UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

West Coast Region
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404

JAN 1 5 2016

Refer to NMFS No: WCR-2015-2518

Patricia Grantham
Forest Supervisor
Klamath National Forest
1711 South Main Street
Yreka, California 9609

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Westside Fire Recovery Project on the Klamath National Forest, Siskiyou County, California

Dear Ms. Grantham:

Thank you for your letter of July 24, 2015, requesting initiation of formal consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 *et seq.*) for the Westside Fire Recovery Project (Project). The enclosed biological opinion describes NMFS' analysis of the effect of the U.S. Forest Service Klamath National Forest's (KNF) implementation of the proposed Project on threatened Southern Oregon/Northern California Coast (SONCC) coho salmon *(Oncorhynchus kisutch)* evolutionarily significant unit (ESU) and its designated critical habitat. NMFS also reviewed the proposed action for potential effects on essential fish habitat (EFH) designated under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), including conservation measures and any determination you made regarding the potential effects of the action. This review was pursuant to section 305(b) of the MSA, implementing regulations at 50 CFR 600.920, and agency guidance for use of the ESA consultation process to complete EFH consultation.

Based on the best available scientific and commercial information, NMFS concludes that the action, as proposed, is not likely to jeopardize the continued existence of the SONCC coho salmon Evolutionarily Significant Unit (ESU), and is not likely to result in the destruction or adverse modification of critical habitat for the SONCC coho salmon ESU. However, NMFS expects incidental take of SONCC coho salmon, as well as adverse effects to designated critical habitat for SONCC coho salmon as a result of implementation of the proposed action. An incidental take statement with non-discretionary terms and conditions is included with the enclosed biological opinion.

The proposed Project is located in an area that is identified as EFH for Pacific Coast salmon, which are managed under the Pacific Coast Salmon Fishery Management Plan. Based on our

review, NMFS concludes the proposed Project would adversely affect EFH for Pacific Coast salmon. However, the proposed Project contains adequate measures to avoid, minimize, mitigate, or otherwise offset the adverse effects to EFH. Therefore, NMFS has no additional conservation recommendations to provide.

The KNF has not requested to initiate section 7 consultation with NMFS on listed threatened Southern Resident Killer Whales (SRKW) for the Project. However, we advise that the KNF consider our EFH analysis and determination that the Project would adversely affect EFH for Pacific Coast salmon and Chinook salmon, which are primary food sources of SRKW.

NMFS appreciates the KNF's close and sustained coordination and collaboration throughout the consultation period. If you have any questions regarding this section 7 consultation, or if you require additional information, please contact Mr. Don Flickinger of NMFS at (530) 841-4414.

Sincerely,

for

William W. Stelle, Jr.
Regional Administrator

Enclosure

cc: Bobbie DiMonte Miller, USFS, Yreka, CA
Jenny Erikson, USFWS, Yreka, CA
Craig Tucker, Karuk Tribe, Happy Camp, CA
CHRON File (pdf)
Division- File copy to ARN File # 151422WCR2015AR00120

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

Westside Fire Recovery Project

NMFS Consultation Number: WCR-2015-2518
Action Agency: U.S. Forest Service, Klamath National Forest

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Southern Oregon / Northern California coastal coho salmon (*Oncorhynchus kisutch*)	Threatened	Yes	No	No

Fishery Management Plan That Describes EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	No

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

Issued By: for
William W. Stelle, Jr.
Regional Administrator

Date: JAN 1 5 2016

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LIST OF ABBREVIATIONS USED

ABBREVIATION	DEFINITION
ASP	Anadromous Salmonid Protection Rules
BAER	Burned Area Emergency Rehabilitation
BOF	Board Of Forestry
CAFO	Concentrated Animal Feeding Operations
CDFW	California Department Of Fish And Wildlife
CWA	Clean Water Act
DBH	Diameter At Breast Height
EFH	Essential Fish Habitat
EHR	Erosion Hazard Rating
ERA	Equivalent Roaded Area
ESA	Endangered Species Act
ET SEQ.	[Latin *Et Sequens*] And The Following One
ESU	Evolutionarily Significant Unit
FEIS	Final Environmental Impact Statement
GDRC	Green Diamond Resource Company
IP	Intrinsic Potential
ITS	Incidental Take Statement
ETC.	[Latin Et Cetera] And Others, Especially Of The Same Kind: An So Forth
KNF	Klamath National Forest
LWD	Large Woody Debris
MSA	Magnuson-Stevens Fishery Conservation And Management Act
NMFS	National Marine Fisheries Service

NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
PCE	Primary Constituent Element(S)
PE	Project Element
RCD	Resource Conservation District
RR	Riparian Reserves
SWRCB	State Water Resources Control Board
T/I	Threatened Or Impaired (Values)
TMDL	Total Maximum Daily Load
USC	United States Code
USFS	United States Forest Service
USFWS	United States Fish And Wildlife Service
VSP	Viable Salmonid Populations

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

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

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

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available through NMFS' Public Consultation Tracking System [https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts]. A complete record of this consultation is on file at the NMFS Arcata, California office.

1.2 Consultation History

The three wildland fire complexes comprising the Westside Fire Recovery Project (Project) area ignited on July 30, 2014 (Beaver Fire), July 31, 2014 (Whites Fire), and August 12, 2014 (Happy Camp Complex), and together burned approximately 183,500 acres, of public (162,580 acres) and private (20,910 acres) lands. These fires brought about landscape-level changes to forest soils, watersheds, vegetation, and wildlife. A significant amount of the burn severity on Klamath National Forest (KNF) lands was rated as medium (22-30 percent) or high (1-6 percent), resulting in areas where: all understory plants and twigs on the soils surface were charred or consumed; the pre-fire soil organic layer was largely consumed; and the majority of mature trees were killed. In response, the KNF is proposing to undertake fuels reduction, complete site preparation and reforestation, remove hazard trees along roads, and treat Legacy (sediment) sites within the Elk Creek watershed, while also salvaging merchantable dead and dying timber on generally high burn severity sites within the Happy Camp Complex and Whites Fire perimeters.

