1C is a short 0.2 mile reach

[6] Late returning Type N coho ocean distribution is North of the Columbia River

between Woods Creek and Crystal Creek with Chinook spawning habitat. The Cispus River reaches with high EDT restoration scores (Tier 1 Reaches) for coho and steelhead are upstream of Iron Creek.

The EDT Habitat Factors Analysis identifies the most important habitat factors affecting fish in each reach. For Fall and Spring Chinook in Cispus Reach 1C, the primary limiting factor is egg incubation degraded by channel stability and sediment.

2.5 Effects of the Action

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

Effects of the proposed action will include temporary and long term effects. Temporary effects can alter habitat conditions for minutes, days, weeks or months. Long term effects can persist a year or even decades. The duration of effects will influence the number of individual fish exposed. Below we describe how the effects of the proposed action influence features of critical habitat and their conservation values, and species response to these habitat changes.

2.5.1 Effects on Critical Habitat

The physical and biological features (PBF) for salmon and steelhead critical habitat in the action area are:

1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development. These features are essential to conservation because, without them reproduction would be diminished or prevented.

2) Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility, water quality and forage supporting juvenile development, and 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. These features are essential to conservation because, without them juveniles cannot access and use the areas needed to forage, grow, and develop behaviors (e.g., predator avoidance, competition) that help ensure their survival (NMFS, 2005).

The proposed actions include timber harvest, road construction and maintenance, and timber hauling. Each of these actions can have effects on critical habitat PBFs. Water quality and quantity, which are common to both spawning and rearing habitat, are PBFs that will be affected by the proposed action. Substrate, a feature of spawning habitat, will also be affected. The remaining PBFs are unlikely to be affected.

Water and Substrate Quality - Suspended sediment and substrate sediment

Water Quality. Riparian timber harvest, road construction, and timber hauling can degrade spawning and rearing water quality by increasing the supply of sediment to the stream and increasing the suspended sediment concentration (turbidity). The Kraus Ridge project includes 759 acres of outer riparian reserve thinning in areas ranging from 60 to 240 feet from Class I, II, III, and IV streams; depending on whether the streams are perennial or intermittent, and whether they host resident or anadromous fish.

Timber harvest kills tree roots that stabilize soil on slopes and increases the probability of slope failure (Robison et al., 1999; Swanston and Swanson, 1976). Ground-based yarding loosens soil and creates routes for transport of this soil to streams.

Road construction and maintenance increases the length of roads susceptible to mass wastings and soil erosion transported downslope by stormwater runoff towards streams. The roads that are the greatest risk of contributing sediment to anadromous stream reaches are the roads in close proximity to anadromous fish habitat. For the Kraus Ridge project, there are 34 harvest sites along 9.6 miles of road that are proximate to anadromous fish habitat. Of the 9.6 miles of road, 3.9 miles will be newly constructed road, while the remaining 5.7 miles are relic roads from previous harvests that have been deemed fully recovered and hydrologically stable. While not immediately adjacent to anadromous reaches, lengthening existing roads and reopening closed, stabilized roads increases the drainage network and replaces fill on steep slopes that was lost in previous landslides. These activities will also increase the probability of sediment delivery to the Greenhorn Creek and Woods Creek sub-watershed (winter steelhead spawning and rearing habitat) and the Cispus River (steelhead, Chinook, and coho habitat).

Forest roads deliver sediment to streams through interception of rainfall by the road surface during normal rain events and interception of subsurface flow by the road cutslope during extreme rain events. Rainfall infiltration rates on forest roads are an order of magnitude lower than native soils (Wemple and Jones, 2003), while log hauling keeps the sediment on the road surface loose. Thus, every time it rains, water intercepted by the road will entrain and transport some of these sediment particles downslope until they reach a drainage structure that conveys them below the road where they settle on the surface (Napper, 2008). This transport mechanism is exacerbated when road drainage structures become plugged and the water intercepted by the road stays on the road longer and entrains even more sediment or creates a washout. Over time, the sediment is progressively washed down the slope so that small pulses of sediment are delivered to the stream with high frequency over the rainy season and transported as bedload and suspended load.

The second mechanism where forest roads cause sediment to be delivered to streams is during extreme rain events when the soil profile in the slope above the road becomes sufficiently saturated with water that the top of the subsurface flow is higher than the depth of the road cutslope. The road intercepts this subsurface flow, re-routs it in the ditch and concentrates it at a drainage structure (Borga et al., 2005). Under these conditions, the hillslope below the road drainage outlets becomes extremely saturated wherein the soil cohesion is overcome by the weight of the soil causing a landslide to deliver a large mass of soil to the stream. The river

transports this sediment as both suspended sediment and bedload that interchange with the channel bottom substrate and alter the particle size distribution. Since landslides are caused by large rain events, they are relatively rare. Landslides also replenish the stream with gravel, cobble, and any large wood that becomes uprooted by the landslide, in addition to the finer sediment size fractions.