The NMFS representative participating in NMFS-KNF Level 1 coordination[1], attended field Project reviews on: October 27, 2014, December 3, 2014, January 8, 2015, March 5, 2015, and April 3, 2015. The Project was discussed in detail, including map and Project Design Feature

[1]Level 1 Teams are the core component of a streamlined consultation process. Level 1 Teams are comprised of biologists designated by their respective agencies as team members. Their role is to assist the participating land management agencies in designing programs and activities in such a way as to minimize or avoid adverse impacts to listed species and their habitats (USFS, NMFS, BOR, and US FWS 1999).

review, at a Level 1 coordination meeting on January 7, 2015, and Project interdisciplinary team meetings on January 9, 2015, and March 20, 2015. Information sharing and incorporation of minimization measures to protect SONCC coho salmon and their critical habitat continued during the entire period of Project development, from October 2014 to the present. A draft Project Biological Assessment (BA) was submitted to NMFS on April 1, 2015. Comments from NMFS were received on April 9, 2015, and on April 11, 2015. Comments were reviewed and discussed together on April 10, 2015, and April 13, 2015. The BA was finalized on April 13, 2015. The request for informal consultation and the final BA were received by NMFS on April 16, 2015. Due to revisions to the Project proposed action, the Project consultation period was extended.

All revisions to the Project were finalized in a Project addendum, received by NMFS via email on June, 22, 2015, and the Project consultation period was extended until July 22, 2015. On July 22, 2015, NMFS sent the KNF a letter of non-concurrence relating to the Project, providing reasons for this determination, and requested that the KNF request initiation of formal consultation. On July 24, 2015, the KNF responded to the NMFS letter of non-concurrence, acknowledged NMFS' disagreement with the KNF's Not Likely to Adversely Affect (NLAA) effects determination for the Project, briefly reconfirmed the basis for the KNF's NLAA effects determination, and then, to expedite the consultation process, requested formal consultation and indicated the willingness to provide any further information that NMFS might request. On July 24, 2015 formal consultation was initiated.

1.3 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas (50 CFR 402.02).

The USFS proposes to undertake a wildland fire recovery project within the Happy Camp Complex, Beaver Fire, and Whites Fire areas, which were burned by wildfire in 2014. USFS will treat residual fuels on approximately 60,550 acres, 5,760 acres of which will be salvaged harvested (USFS 2015c) within the 218,000 acre Project boundary on the Westside of the Klamath National Forest (see Appendix A below, Figures 1a-1f). The addendum (USFS 2015b) to the Project BA (USFS 2015a), received on June 22, 2015, describes the following activities/Project elements (PEs): commercial salvage harvest; reforestation; fuels reduction; hazard tree removal; temporary road and landing construction; water drafting; and Legacy (sediment) Site treatment. Salvage harvest under the project would occur over a two-year period (starting in 2015). Other Project activities, including prescribed burning and Legacy Site treatments, may take up to two decades to complete.

1.3.1 Commercial Salvage Harvest and Reforestation

Commercial salvage harvest and reforestation is proposed on approximately 5,760 acres using ground-based, skyline, and helicopter logging systems (USFS 2015c) within eleven 5th field watersheds (USFS 2015b, Table 3), along with site preparation and planting of approximately 12,891 acres (USFS 2015c), 852 acres of which will be in Riparian Reserve (RR), *i.e.*., areas adjacent to, or that influence, aquatic habitat (USFS 2015e). Standing dead trees at least 14

inches in diameter at breast height (dbh) will be selected for commercial salvage harvest following guidelines in Report #RO-11-01 "Marking Guidelines for Fire-Injured Trees in California" (Smith and Cluck, 2011). Reforestation includes site-preparation, planting and release, to increase the likelihood of and speed by which burned areas are reforested. Reforestation treatments within RRs are proposed within Project plantation site preparation and planting units in the Whites Fire and Happy Camp Complex, to achieve ground cover and to encourage natural recovery of vegetation and soils. There will be no commercial salvage harvest within wilderness, backcountry, research natural areas, designated or recommended wild rivers, inventoried roadless areas, or RRs along stream channels. RRs can include unstable and potentially unstable areas that are not in riparian areas, but that are primary sources of wood and sediment to streams (USFS 1994). Similarly, there will be no mechanized equipment operation in RRs where commercial salvage harvest or reforestation takes place.

1.3.2 Fuels Reduction

Fuels Reduction treatments are proposed on approximately 24,450 acres (USFS 2015c) where high and moderate vegetation mortality was caused by the 2014 wildfires, and will include hand work, mechanical thinning, mastication (mulching understory fuels with a rotating blade), lop and scattering, chipping, broadcast burning, jackpot burning (burning of concentrations of fuels on the ground), and pile burning. Treatment of slash/activity fuels associated with salvage logging will include, as needed, jackpot burning, pile or windrow burning, and/or lop and scatter. In approximately 3,594 acres of RRs (USFS 2015e), fuels treatment will occur where fire-killed trees can be mitigated without the use of ground-based equipment (USFS 2015a, Tables 3 and 4). Trees up to 16 inches dbh may be cut and felled in RRs. Fuels treatments will include hand-work only, and lop-and-scatter or other fuels reduction will be implemented if fuel loading is above seven tons per acre. Fuels may be hand-piled or windrowed and then burned.

1.3.3 Hazard Tree Removal

Hazard tree removal is proposed along a maximum of approximately 320 miles of Forest Service roads, County Roads, and State Highways (equivalent to approximately 14,320 acres, including 2,256 acres within RRs, and 12 linear miles of roads within 200 feet of SONCC coho salmon critical habitat (USFS 2015b, USFS 2015c, USFS 2015e, see Project maps below), to provide for public and Forest worker safety and future fire suppression efforts. Hazard trees will be identified, felled, and removed, as needed for safety, in compliance with Region 5 Hazard Tree Guidelines (USFS 2012). During hazard tree felling and removal in RRs, mechanized equipment will be prohibited from leaving roads. Hazard trees greater than 26 inches dbh will be retained on site if they are felled within one site tree height distance from all streams, whether perennial or intermittent. Similarly, such trees will be retained on site when they are located downslope of a road in a position from which, if felled, they would contact a fish-bearing stream. All hazard trees felled within 25 feet of any stream channel will be retained on site, unless such felled trees pose a threat to safety or accessibility. Prior to roadside hazard tree felling, Karuk Tribe, USFS, or NMFS fisheries biologists will confirm that the hazard tree mark downslope of roads adjacent to SONCC coho salmon critical habitat is in compliance with Region 5 Hazard Tree Guidelines (USFS 2012) in Beaver Creek, Walker Creek, Grider Creek, China Creek, Little Horse Creek, East Fork Elk Creek, Cougar Creek, Tompkins Creek, North Russian Creek, North Fork Salmon

River, and Whites Gulch.

1.3.4 Temporary Roads (including Stream Crossings), Landings, and Water Drafting

Temporary roads (including stream crossings), landings, and water drafting will include approximately 6.2 miles of temporary road use, including approximately 0.1 mile of new temporary road construction (none within RRs), 4.8 mils of temporary road use on reopened USFS Maintenance Level 1 roads, 0.1 mile of temporary road use on reopened temporary roads, 1.2 miles of temporary road use on re-opened decommissioned road segments (USFS 2015e, Table 3), and four temporary road/stream crossings (USFS 2015b, Table 4). All four temporary road/stream crossings will be located outside of anadromous salmonid habitat.