Timber haul on roads proximate to anadromous streams delivers sediment directly to the stream. Approximately 1.6 miles of native or aggregate surface log haul road is within 0.75 miles of anadromous fish habitat in Woods Creek sub-watershed. Log hauling on roads beyond 0.75 miles of anadromous streams tributaries to anadromous stream that are constructed on steep slopes also deliver sediment to streams. Sediment delivered to Greenhorn and Woods Creek tributaries will be transported downstream to the anadromous reaches and ultimately to the Cispus River.

Thinning and ground yarding PDCs reduce pathways for soil to reach the stream because: 1) Ground-based yarding is limited to slopes less than 35 percent[7] ; 2) No harvest inner riparian reserve buffers (90 to 180 feet for class III and IV streams, 180 feet for class II fish bearing streams, and 240 feet for class I anadromous streams) block outer riparian buffer soil from reaching the stream (Burroughs and King, 1989; Corbett and Lynch, 1985; Gomi et al., 2005); and 3) Skid trails are treated following harvest to re-stabilize disturbed soils. Therefore, in the short term, and in the absence of unusual storm events, commercial thinning in outer riparian reserves should not deliver significant amounts of sediment to the stream. After commercial thinning, the remaining trees can grow rapidly with decreased competition for sunlight and soil nutrients and, as a result, increase their root mass and ability to stabilize soils in the treated stand.

To reduce the amount of transported sediment from roads, PDCs specify road surface material properties, road grades, distance between drains and the location of road cuts and fill (Copstead et al., 1998) so as to minimize the amount of entrained sediment that reaches streams. The materials with which roads are built become well-compacted, reducing its likelihood of erosion. New roads will be constructed with design PDCs that reduce the amount of sediment produced from these lengthened road segments, relative to the existing roads constructed from 1940 to 1970. Reopened roads will be closed and stabilized after timber harvest so the time interval when they deliver sediment to streams is limited to the duration of their use as haul routes. Therefore, the amount of sediment delivered to streams should be not much greater than the environmental baseline.

In addition, the PDCs require USFS to suspend log hauling where the road surface is deteriorating due to rutting or standing water, or where turbid runoff is likely to reach stream channels, which should reduce the potential for high sediment load.

Substrate Quality. Just as riparian timber harvest, road construction and timber hauling can deliver sediment that degrades water quality, the activities and their sediment delivery can also degrade spawning substrate quality, by increasing the fraction of fine sediment in the substrate used to construct redds. All of the sediment from outer riparian buffer thinning, road construction

[7] on steeper slopes, skyline and helicopter yarding systems are used because the logs are suspended above the ground throughout much or all of the yarding process and don't loosen soil

and timber hauling that reaches the channel is transported downstream as suspended load and bedload. Bedload and suspended sediment encounter and becomes part of the channel substrate (Cui et al., 2003; Parker and Toro-Escobar, 2002) so over time the substrate accumulates an increasing fraction of small sediment sizes. When salmon redds are constructed from this substrate, the large interstitial spaces between gravel and cobble particles is partially occluded by sand and more prone to become plugged by finer suspended sediment particles constantly flowing over and through the redd.

To summarize, spawning habitats in Greenhorn and Woods Creeks, and the Cispus River near the confluences with these creeks, are likely to be episodically degraded both at the time of timber harvest, as well as over a period of subsequent years, by sediment affecting water quality and substrate, as PDCs limit the amount of sediment load to, but do not fully prevent sediment from reaching, the nearby streams. Water quality and substrate effects are most likely to have higher intensity of degradation as a short term effect, with chronic low level effects that persist until vegetation in disturbed areas has re-established and stabilized soils.

Water Quality - Temperature

Riparian timber harvest, road construction and log hauling can degrade juvenile salmon and steelhead rearing water quality by decreasing canopy cover shade over the channel, increasing water temperature. Removing trees in riparian buffers reduces the amount of shade and increases thermal loading to the stream (Moore and Wondzell, 2005). The Environmental Protection Agency (EPA) modeled the effects of different thinning prescriptions on stream shade (EPA, 2013) as a function of: 1) the riparian buffer total width; 2) the inner riparian no-harvest buffer width; 3) the inner riparian buffer canopy cover; 4) the pre harvest outer riparian buffer canopy cover; and 5) the post-harvest outer riparian buffer canopy cover. The model was validated with a before-after-control-impact (BACI) study on 33 streams exposed to riparian harvest (EPA, 2013). The model predicted an increase in stream temperature for streams that have a shade loss greater than 6 percent.

For outer riparian reserve thinning to 50 percent canopy cover in a north to south running stream, like Greenhorn and Woods Creeks, with a 120-foot wide inner riparian buffer and starting with 80 percent canopy cover, the EPA model predicts just 0.2 percent shade loss over the stream. For the Kraus Ridge project, 240 foot no cut riparian reserve buffers will be used in areas proximate to Class I streams and 180 foot no cut inner riparian reserve buffers will be thinned that are proximate to Class II streams. Based on the EPA model predictions, these outer riparian reserve thinning actions should not result in measurable shade loss or increases in stream temperature, even though the inner riparian reserve trees are still young and small, because the buffers are significantly wider than the 120 foot buffers in the model.

The Kraus Ridge project will also thin outer riparian area buffers on Class III and Class IV streams with 60- to 180-foot no cut inner riparian reserve buffers. An EPA analysis of seven studies (Science Team Review, 2008) determined that shade loss increases when the inner riparian buffer is narrowed to less than 100 feet. Therefore, in Class III and Class IV stream outer riparian buffer thinning could measurably increase the temperature of tributary water that is ultimately delivered to anadromous reaches in the Greenhorn and Woods Creek sub-watersheds.

It is unlikely that this will measurably increase the temperature of the Class I anadromous reaches because: 1) when the Class III or Class IV streams have high baseline temperatures the prescribed inner riparian buffer must exceed 100 feet which reduces the amount shade loss from the riparian buffer; 2) the flow and flow rate of Greenhorn Creek and the Woods Creek are much larger than tributary flows; and 3) other heat transfer processes (groundwater exchange, etc.) could re-cool the water in the Class III and Class IV streams before they mix with Greenhorn Creek or Woods Creek.

Water temperature is also influenced by the channels width to depth ratio. Water in wide, shallow channels intercepts more total solar radiation and heats up more that water in deep, narrow channels. The width to depth ratio of channels is increased by amount and rate at which sediment is delivered to and stored in the channel so increasing the length of forest roads and the amount of timber hauling on these roads will increase the mass and mass rate at which sediment is delivered to Greenhorn and Woods Creek. Width to depth ratio is decreased by large wood in stream channels. Since large wood in streams generally originated within 100 feet of the channel, there is a slight possibility that commercial thinning in the outer riparian zone of Class III and Class IV streams could remove trees that would ultimately have fallen into a tributary and been transported to an anadromous reach of Greenhorn Creek or Woods Creek. Some large trees in the riparian buffer may also be removed during FR 25 road construction, although, if these trees are in the 240 foot wide inner riparian reserve, they will be left on the ground so that natural processes can transport them into the stream. The average width to depth ratio of the temperature limited reaches of Woods Creek is already almost 10. It is unlikely that there will be enough additional sediment delivered to or large trees removed from riparian buffers to change this average width to depth ratio.

In summary, water temperatures in spawning and rearing habitats are unlikely to be discernibly affected given the size of "no cut- buffer" prescribed with the proposed action. In areas where temperature is incrementally further impaired, this effect is expected to be long term (lasting several years) until sufficient growth of trees re-establishes canopy cover and shade.

Water Quality - Contaminants

Riparian timber harvest, road construction and timber hauling can degrade spawning and rearing water quality by allowing contaminants to reach streams, because trucks and construction equipment that use petroleum hydrocarbon fuel and fluids and metals in sacrificial parts such as brake pads. Leaks and spills of fluids and normal wear of parts introduce liquid contaminants and metals to the environment. Once on the ground fluids and metals are transported downhill to streams. The operation of timber harvest machinery near streams could introduce petroleum-based hydrocarbons found in fuels and fluids to anadromous fish habitat, however the contractors are required to comply with preventative measures described in the proposed action (i.e., maintain all equipment in good repair and free of abnormal leakage of lubricants, fuel, coolants, and hydraulic fluid; do not service equipment where pollution to soil or water is likely, furnish oil-absorbing mats for use under all stationary equipment or equipment being serviced to prevent leaking or spilled petroleum based products from contaminating soil and water resources, remove from National Forest lands all contaminated soil, vegetation, debris, etc.).

In summary, NMFS finds it unlikely that fluid and metal concentrations will reach aquatic habitat at levels that are toxic or harmful to listed species or their prey, and thus water quality in spawning and rearing habitats should remain unimpaired by this risk factor because: 1) the small amount of equipment relative the size of the watershed; 2) the prevention protocols; and 3) the anticipated distance between the areas where equipment will operate and the streams.

Water Quantity - Peak Flows

Upland timber harvest and road construction can degrade spawning and rearing water quantity by changing the magnitude and frequency of peak flows. The LCR Salmon and Steelhead Recovery Plan (NMFS, 2013b) describes how upland tree harvests in upper Cowlitz River watersheds can alter the timing of snow melt such that the magnitude of peak flows can increase. After trees are removed from an upland hillslope, the fraction of winter snow and spring rain that reaches the ground increases while the amount of soil moisture removed by evapotranspiration decreases, leading to higher peak flows. As described in the Environmental Baseline, increased peak flows will increase bedload transport in the spring, when salmon and steelhead redds are present, until the channel bedload and substrate particle size distribution equilibrate to the new peak flow amplitude and frequency.

The USFS BA predicts the proposed action has moderate potential to increase peak flows. Research summarized in Grant et al. (2008) shows that increases in the intra annual peak flows resulting from the Kraus Ridge project are unlikely to be detectable because the harvest units are distributed in a watershed that is greater than 10 square kilometers, the harvest is commercial thinning rather than clearcuts, and peak flow magnitude is determined by the watershed road density.