A maximum of 40 existing and 75 new landings will be (re)constructed (USFS 2015b, Table 7). Individual helicopter landings will not be larger than two acres, while individual skyline or ground-based landings will not be larger than one and one-half acres. Six Project landings will occur within RRs, namely DZ03, DZ10, DZ23, L043, L044, and L090, and these will be discussed further below.

The KNF proposes to draw water from waterways in the Action Area (water drafting) to use for dust abatement on roadways. Water drafting will occur at extant, designated water drafting sites (USFS 2015a, Table 10), and will follow NOAA Fisheries Water Drafting Specifications (2001), Project Design Feature Watershed-34, and Best Management Practice (BMP) 2.5 (USFS 2015a, Appendix E). Water drafting will be monitored by USFS fisheries biologists throughout Project implementation, and shifted to sites with sufficient surface flows to comply with water drafting specifications if/when surface flows diminish at any designated water drafting sites (see Appendix A below, Figures 2a-2f).

1.3.5 Legacy (Sediment) Site Treatments

Legacy (sediment) site treatments are proposed to reduce sediment mobilization and delivery along USFS system roads and at stream crossings at approximately 165 locations, primarily within the Elk Creek watershed, but also within the Grider Creek and Kuntz Creek watersheds. Legacy site treatments will occur along 33 miles of USFS system roads, with approximately 148 of these legacy sites located in the Elk Creek watershed (USFS 2015a, Appendix A). Some of these Legacy sites are located on existing landings or on roadbeds: historical roads, abandoned temporary roads, or decommissioned roads. Legacy site treatments include: culvert upgrades (45 sites); diversion prevention (51 sites); aquatic organism passage improvement (three sites); retaining wall construction (seven sites); fill reduction (16 sites); fill removal (27 sites); and culvert/ditch infrastructure repair or maintenance (16 sites). All Project Legacy Sites are located outside of and at least 300 feet upstream from SONCC coho salmon critical habitat. Similarly, no Project Legacy sites are located in any habitat occupied by SONCC coho salmon, or by any anadromous salmonids. However, legacy site treatments will result in long term beneficial effects to critical habitat located downstream by reducing the amount of sediment delivered to those sites over time.

1.3.6 Project Resource Protection Measures

Project design features (PDFs), BMPs (USFS 2015a), and wet weather operation standards (WWOS) (USFS 2002), collectively called resource protection measures, are proposed to minimize impacts to aquatic resources and organisms. The Project addendum (USFS 2015b) clarifies how these Project resource protection measures have been strengthened since initiation of consultation on April 16, 2015. These revisions to resource protection measures were tracked and analyzed by USFS and NMFS during Level 1 collaboration, to ensure that both singly, and cumulatively, they reduce anticipated Project effects on SONCC coho salmon and its critical habitat. The revisions (in *italics*) are as follows:

1) PDF Watershed-4 states that tractors and mechanical harvesters will be excluded from all RRs associated with stream channels, active landslides, inner gorges (*i.e.*., slopes greater than 65 percent leading to a linear feature that connects to stream network, with or *without annual scour*), and toe zones of dormant landslide deposits. *During roadside hazard tree removal actions within RRs, ground-based equipment will not leave the road*;

2) PDF Watershed-6 was revised to confirm that there will be no salvage harvest on active landslides *or toe zones of dormant landslides, except for salvage harvest units 5, 23, 32, 39, 55, 56, 57, 59, 64, 226, 268, 406, 520, 524, 525, and 530* (USFS 2015b, Table 2) *which were field reviewed by the KNF geologist*. The geologist determined that these salvage harvest unit sites showed no indication of movement for at least ten years and have vegetation conditions that would benefit from planting. These salvage harvest units are generally small in size, involve no ground based operations, and many are associated with road fill failures/slips which are known and have been extensively mapped;

3) PDF Watershed-12 was revised to clarify that all hazard trees cut within 25 feet of a stream channel or spring will be left on site unless they continue to pose a threat to safety or accessibility. *Along all stream channels (perennial and intermittent)*, all hazard trees 26 inches dbh or greater that are within the first site tree distance (150-170 feet) of any stream channel will be left on site unless after felling, they continue to pose a threat to safety, infrastructure, forest road drainage system integrity or accessibility. *Any hazard tree (equal or greater than 26 inches dbh) below a road that would contact a fish bearing stream channel if felled that direction will be retained on site* (USFS 2015b);

4) A wildlife PDF was added to further restrict removal of live trees during roadside hazard operations. The new Wildlife PDF states: "*Trees without fire damage will not be felled unless they are an immediate hazard*;"

5) 7th field checklists have been updated during the development of the Project (*e.g.*, 7th field subwatersheds within the Beaver Fire footprint);

6) During Project implementation, the USFS, Karuk Tribe, and NMFS will share information about where Project water drafting is occurring, jointly monitor those water drafting actions, and assist USFS representatives in deciding where to shift Project water drafting so that it is not likely to adversely affect SONCC coho salmon and its critical habitat; and

7) The USFS and NMFS level 1 team will closely monitor the status of ground disturbing actions if/when operations are occurring outside of the Normal Operating Season (NOS) or within the NOS during wet weather, to ensure compliance with Forest Service Best Management Practices and Wet Weather Operations Standards.

1.3.7 Project Timing

Project implementation was proposed to begin in the summer/fall of 2015 but likely will not start until early 2016. Project commercial salvage harvest and hazard tree removal is expected to be completed over the course of two years. All Project activities will be restricted during periods of wet weather, in compliance with WWOS (USFS 2002). PDFs and BMPs (USFS 2015a, Appendix E) will also condition Project operations during periods of wet weather. Fuels treatments will occur within ten years after Project salvage harvest and hazard tree removal have been completed. Because prescribed burning activities are dependent upon weather conditions and staff availability, such burning may continue for several years following completion of other Project vegetation treatment activities. Legacy site treatments in the Elk Creek watershed are projected to begin in 2019, and the schedule for treating these Legacy sites predicts they may continue for up to two decades (USFS 2015e, Table 9). The actual Legacy site treatment schedule will be determined by USFS consultation with the North Coast Water Quality Control Board and funding availability.

1.3.8 Interrelated and Interdependent Actions

"Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02). Due to the comprehensive manner in which activities have been included in the proposed action described above, NMFS does not anticipate any interrelated or interdependent actions associated with the proposed action.

1.4 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 Project action area encompasses 218,000 acres and is located within portions of the 2014 Happy Camp Complex, Whites Fire, and Beaver Fire: which are all located between Happy Camp, CA and Scott Bar, CA, east of Sawyers Bar, CA, and northwest of Oak Knoll, CA, respectively (centroid: 41.48464 N, 123.11088 W; see Appendix A, Figures 1a-1f). The Project boundary encompasses Matrix-General Forest, Riparian Reserve, Late Successional Reserve, Partial Retention and Recreational River land allocations. The ESA action area includes eleven 5th-field watersheds, and their respective 7th field subwatersheds or drainages, all of which provide habitat for SONCC coho salmon. The eleven 5th-field watersheds that will be affected by Project activities in some manner are: Beaver Creek, Elk Creek, Horse Creek-Klamath River, Humbug Creek-Klamath River, Indian Creek, Lower Scott River, North Fork Salmon River, Seiad Creek-Klamath River, South Fork Salmon River, Thompson Creek-Klamath River, and Ukonom Creek-Klamath River. Numerous 7th-field subwatersheds will be affected by the

Project, for which environmental baseline and Project effects checklists are provided in Appendix D of the Project BA (USFS 2015a). The upstream extent of the action area is defined as Beaver Creek in the Klamath River, Kelsey Creek in Scott River, and North and South Russian creeks in Salmon River. The action area extends downstream to the Confluence of the Klamath and Salmon Rivers, where potential Project impacts merge, and beyond which such impacts are expected to become indistinguishable from background conditions.

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, Federal agencies must ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides an opinion stating how the agency's actions would affect listed species and their critical habitat. If incidental take is expected, section 7(b)(4) requires NMFS to provide an incidental take statement (ITS) that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures and terms and conditions to minimize such impacts.

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

The adverse modification analysis considers the impacts of the Federal action on the conservation value of designated critical habitat. This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.[2]

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

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

[2] Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS (Application of the "Destruction or Adverse Modification" Standard Under Section 7(a)(2) of the Endangered Species Act) (November 7, 2005).

- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat.
- Reach jeopardy and adverse modification conclusions.
- If necessary, define a reasonable and prudent alternative to the proposed action.

For critical habitat, NMFS determines the range-wide status of critical habitat by examining the condition of its physical or biological features (also called "primary constituent elements" or PCEs for short) – which were identified when critical habitat was designated. Species and critical habitat status are discussed in section 2.2 of this biological opinion.

To conduct the assessment, NMFS examined an extensive amount of information from a variety of sources. Detailed background information on biology, status, and critical habitat of SONCC coho salmon has been published in a number of documents, including: peer-reviewed scientific journals; primary reference materials; and governmental and non-governmental reports. Additional information relating to the effects of Project activities on SONCC coho salmon, their anticipated response to Project activities, and the environmental consequences of the Project as a whole was formulated from the aforementioned resources, and from the Project BA (USFS 2015a, USFS 2015b). Information was also provided in email messages and telephone conversations between November 2014 and November 2015. For information that has been taken directly from published, citable documents, those citations have been referenced in the text and listed at the end of this document.

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' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential physical and biological features that help to form that conservation value.

Once the biological status of a species' populations has been determined, NMFS assesses the status of the entire species using criteria for groups of populations, as described in recovery plans and guidance from technical recovery teams. Considerations for species viability include having multiple populations that are viable, ensuring that populations with unique life histories and phenotypes are viable, and that some viable populations are both widespread to avoid concurrent extinctions from mass catastrophes and spatially close to allow functioning as metapopulations (McElhany *et al.* 2000).

2.2.1 SONCC Coho Salmon General Life History

Coho salmon is an anadromous fish species that generally exhibits a relatively simple three-year life cycle. Adults typically begin their freshwater spawning migration in the late summer and fall, spawn by mid-winter, and then die. Spawning occurs mainly in November to December in small streams that flow directly into the ocean, or tributaries and headwater creeks of larger rivers (Sandercock 1991, Moyle 2002). Depending on river temperatures, eggs incubate in ‘‘redds’’ (gravel nests excavated by spawning females) for 1.5 to 4 months before hatching as ‘‘alevins’’ (a larval life stage dependent on food stored in a yolk sac). Following yolk sac absorption, alevins emerge from the gravel as young juveniles or ‘‘fry’’ and begin actively feeding. Juvenile rearing usually occurs in tributary streams with a gradient of 3 percent or less, although they may move up to streams of 4 percent or 5 percent gradient. Juveniles have been found in streams as small as 1 to 2 meters wide. They may spend 1 to 2 years rearing in freshwater (Bell and Duffy 2007), or emigrate to an estuary shortly after emerging from spawning gravels (Tschaplinski 1988). Coho salmon juveniles are also known to “redistribute” into non-natal rearing streams, lakes, or ponds, often following rainstorms, where they continue to rear (Peterson 1982).

Juveniles rear in fresh water for up to 15 months, and then migrate to the ocean as “smolts” in the spring. Coho salmon typically spend about another 15 months in the ocean before returning to their natal stream to spawn as 3-year-olds. Some precocious males, called ‘‘jacks,’’ return to spawn after only 6 months at sea. Coho salmon were historically distributed throughout the North Pacific Ocean from central California to Point Hope, AK, through the Aleutian Islands, and from the Anadyr River, Russia, south to Hokkaido, Japan. Historically, this species probably inhabited most coastal streams in Washington, Oregon, and northern and central California. NMFS identified six coho salmon evolutionarily significant units in Washington, Oregon, and California (Weitkamp *et al.* 1995), including the SONCC. The SONCC coho salmon ESU is composed of 41 populations between Punta Gorda, California and Cape Blanco, Oregon.

2.2.2 Status of SONCC Coho Salmon

KNF determined that the proposed action may affect the SONCC coho salmon ESU (70 FR 37160; June 28, 2005; SONCC coho salmon were originally listed as a threatened species in 1997: 62 FR 24588, May 6, 1997) and its critical habitat (64 FR 24049; May 5, 1999). Page 24049 of the May 5, 1999, Federal Register final rule defines critical habitat for the SONCC coho salmon ESUs as the area which “encompasses accessible reaches of all rivers (including estuarine areas and tributaries) between the Mattole River in California, and the Elk River in Oregon, inclusive.” In June 2005, NMFS reaffirmed the status of SONCC coho salmon as a threatened species and also listed three hatchery stocks as part of the ESU (70 FR 37160; June 28, 2005). Analysis of recent genetic data from coho salmon in this and adjacent ESUs (Oregon Coast ESU to the north and Central California Coast ESU to the south) supports the existing boundaries of the SONCC coho salmon ESU boundary (Stout *et al.* 2010, Williams *et al.* 2011). NMFS recently completed a status review of the SONCC coho salmon ESU (Ly and Ruddy 2011) and determined that the ESU, although trending in declining abundance, should remain listed as threatened. The distribution of SONCC coho salmon and its critical habitat within the

Project action area is based on existing stream survey information collected or verified by KNF aquatic biologists (USFS 2015a, Appendix A).