In summary, NMFS does not anticipate measureable or significant changes in peak flow/water quantity from the proposed action, retaining current conditions for spawning and rearing areas.

2.5.2 Effects on Listed Species

LCR Chinook salmon, LCR coho salmon and LCR steelhead will be exposed to and affected by the proposed action's effects on critical habitat, to the extent that they are present in, or dependent upon, the habitat at the time of the effects.

Suspended and Substrate Sediment

Listed fish are likely to be exposed to water quality reductions when riparian timber harvest, road construction, and log hauling deliver sediment to streams at levels over and above the sediment supplied by natural processes. Sediment that enters the river is entrained, transported and deposited according to the hydraulic power of the flow and affects listed species in a number of ways. Before it becomes dispersed, it may create sufficiently concentrated suspended sediment zones that fish health and behavior is directly affected. In 1996, Newcombe and Jensen (1996) created charts that summarized the reported effects of salmonid exposure to different concentrations of suspended sediment for a given time. For example, exposure to 400 mg/L of suspended sediment for 2.7 hours yields minor physiological stress (coughing) and exposure to

400 mg/L for 7.3 hours causes major physiological stress (long term reduction in feeding success).

Prolonged high suspended sediment concentrations from the proposed action are expected to be unusual because landslides and mobilization of road sediment displaced to ditches by log trucks are delivered as a pulse during large rain events that also cause high streamflow. High streamflow disperses suspended sediment rapidly thus reducing in-stream concentrations. However, juvenile fish that experience high suspended sediment concentrations in such circumstances must find refuge from high streamflows at the margins of the channel or in side channels that are not well mixed with the suspended sediment in the main channel streamflow, so exposure could be briefly intense. It is possible, despite PDC use, that a large landslide into the anadromous reaches of Greenhorn Creek, Woods Creek or the Cispus River could create extremely high suspended sediment concentrations for a long enough period of time to adversely affect salmonid health.

Although direct exposure to suspended sediment may harm or kill some juvenile Chinook salmon, coho salmon, and steelhead in Greenhorn and Woods Creek sub-watersheds, this loss is not anticipated to affect the abundance, productivity, spatial structure or diversity of the Cispus River populations of these species, as these sub-watersheds are ranked very low (tier 4) with respect to contributing to the Cispus River recovery domain.

Depending on timing and intensity, sediment delivered the action area may also impair spawning success by becoming incorporated into salmon and steelhead redds and decrease the fraction of eggs that hatch. Specifically sediments in Greenhorn and Woods Creeks are more likely to affect coho salmon and steelhead, while Chinook salmon are more likely to be affected by sediment delivery to the Cispus River. Redds constructed from substrate with a significant fraction of sand are more likely to have interstitial spaces plugged by fine sediment suspended in the water column. As interstitial spaces become plugged, the probability that eggs and embryos in redds receive the quantity of dissolved oxygen they need to survive is reduced. The fines fraction within gravel/cobble substrate is a primary predictor of spawning habitat quality. Lapointe et al. (2004) tested the hypothesis that over a range of substrate sand fractions, the variation of silt fraction determines reproductive success. Hydraulic conductivity of uniform material varies with the square of the particle diameter. Empirically, for silt <.062 mm diameter and .63mm < sand < 2 mm diameter, percent survival (percent) = 83 − 2.3 (percent sand) − 6 (percent sand ∗ percent silt). So for example, 5 percent sand and 1 percent silt reduces egg survival from 83 percent to 41 percent; a substantial reduction in egg viability.

Levasseur et al. (2006) compared a relatively pristine Atlantic salmon spawning site on the Sainte-Marguerite River with a site degraded by sedimentation from an upstream, stream straightening project to determine the relative importance of sediment size fractions as a predictor of salmon embryo survival to hatching. They obtained concurrent field measurements of fine sediment content and salmon embryo survival in artificial redds. Average embryo survival dropped from 87 percent to 35 percent when silt and very, fine sand content of the substrate increased above 0.2 percent.

Sear et al. (2014) conducted a field investigation of how vertical hydraulic gradient, fine sediment accumulation, bed mobility and thermal regime control DO concentrations and oxygen transfer to salmonid eggs in redds to calibrate a model where intra-gravel flow is represented by Darcy's law. The model was calibrated with the actual volume of fine sediment that accumulated in redds during the study period. Over time, down-welling of oxygen rich water was reduced as incubation progressed because fine sediment accumulated in the pore spaces, reducing hydraulic conductivity. Intra-gravel velocity decreased from 2,132 centimeters per hour at the beginning of incubation to 1 centimeter per hour.