Williams *et al.* (2008) built on the population structure and the concepts of Viable Salmonid Populations (VSP, McElhany *et al.* 2000) to establish the extinction risk criteria at both population and ESU scales. The population extinction risk criteria represent an extension of an approach developed by Allendorf *et al.* (1997), and include metrics related to population abundance (effective population size), population decline, catastrophic decline, spawner density, hatchery influence, and population viability assessment. Populations that fail to satisfy several extinction risk metrics are likely at greater risk than those that fail to satisfy a single metric.

If a spawning population is too small, the survival and production of eggs or offspring may suffer because it may be difficult for spawners to find mates, or predation pressure may be too great (Liermann and Hilborn 2001, Williams *et al.* 2008). This situation, called depensation, accelerates a decline toward extinction. In order to determine the status and trend of the SONCC coho salmon ESU, NMFS uses the population extinction risk criteria and the concept of a VSP for evaluating populations (McElhany *et al.* 2000). A VSP is defined as one that has a low risk of extinction over 100 years. Viable salmonid populations are described in terms of four parameters: abundance, population productivity, spatial structure, and diversity. These parameters are predictors of extinction risk, and reflect general biological and ecological processes that are critical to the growth and survival of salmon (McElhany *et al.* 2000). The following subsection provides the evaluation of the current status and trend of the SONCC coho salmon ESU based on the four VSP parameters. It also informs the jeopardy analysis and determination in Integration and Synthesis, section 2.6, below.

a. Abundance

Quantitative population-level estimates of adult spawner abundance spanning more than 9 years are scarce for SONCC coho salmon. Data consist of continuation of a few time series of adult abundance, expansion of efforts in coastal basins of Oregon to include SONCC coho salmon populations, and continuation and addition of several population scale monitoring efforts in California. Other than Shasta River and Scott River adult SONCC coho salmon counts, reliable current time series of naturally produced adult spawners are not available for the California portion of the SONCC ESU at the "population" scale.

Although long-term data on coho salmon abundance are scarce, the available monitoring data indicate that spawner abundance has declined for populations in this ESU. Though population-level estimates of abundance for most independent populations are lacking, the best available data indicate that most of the 30 independent populations in the ESU are at high risk of extinction because they are below or likely below their depensation threshold (NMFS 2012). Populations that are under depensation have an increased likelihood of being extirpated. Extirpations have already occurred in portions of the Eel River basin and the Bear River (NMFS 2014a). Because the extinction risk of an ESU depends upon the extinction risk of its constituent independent populations (Williams *et al.* 2008) and the population abundance of most independent populations are below their depensation threshold, the SONCC coho salmon ESU is at high risk of extinction with regards to abundance.

b. Population Productivity

As discussed above in the abundance section, available data indicate that many populations have declined, which may reflect a reduction in productivity. For instance, the Shasta River population has declined in abundance by almost 50 percent from one generation to the next (Williams *et al.* 2011). Partial counts from Prairie Creek, a tributary of Redwood Creek, and Freshwater Creek, a tributary of Humboldt Bay show a negative trend. In general, SONCC coho salmon have declined substantially from historic levels. Productivity does not appear to be sufficient to maintain viable abundances in many SONCC coho salmon populations. Because productivity appears to be negative for most SONCC coho salmon populations, this ESU is not currently viable in regard to population productivity.

c. Spatial Structure

Data are inadequate to determine whether the spatial distribution of SONCC coho salmon has changed since 2005. In 2005, Good *et al.* (2005) noted that there were strong indications that breeding groups have been lost from a significant percentage of streams within their historical range. Relatively low levels of observed presence in historically occupied coho salmon streams (32 to 56 percent from 1986 to 2000) indicate continued low abundance in the California portion of the SONCC coho salmon ESU. The relatively high occupancy rate of historical streams observed in brood year 2001 suggests that much habitat remains accessible to coho salmon (70 FR 37160; June 28, 2005). Brown *et al.* (1994) found survey information on 115 streams within the SONCC coho salmon ESU, of which 73 (64 percent) still supported coho salmon runs while 42 (36 percent) did not. The streams Brown *et al.* (1994) identified as lacking coho salmon runs were all tributaries of the Klamath River and Eel River basins. CDFG (2002a) reported a decline in SONCC coho salmon occupancy, with the percent reduction dependent on the data sets used. Although there is considerable year-to-year variation in estimated occupancy rates, it appears that there has been no dramatic change in the percent of coho salmon streams occupied from the late 1980s and early 1990s to 2000 (Good *et al.* 2005). However, the number of streams and rivers currently supporting coho salmon in this ESU have been greatly reduced from historical levels, and watershed-specific extirpations of coho salmon are documented (Brown *et al.*1994, CDFG 2004, Good *et al.* 2005, Moyle *et al.* 2008, Yoshiyama and Moyle 2010).

d. Diversity

The primary factors affecting the diversity of SONCC coho salmon appear to be low population abundance and the influence of hatcheries and out-of-basin introductions. Although the operation of a hatchery tends to increase the abundance of returning adults (70 FR 37160; June 28, 2005), the reproductive success of hatchery-born salmonids spawning in the wild is likely less than that of naturally produced fish (Araki and Blouin 2007). As a result, the higher the proportion of hatchery-born spawners, the lower the overall productivity of the population, as demonstrated by Chilcote (2003). Williams *et al.* (2008) considered a population to be at least at a moderate risk of extinction if the contribution of hatchery coho salmon spawning in the wild exceeds 5 percent. Populations have a lower risk of extinction if no or negligible ecological or genetic effects are demonstrated as a result of past or current hatchery operations. Because the main stocks in the SONCC coho salmon ESU (*i.e.*., Rogue River, Klamath River, and Trinity River) remain heavily influenced by hatcheries and have little natural production in mainstem

rivers (Weitkamp *et al.* 1995, Good *et al.* 2005), many of these populations are at high risk of extinction relative to the genetic diversity parameter.

In addition, some populations are extirpated or nearly extirpated (*i.e.*., Middle Fork Eel, Bear River, Upper Mainstem Eel) and some brood years have low abundance or may even be absent in some areas (*e.g.*, Shasta River, Scott River, Mattole River, Mainstem Eel River), which further restricts the diversity present in the ESU. The ESU's current genetic variability and variation in life history likely contribute significantly to long-term risk of extinction. Given the recent trends in abundance across the ESU, the genetic and life history diversity of populations is likely very low and is inadequate to contribute to a viable ESU.

In summary, most independent populations in the SONCC coho salmon ESU are at risk of extinction because they are below or are likely below their depensation threshold (NMFS 2012). SONCC coho salmon have declined from historic levels, and their current productivity does not appear sufficient to maintain viable abundances in many SONCC coho salmon populations. The number of streams currently supporting SONCC coho salmon have been reduced from historical levels, and some brood years have low abundance or may even be absent in some areas (*e.g.*, Shasta River, Mattole River, Mainstem Eel River), further restricting current diversity the ESU. Given the recent trends in reduced abundance across the ESU, genetic and life history diversity of populations are likely low and insufficient to contribute to a viable ESU. All of these factors contribute to the current elevated extinction risk of SONCC coho salmon.

2.2.3 Status of Critical Habitat for SONCC Coho Salmon

Critical habitat for SONCC coho salmon was designated as all accessible reaches of rivers (including estuarine areas and tributaries) between Cape Blanco, Oregon, and Punta Gorda, California (64 FR 24049, May 5, 1999). Critical habitat includes all waterways, substrate, and adjacent riparian zones below longstanding, naturally impassable barriers *(i.e.*., natural waterfalls in existence for at least several hundred years). In the critical habitat designation, NMFS identified five essential habitat types for SONCC coho salmon: (1) spawning areas; (2) adult migration corridors; (3) juvenile summer and winter rearing areas; (4) juvenile migration corridors; and (5) areas for growth and development to adulthood. Within these areas, essential features of coho salmon critical habitat include adequate substrate, water quality, water quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, space, and safe passage conditions. NMFS reviewed the status of designated critical habitat affected by the proposed action by examining the condition and trends of essential physical and biological features throughout the action area. These features are essential to the conservation of the listed species because they support one or more life stages of the species. NMFS refers to these features as the Primary Constituent Elements (PCEs) of critical habitat. In general, these PCEs include sites essential to support one or more life stages of SONCC coho salmon (*e.g.*, spawning, rearing, or migration), and contain physical or biological features essential to the conservation of the listed species (*e.g.*, spawning gravels, water quality and quantity, side channels, or food). The following sections will present the various factors contributing to the degradation of SONCC coho salmon critical habitat in the Project area, and the extent of their contribution to degradation of such critical habitat.

2.2.4 Factors Responsible for SONCC Coho Salmon and SONCC Critical Habitat Status

When the SONCC coho salmon ESU was listed, the major factors identified as responsible for the decline of coho salmon in Oregon and California and/or degradation of their habitat included logging, road building, grazing, mining, urbanization, stream channelization, dams, wetland loss, beaver trapping, artificial propagation, over-fishing, water withdrawals, and unscreened diversions for irrigation (62 FR 2458, May 6, 1997; Weitkamp *et al.* 1995). The lack, or inadequacy, of protective measures in existing regulatory mechanisms, including land management plans (*e.g.*, State Forest Practice Rules), Clean Water Act section 404 regulatory activities, urban growth management, harvest and hatchery management have also contributed by varying degrees to the decline of coho salmon. In addition to these factors responsible for the current status of the SONCC coho salmon ESU and their critical habitat, ocean conditions, reduction in marine derived nutrients, small population size, and climate change also affect the current status of SONCC coho salmon ESU. Below, some of these activities are presented in more detail.

2.2.4.1 Timber Harvest

At the time of the SONCC coho salmon listing in 1997 (62 FR 24588), timber harvest was identified as a significant threat to coho salmon in this ESU. Timber harvest remains a high or very high threat in 20 of 39 populations in this ESU, due to reduced inputs of leaf litter, terrestrial insects, and large wood to forest streams. Loss of these inputs has contributed to the inability of already degraded forested landscapes to rebound from the detrimental impacts of past timber harvest (NMFS 2014a).

Within the last 15 years, three large scale habitat conservation plans (HCPs) have been developed and implemented within the range of the SONCC coho salmon ESU: the Humboldt Redwoods Company (HRC, formerly PALCo) HCP (1999-2049), covering approximately 210,000 acres of industrial timberlands in coastal northern California; the Green Diamond Resource Company (GDRC) HCP (2006-2056, covering approximately 410,000 acres in coastal northern California; and the Fruit Growers Supply Company HCP (2012-2062) covering 152,178 acres in central far northern California.[3] All of these HCPs are expected to improve management of private timberlands in northern California over the coming decades, to offset impacts from past timber harvests within the range of this ESU.

NMFS staff have actively engaged and participated in California Board of Forestry (BOF) meetings and expressed concern to the BOF that the Anadromous Salmonid Protection (ASP) rules, while resulting in some improvements to riparian protections, will not adequately protect anadromous salmonids until several inadequacies in the Forest Practice Rules are addressed. Specifically, NMFS believes that take of listed salmonids associated with timber harvest operations in California could be minimized, but not entirely avoided, if the following additional protections were added to the existing ASP rules: 1) provide Class II-S (standard) streams with

[3] On May 29, 2015, the incidental take permit issued by NMFS for the Fruit Grower's HCP was vacated by the U.S. District Court for the Northern District of California. Efforts are underway on a revised HCP and attendant environmental documents. The incidental take avoidance and minimization measures of the HCP are being implemented in the interim.

the same protections afforded Class II-L (large) streams in the Southern Subdistrict of the Coast Forest District, to provide a level of protection that is consistent with the stated goal of the ASP rules; and 2) include provisions to ensure hydrologic disconnection between logging roads and landings with streams, particularly rocking standards for winter hauling, geologic review for road construction on slopes > 65 percent, and permanently maintaining or removing road drainage structures following use. In addition, NMFS believes the use of scientific guidance will provide additional limitations in the rate of timber harvest in watersheds to avoid cumulative impacts of multiple harvests, and to provide greater protections that ensure the integrity of high gradient slopes and unstable areas. This may include limiting the areal extent of harvest in such areas. In summary, NMFS is working collaboratively with the BOF to limit the effects of forestry operations on threatened and endangered salmonid populations in California, including the SONCC coho salmon ESU. At this time, however, the effects of past and present timber harvest activities continue to be an ongoing threat to this ESU.

2.2.4.2 Roads

At the time of the original SONCC coho salmon listing in 1997 (62 FR 24588), roads were identified as a threat to the SONCC coho salmon ESU. Roads, especially unpaved roads, are a pervasive feature throughout the ESU and reflect a legacy of land use activities. Nearly all SONCC coho salmon populations are affected by high road density, with some watersheds having greater than 3 linear miles of road per square mile (mi2) of watershed. Armentrout *et al.* (1999) used a reference of 2.5 mi/mi^2 of roads as a watershed management objective to maintain hydrologic integrity in Lassen National Forest watersheds harboring anadromous fish.