The USFS provided estimates regarding the potential for their proposed road activities to deliver sediment to a stream based on road density, proximity of the road to the stream, and number of stream crossings. Road density ranges from relatively low 2.3 to a moderate 3.1 miles per square mile with 146 stream crossings. There is potential for mass wasting sediment input to the Woods Creek sub-watershed from the road network. If a mass wasting event were to take place coho salmon and steelhead would be the most at risk due to all freshwater life states utilizing the lowest reaches of Woods Creek. Incubating Chinook salmon eggs in the Cispus River could be at risk if the intensity of the mass wasting event provided enough sediment that it was unable to settle out within the Woods Creek sub-watershed and occurred during times Chinook Salmon eggs were in redds. Road prism sections on un-vegetated cut slopes and stream crossings are susceptible to erosion and are prone to wash out. Because tributary streams have a deficit of pool forming large wood, the sediment will be transported to lower gradient depositional reaches of the tributaries. Gravel and sand from the road sediment that would be beneficial to the streambed are retained longer on the hill slope while fine sediment that can plug pore spaces is rapidly transported to the stream. Fill hauled in to repair a road will likely, in the long run, end up in the channel. The way the river processes this sediment depends on the hydraulics of the channel. When the sediment enters a channel with a low or moderate slope, it stays in the system longer and can accumulate in pools and in the substrate. Since anadromous fish use channels with shallow slopes, the Forest Service sorts road construction actions into those that are within 0.75 miles of listed fish habitat and those that are outside 0.75 miles of listed fish habitat. Road construction within 0.75 miles of listed fish habitat has a greater probability of delivering sediment to streams in a pulse that will accumulate in and be harmful to fish habitat.

The degradation of salmon and steelhead spawning substrate in the action area by landslides originating from roads affects approximately 1 percent of the critical habitat in the Upper Cowlitz River that currently occupied by Spring Chinook and less than 1 percent of the critical habitat in the Upper Cowlitz, Cispus and Tilton Rivers occupied by coho and steelhead. We expect small pulses of sediment from the road surface to reach Greenhorn and Woods Creeks fairly frequently and we expect large amounts of sediment from road initiated land slopes to rarely reach the channel. Once it reaches the channel, the sediment has to become incorporated into the substrate and even then the fine and very fine sediment fractions in the substrate are just one of the variables that determines the DO supplied to eggs and embryos in redds. As discussed in effects to critical habitat section, the mass and mass rate of sediment delivery to anadromous spawning reaches of Greenhorn Creek and Woods Creek may increase as a result of the proposed action because sediment delivery is positively correlated with road length and road traffic and both will increase during the timber harvest project. However, the increase in the mass and mass rate of sediment delivery during the project is expected to be small because PDC to control the

amount of sediment available from the increased road length and increased log haul trips, the erosion of that sediment during storms and the transport of that sediment from hillslopes to streams have greatly improved.

In summary, because we anticipate chronic low level introduction of sediment rather than intense high load from a landslide, the increment of impact on redds, egg survival, and alevin survival is expected to be small, and difficult to discern as a loss of abundance or reduction in productivity.

Temperature, Contaminants, and Peak Flows

As described above, it is unlikely that the proposed actions will contribute to a measurable increase in water temperature in the action area. Because the project is unlikely to negatively affect water temperature, no mechanism of exposure for salmonids exists. We note that baseline water temperatures exceed state standards and resulting effects of that condition on salmonids are described in the baseline section of this opinion. Because the proposed action includes "no cut" buffers for all stream classes, it is possible that over time, stream temperatures will improve as total tree canopy and shade increase.

Similarly, as described in the effects on critical habitat, the project is unlikely to alter water quality via contaminants, and peak flows are also unlikely to alter as a result of the project, thus listed fish are not likely to be exposed to such effects.

Shock from explosives

Aggregate production for road construction may expose listed fish species to pressure waves and vibration from high explosives. High explosive detonations produce a supersonic, over-pressurization, compression wave moving radially at 5,000 to 22,000 feet per second and surface waves that produce ground vibration. The compressional wave has a sharp peak followed by a negative (rarefaction) pressure trough. When this compressional wave reaches a stream, it oscillates the water column such that a parcel of water moves back and forth in the direction the pressure wave is traveling. The oscillating water force does mechanical work on fish tissue and organs, thus adversely affecting them.

Vibration from surface waves shakes salmonid eggs in their redd causing them to rupture or become damaged (ADFG 1994). The amount of damage that the shock wave does on fish tissue and the velocity of vibrations that reach redds are determined by the size of the explosion (pounds of explosive) and the distance from the explosion to the stream. USFS explosive size and distance limits are based on ADFG (1994). This study concluded that high explosive blasts that deliver a peak pressure wave below 2.7 pounds (force) per square inch (205 dB re: 1 uPa) is protective of juveniles and adults and peak vibration velocity below 0.5 inches per second to streams is protective of eggs and embryos in redds. USFS provided the direct line distance in feet from each quarry to the Cispus River. Project Design Criteria 4 (Road Construction and Maintenance) keeps the maximum explosive weight well below the weight associated with these limits.

In summary, it is unlikely that explosive activities will reach levels that significantly impair eggs, juveniles, or adults.

2.6 Cumulative Effects

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

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

The non-federal landscape in the action area and surrounding environment is dominated by commercial forestry on privately owned and managed timber lands. Less than 10 percent of the action area is in private ownership. Private land is also used for timber production. Harvests and roads in those acres contribute to the sediment effects to the anadromous river reaches within the Kraus Ridge Vegetation Management action area. Effects from commercial forestry on privately managed lands will include sedimentation from forest roads, sediment conveyance from timber lands recently harvested, potential use of pesticides, and the indirect effects of increased sedimentation on spawning, rearing and migratory habitat PCEs. These lands are managed under Washington State's Forest Practices Rules, which are, in turn, subject to provisions adopted in the Washington State Forest Practices Rules HCP with the WDNR (WDNR, 2005). Implementation of this plan has carried forward improvements to fish passage and road management via Road Maintenance and Abandonment Plans (RMAPs) to properly abandon or stabilize existing forest roads, and improve standards on how new roads are to be built and existing roads maintained or abandoned to ensure fish passage and minimize sediment delivery to streams and rivers. These rules, and the HCP that provides incidental take coverage to private forestry operations that comply with them, also specify riparian buffers to minimize adverse effects from logging operations on stream sedimentation, water quality, and habitat. Thus, non-federal cumulative effects would be comparable with the effects described for the proposed action.

2.7 Integration and Synthesis

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

species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

LCR Chinook salmon, LCR coho, and LCR steelhead are each listed as threatened species. Their status is based on low abundance, productivity, and spatial structure, and this status is due in part to decreased and/or degraded habitat throughout their range. The proposed action will affect habitat in the Cispus River tributary watersheds and the Cispus River watershed below tributary confluences. Tributaries to the Cispus River and provide spawning and rearing habitat for the Cispus River populations of LCR Spring Chinook, LCR coho, and LCR steelhead.

There are nine populations of LCR Spring Chinook. Seven of these populations are in the Cascade strata. All populations except the Sandy River population currently have a very low probability of persistence. LCR Spring Chinook recovery is based on four Cascade strata populations, including the Cispus River populations, reaching a high probability of persistence. The limiting factors to recovery for the tributary phase of Spring Chinook life history are reduced access to spawning and rearing habitats, and hatchery (competition) effects. Both of these limiting factors pertain to Cispus River Spring Chinook. The number of natural spawners is limited by the fraction of outmigrating smolts collected at the Cowlitz Falls Dam and naturally produced Chinook juveniles compete with 300,000 hatchery Chinook subyearlings transported to the Upper Cowlitz each year under the reintroduction program.

There are 25 populations of LCR coho salmon. Fourteen of these populations are in the Cascade strata. All Cascade strata populations except the Clackamas River population have a very low probability of persistence. LCR coho recovery is based on nine Cascade populations, including the Upper Cowlitz and Cispus River populations, reaching a high probability of persistence. The limiting factors to recovery for the tributary phase of LCR coho are fish passage barriers, and hatchery related effects. Both of these limiting factors pertain to Cispus River coho. The number of returning natural spawners is limited by the fraction of outmigrating smolts collected at the Cowlitz Falls Dam and naturally produced juveniles compete with offspring from adult hatchery coho transported to the Upper Cowlitz each year to spawn under the reintroduction program.

There are 17 populations of LCR winter run steelhead. Fourteen of these populations are in the Cascade strata. Eleven of these populations, including the Cispus River population, have a low or very low probability of persistence. LCR coho recovery is based on nine populations, including the Cispus River population, reaching a high probability of persistence. Limiting factors to recovery for the tributary phase of their life history are access to spawning and rearing habitats, and hatchery related effects. Both of these limiting factors apply to Cispus River steelhead. The number of returning natural spawners is limited by the fraction of outmigrating smolts collected at the Cowlitz Falls Dam and naturally produced juveniles compete with 287,500 hatchery produced juveniles planted in the Upper Cowlitz as part of the reintroduction program.

Greenhorn and Woods Creek have about 1.8 and 4.6 miles of accessible coho and steelhead spawning habitat respectively. These lower reaches of both Greenhorn and Woods Creek have been classified as Tier 4 critical habitat with a low priority for restoration. The habitat quality of the anadromous reaches of Greenhorn and Woods Creeks is fair and EDT analysis predicts a less

than 1 percent increase in ESA listed species abundance and productivity if restored to historical condition (template), indicating these reaches didn't contribute significantly to Cispus River historical abundances, and are unlikely to contribute significantly to the recovery of the species within the Cispus River recovery domain.

The most important reach in the action area for Spring Chinook is Cispus 1C, a short 0.2 mile reach between Woods Creek and Crystal Creek with Chinook spawning habitat, however both Greenhorn Creek and Woods Creek deliver sediment into this reach. EDT predicts a 5 percent increase in Chinook productivity if Cispus River reach 1C is restored to historical conditions.