Although some roads have been decommissioned in timbered areas, in many instances, maintenance of existing roads is lacking, leading to chronic impacts to salmonid habitat downslope. Where roads cross salmonid-bearing streams, improperly placed culverts have blocked access to many stream reaches. Roads intercept natural drainage patterns, potentially increasing peak flows (Ziemer 1998) with consequent effects on the stability of stream substrates and banks (Chamberlin *et al.* 1991, McIntosh *et al.* 1994). Excessive sediment decreases emergence survival (Phillips *et al.* 1975; McHenry *et al.* 1994; Kondolf 2000), reduces carrying capacity for juvenile salmonids due to pool filling, and reduces feeding and growth due to high turbidity levels (Sigler *et al.* 1984).

In 2007, NMFS approved Humboldt, Del Norte, Trinity, Siskiyou and Mendocino Counties' (Five Counties) "Water Quality and Stream Habitat Protection Manual for County Road Maintenance in Northwestern California Watersheds" (Five Counties 2002) under the existing salmon and steelhead 4(d) rule for threatened salmonids in California. To qualify their road programs, the Five Counties collaboratively developed the Manual to address county road maintenance impacts on coho salmon. Despite recent efforts to address impacts associated with county roads, there still remains inadequate funding for road projects, and inadequate resources for timely maintenance of public and private roads throughout the ESU. In spite of the Five Counties' efforts, and ongoing efforts to treat identified Legacy sediment sites on national forest lands, roads and road impacts remain an ongoing threat to the SONCC coho salmon ESU.

2.2.4.3 Agricultural Operations and Grazing

At the time of the original SONCC coho salmon listing in 1997 (62 FR 24588), agricultural practices were identified as a threat to the SONCC coho salmon ESU. In California, Regional Water Quality Control Boards regulate water quality through their Total Maximum Daily Load (TMDL) program and permit waiver programs for agricultural runoff. Since the original listing of SONCC coho salmon, pollutant-based TMDLs have been completed for many Project-affected watersheds (Klamath River – sediment, Salmon River – temperature, Scott River – sediment and temperature; NMFS 2014a), to manage excessive pollutants and other water quality impediments via implementation provisions. The beneficial use of salmonids is most often affected by non-point source sediment and temperature impairments, so development of non-point source TMDLs, such as for agriculture and grazing, is important. The ability of these TMDLs to protect SONCC coho salmon is expected to be significant in the long term. Ultimately their efficacy in protecting coho salmon habitat will depend on how well the protective measures are implemented, monitored, and enforced. In summary, agricultural operations and grazing continue to be a threat to the SONCC coho salmon ESU, although some habitat quality improvements associated with three decades of restoration are apparent along streams adjacent to agriculture and grazing operations.

2.2.4.4 Water Withdrawal and Unscreened Diversions

At the time of the original SONCC coho salmon listing in 1997 (62 FR 24588), water withdrawal and unscreened diversions were identified as threats to the SONCC coho salmon ESU. Until the onset of the 2012-2015 drought, no significant reductions in water withdrawals occurred, but many diversions were properly screened to protect juvenile coho salmon from entrainment and other impacts.

In November of 2009, the California State Legislature passed a series of bills that require groundwater monitoring and enforcement of illegal diversions, more ambitious water conservation policy, and water recycling and conservation programs. More recently, in January 2015, the SWRCB issued a revised ruling governing the acquisition and exercise of rights to reasonable and beneficial use of surface waters, and of groundwater flowing in known and definite channels, by priority of appropriation initiated on or after December 19, 1914 (http://www.swrcb.ca.gov/laws_regulations/docs/wrlaws.pdf). Then on May 5, 2015, the SWRCB adopted an emergency water conservation regulation implementing mandatory water reductions in urban areas, too, to reduce potable urban water usage by 25 percent statewide. Implementation of these new measures has potential to help reduce less efficient or unauthorized use of potable water and diversions in SONCC coho watersheds, but there is still no comprehensive strategy for providing instream flow for coho salmon in both California and Oregon. If effectively implemented, these California water bills should contribute to improved instream habitat in the future. In summary, important efforts have been implemented to reduce the impacts of water withdrawal and unscreened water diversions but, given prolonged drought conditions in the West since 2012, these activities continue to represent a threat to the SONCC coho salmon ESU.

2.2.4.5 Mining

Gravel extraction reduces overall habitat complexity and reduces the quality and quantity of available pool habitat (Simon and Hupp 1992). At the time of the original SONCC coho salmon listing in 1997 (62 FR 24588), mining was identified as a threat to the SONCC coho salmon ESU. Since the listing, instream gravel mining practices have improved in Northern California and Southern Oregon. Mining operations are permitted by the U.S. Army Corps of Engineers (Corps) and the permits in place contain numerous impact minimization measures to reduce the effects of gravel extraction on coho salmon and their critical habitat. Given the sensitivity of channels to disturbance (*i.e.*., current lack of floodplain and channel structure and low levels of instream wood), and the use of gravel extraction reaches by juvenile SONCC coho salmon for summer rearing, gravel extraction is a significant threat to rearing juveniles and a moderate threat to adults who require resting habitat in pools during upstream migration. In recent years, NMFS has worked with the Corps and others, pursuant to section 7 of the ESA, to minimize the effects of several gravel mining operations in Humboldt County and southern Oregon, and the measures included in the resulting biological opinions provide increased protections for coho salmon and their critical habitat. Since 2010, the intensity of gravel mining operations in the Mad River has been correlated with annual water yields and annual estimates of sediment recruitment (NMFS 2009), which is expected to significantly reduce impacts to coho salmon in the Mad River. Since the listing of the SONCC coho salmon ESU, California has developed new regulations including special closed areas, closed seasons, and restrictions on gravel mining methods and operations to minimize and prevent disturbance of aquatic habitat (Cal. Code Regs., tit. 14, Sections 228 and 228.5). These new regulations are to help protect habitat, but careful monitoring of mining activity is necessary to ensure compliance.

On August 6, 2009, the California governor signed into law SB 670 placing a moratorium on suction dredge mining permits due to the potentially detrimental effects the practice has on salmonid spawning and rearing habitat. As a result of the moratorium, and in spite of some recent high banking activities, suction dredging does not presently have a significant effect on SONCC coho salmon or its critical habitat. Though a court-ordered environmental review addressing the effects of suction dredging was completed by the California Department of Fish and Wildlife (CDFW) and submitted to the California Legislature on April 1, 2013, the moratorium on use of any motorized vacuum or suction dredge equipment remains in effect. In summary, the threat from gravel mining on SONCC coho salmon has been reduced in northern California and Southern Oregon since the last review in 2005, and the threat from suction dredging has been temporarily eliminated.