The existing Forest Service road network and associated traffic delivers sediment to Greenhorn and Woods Creeks, especially as the storm-water drainage system ages and degrades. Sediment fills pools and causes the channel to widen which causes additional streambank erosion and widening during bankfull flows. Wide, shallow channels are less completely shaded by riparian trees and intercept more solar radiation per unit flow than narrow, deep channel flows. Permanent roads through the riparian buffer eliminate trees that would provide shade and, ultimately, LWD for the stream. The fine sediment fraction in the channel substrate reduces the substrate suitability for redd construction. The uplands road network also intercepts overland and subsurface water runoff and delivers it directly to tributaries, increasing the frequency and magnitude of peak flows relative to a roadless watershed. Peak flows move bedload and scour redds so more frequent peak flows decrease salmon and steelhead fry production.

From the 1940s to the 1970s, trees were harvested right up to the edge of the channel. Both Greenhorn and Woods Creek are Class I streams with wide riparian buffers but the trees are relatively young and small with a high fraction of hardwoods and do not completely shade the widened channel. Woods Creek water temperature exceeds State standards during the summer. The proposed action will not affect either of the limiting factors for the Cispus population of steelhead, coho, or Chinook salmon. The proposed action is reasonably certain to increase the supply of sediment from the roads to Greenhorn Creek, Woods Creek and ultimately the Cispus River channels, sustaining the degraded water, channel and substrate conditions from the existing road network. This additional supply of sediment will be offset by contemporaneous improvements in road drainage designs since the original road network was constructed, and construction PDCs that will upgrade to the water drainage systems in the baseline road. Most of the road extensions constructed for the project will be closed and stabilized when the project is complete so sediment delivery from these sources to Greenhorn Creek, Woods Creek and the Cispus River are expected to cease.

Wide riparian buffers around Greenhorn and Woods Creek sub-watershed Class II tributaries will prevent the proposed outer buffer thinning from affecting stream shade and water temperature. Commercial thinning in the outer riparian buffer of Class III and Class IV tributaries to both sub-watershed could result in increased solar heating and increased temperature of water ultimately delivered to the already warm summer water in Woods Creek but NMFS does not expect this to measurably increase water temperature in either creek because Class III stream summer flows are low and Class IV stream summer flows are intermittent. Water quality impairment from sediment input is likely to occur intermittently, rather than chronically, coinciding with large rainfall events when stream conditions would have naturally

high levels of sediment. Water quality is likely to return to baseline conditions between large rainfall events, and the habitat will maintain its overall low conservation value despite episodes of increased turbidity due to the proposed action.

ESA listed salmon and steelhead in Greenhorn Creek, Woods Creek and the Cispus River will be exposed to suspended sediment that originates from the baseline road system and the proposed action's temporary road extensions, landings, and yarding corridors. The effects of suspended sediment on fish depend on concentration and the duration of exposure. Both are highly unpredictable given the stochastic nature of erosion and the complex delivery pathway, but as described above, we expect the PDCs to avoid intense delivery. Although turbidity effects associated with the proposed action may temporarily affect the critical habitat PBF, water quality, and harm individual salmonids from ESA listed populations. NMFS analysis did not identify turbidity effects with intensities or durations that would result in a reduction of the conservation value of designated critical habitats or reductions in abundance and productivity of exposed populations, thus the survival and recovery of ESA listed salmonid species are also not reduced. As such, the proposed action should not reduce the recovery potential of ESA-listed salmonids within the Cispus River recovery domain.

2.8 Conclusion

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

2.9 Incidental Take Statement

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

2.9.1 Amount or Extent of Take

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

Take in the form of harm is likely to occur when timber practices increase sediment in stream reaches. Harm is often difficult to quantify as a number of fish to be injured or killed because the abundance of fish present to experience detrimental habitat-based conditions is highly variable, so we cannot predict their presence when short term effects are likely. The ability to anticipate the number becomes even more difficult when effects are long term, because over time presence can range significantly, and is influenced by multiple factors that cannot be predicted, such as ocean survival and weather conditions. In such circumstance we use a surrogate, called an extent of take, which is causally related to the type of harm.

We expect take among the Cispus populations of LCR Chinook salmon, LCR coho, and LCR winter steelhead from 34 harvest sites along 9.6 miles of road. These sites and the amount of road are causal to the harm because these are the source of water quality effects (turbidity) that can smother redds or injure juvenile salmonids.

2.9.2 Effect of the Take

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

2.9.3 Reasonable and Prudent Measures

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

1. Minimize take associated with sediment delivery to streams within the Kraus Ridge Vegetation Management project action area from road surface erosion.

2. Minimize take associated with sediment delivery to Kraus Ridge Vegetation Management project action area from road subsurface flow interception/concentration.

3. Minimize take associated with sediment delivery where roads cross streams.

4. Monitor sediment delivery during periods of high precipitation or prolonged precipitation to ensure take is not exceeded.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the USFS or any applicant must comply with them in order to implement the RPMs (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) The following term and condition implements reasonable and prudent measure 1:
   a) Design road surfaces with sufficient grade to avoid surface ponding and subsurface saturation.

2) The following term and condition implement reasonable and prudent measure 2:
   a) Ensure vegetation is retained on slopes below road prisms to the fullest extent possible ensure maximum stability during wet conditions.

3) The following terms and conditions implement reasonable and prudent measure 3:
   a) Comply with HPA work window during construction of stream crossings to avoid exposing sensitive life stages to construction effects;
   b) Prior to construction of stream crossings, herd fish with block nets to isolate the worksite, to a point 30 upstream and 250 feet downstream of the crossing location to avoid exposure of rearing juveniles to high levels of suspended sediment.

4) The following term and condition implements RPM 4;
   a) During periods of intense rainfall or protracted wet periods, conduct sight survey to ensure roads or harvest areas are not failing or have not failed. If a failure occurs that reaches anadromous fish bearing stream/s, take will be exceeded and the USFS must contact NMFS for re-initiation.

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. NMFS recommends any efforts to increase the abundance and productivity of Cispus River ESA listed salmonids should be focused on Tier 1 and Tier 2 main-stem and tributary reaches, located on FS managed lands.

2. NMFS recommends the use of outreach materials and/or signage being placed at decommissioned road intersections. These signs can inform the public using FS land of the importance of road-to-forest natural succession and how the continual use of these temporary roads contributes to increased sediment delivery to anadromous stream reaches and extends the duration of potential lethal effects to ESA listed salmonids.

2.11 Reinitiation of Consultation

This concludes formal consultation for Kraus Ridge Vegetation Management and Restoration Project.

As 50 CFR 402.16 states, reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control

over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.12 "Not Likely to Adversely Affect" Determinations

Southern Resident (SR) Killer Whales move into the coastal waters along the outer coast from the Queen Charlotte Islands south to central California, including coastal Oregon and off the Columbia River although they do not have critical habitat designated in Oregon(NMFS, 2008). SR killer whales have been documented in the Columbia River plume (Zamon et al., 2007). SR killer whales primarily eat salmon, and prefer Chinook salmon (Hanson et al., 2010; NMFS, 2008).

The proposed program may slightly affect the quantity of their preferred prey, Chinook salmon. The take of Chinook salmon up to the aforementioned amount and extent of take would be so few as to constitute an insignificant reduction in adult equivalent prey resources for SR killer whales that may intercept this species within their range.

The NMFS finds that any effect the proposed program may have on SR killer whale prey, and any in turn any indirect effect on SR killer whales is likely to be insignificant. Therefore, NMFS finds that the proposed program is not likely to adversely affect SR killer whales.

Critical habitat is proposed for SR killer whales at the mouth of the Columbia River and Columbia River Chinook salmon are a PBF of this habitat. Because we anticipate that the effects on LCR salmonids, including LCR Chinook salmon are insufficient to be discerned as a reduction in abundance or productivity, the effects to this proposed PBF are insignificant.

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

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

This analysis is based, in part, on the EFH assessment provided by the USFS and descriptions of EFH for Pacific Coast salmon (PFMC 2014) 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 proposed action affects Pacific Coast Salmon EFH based on the Pacific Coast Salmon Fishery Management Plan (PFMC, 2014).

3.2 Adverse Effects on Essential Fish Habitat

As described in the accompanying biological opinion, the proposed action affects EFH by reconstructing or newly constructing, extending, and reopening roads that have a history of delivering sediment to Greenhorn and Woods Creeks. Reconstructing and using these roads for this project will deliver some sediment to both creeks during the project and unless extraordinary measures are taken to maintain them, it is likely that they will on into the future undergo drainage system failures and continue to deliver sediment to Greenhorn Creek and Woods Creek sub-watersheds into the future. The effects of sediment on EFH is the same as the effects on designated critical habitat described in the accompanying opinion, namely episodic impairment of water quality, and corollary impairment of some spawning areas, in the freshwater environment.

Briefly reiterated, sediment accumulates in the channel substrate and becomes incorporated in salmon redds. Because the interstitial space is reduced, suspended sediment is more likely to be captured by the redd structure. Over time, the hydraulic conductivity is decreased and less dissolved oxygen is delivered to eggs and embryos in redds.

3.3 Essential Fish Habitat Conservation Recommendations

1. To minimize water quality impairment from sediment delivery to the Kraus Ridge action area during the project, monitor road construction and maintenance and control hauling on roads, the USFS should use all PDCs listed in the Proposed Action section of this Opinion.
2. To minimize water quality impairment from minimize sediment delivery to the Kraus Ridge action area after the project is complete, the USFS should design the reconstructed roads using road drainage guideline in the Forest Service Preconstruction Handbook (USFS, 2014).

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in Section 3.2, above, approximately 14 acres of designated EFH for Pacific Coast salmon.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, 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 users of this opinion are USFS. Other interested users could include contracted logging operations. Individual copies of this opinion were provided to the USFS. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion [*and EFH consultation, if applicable*] 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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