2.2.4.6 Urbanization

At the time of the original SONCC coho salmon listing in 1997 (62 FR 24588), urbanization was identified as a threat to the SONCC coho salmon ESU. Urbanization impacts SONCC coho salmon habitat mostly through development and associated road construction and land clearing in and adjacent to floodplains. Development induces changes in the hydrologic regime because of the increased impermeable surfaces, often resulting in increased runoff during winter storm events and reduced infiltration essential to replenish the aquifer. Reduced aquifer replenishment results in lower stream flows in the summer and early fall. Sediments washed from urban areas

contain trace metals such as copper, cadmium, zinc, and lead (Davis *et al.* 2001, Barrett *et al.* 1995). These, together with pesticides, herbicides, fertilizers, gasoline, and other petroleum products, contaminate drainage waters and harm aquatic life necessary for SONCC coho salmon survival. Other habitat impacts include rock slope protection (riprap) along river banks and the construction of levees along rivers and around estuaries for flood protection. Levees have reduced the size of floodplains and estuaries essential for providing rearing habitats for salmonids. Roads, buildings, riprap, and levees continue to be present in floodplains throughout northern California and southern Oregon, and in spite of recent efforts to protect and restore urban floodplain habitat in some watersheds (http://www.sgpga.org/programs/yreka-creek-greenway/), urbanization remains a threat to the SONCC coho salmon ESU and its critical habitat.

2.2.4.7 Commercial and Recreational Harvest

Tribal fishery harvest was not considered to be a major threat to the SONCC coho salmon ESU when the ESU was listed under the ESA (62 FR 24588; May 6, 1997). Klamath Basin tribes (Yurok, Hoopa, and Karuk) harvest a relatively small number of SONCC coho salmon for subsistence and ceremonial purposes (CDFG 2002a). SONCC coho salmon harvested by Native American tribes is primarily incidental to Chinook salmon subsistence fisheries in the Klamath and Trinity rivers.

Non-tribal commercial fisheries have been identified as a major factor in the decline of the SONCC coho salmon ESU (62 FR 24588; May 6, 1997). However, coho salmon-directed fisheries and coho salmon retention have been prohibited off the coast of California since 1996. Ongoing commercial harvest of Chinook salmon results in a small amount of SONCC coho salmon taken incidentally as bycatch (NMFS 1999). The best available measure of ocean exploitation rate for the SONCC coho salmon ESU is a forecast time series from 2000 to 2010 for coho salmon produced in the Klamath and Rogue basins which represents only a portion of the ESU. This bycatch rate was stable and averaged six percent over 2000 to 2007, prior to falling to 1 percent, 3 percent, and 2.2 percent in 2008, 2009, and 2010, respectively, due to closure of nearly all salmon fisheries south of Cape Falcon, Oregon. Post-season estimates of ocean exploitation rate for 2011, 2012, and 2013 are 3.8 percent, 10.8 percent, and 11 percent, respectively (PFMC 2012 and 2013, NMFS 2014b). Because of the generally limited Chinook-directed salmon fishery since 2005, NMFS believes that incidental take of SONCC coho salmon as a result of the Chinook commercial fishery has been a small threat to the SONCC coho salmon ESU.

2.2.4.8 Artificial Propagation

Three artificial propagation programs are considered to be part of the SONCC coho salmon ESU: the Cole Rivers Hatchery (Rogue River), Trinity River Hatchery, and Iron Gate Hatchery (Klamath River) coho programs (70 FR 37160; June 28, 2005). These hatcheries produce not only coho salmon but also Chinook salmon and steelhead for release into the wild. Iron Gate, Trinity River, and Cole Rivers hatcheries release roughly 14,215,000 hatchery salmonids into SONCC coho salmon ESU rivers annually. Annual coho salmon production goals at these hatcheries are 75,000, 500,000, and 200,000, respectively. In addition to the three hatcheries, the

Mad River and Rowdy Creek hatcheries in California and the Elk River Hatchery in Oregon produce steelhead and Chinook salmon that can prey on or compete with wild SONCC coho salmon.

Natural populations in these basins are heavily influenced by hatcheries (Weitkamp *et al.* 1995, Good *et al.* 2005) through genetic and ecological interactions. Genetic risks associated with out-of-basin and out-of-ESU stock transfers have largely been eliminated. However, two significant genetic concerns remain: (1) the potential for domestication selection in hatchery populations such as the Trinity River, where there is little or no infusion of wild genes, and (2) straying by large numbers of hatchery coho salmon either in basin or out-of-basin. Spawning by hatchery salmonids in rivers and streams is often not controlled (Independent Scientific Advisory Board 2002) and hatchery fish do stray into rivers and streams, transferring genes from hatchery populations into naturally spawning populations (Pearse *et al.* 2007). CDFG (2002b) found that 29 percent of coho salmon carcasses recovered at the Shasta River fish counting facility had left maxillary clips in 2001, indicating that they were from the Iron Gate Hatchery. Based on PIT tag detections, caudal punch and left maxillary clip observations, 70 percent of the coho salmon entering the Shasta River were of Iron Gate Hatchery origin in 2012 (CDFG 2013). Although the actual percentages of hatchery fish in the river change from year to year and depend largely on natural returns, these data indicate that straying of Iron Gate Hatchery fish does occur in important tributaries of the Klamath River. Genetic interactions between hatchery and naturally produced stocks can decrease the amount of genetic and phenotypic diversity of a species by homogenizing once disparate traits of hatchery and natural fish. The result can be progeny with lower survival (McGinnity *et al.* 2003, Kostow 2004) and ultimately, a reduction in the reproductive success of the natural stock (Reisenbichler and McIntyre 1977, Chilcote 2003, Araki *et al.* 2007, Chilcote *et al.* 2003), potentially compromising the viability of natural stocks via out breeding depression (Reisenbichler and Rubin 1999, HSRG 2004). Williams *et al.* (2008) considers a population to be at least at moderate risk of extinction if the proportion of naturally spawning fish that are of hatchery origin exceeds five percent. As described above, the available information indicates the proportion of naturally spawning fish of hatchery origin far exceeds five percent, giving these populations likely more than moderate risk of extinction.

2.2.4.9 Disease

Ceratomyxosis, which is caused by *Ceratomyxa shasta*, has been identified as one of the most significant diseases for juvenile salmon due to its prevalence and impacts in the Klamath Basin (Nichols *et al.* 2003). Severe infection of juvenile coho salmon by *C. Shasta* may be contributing to declining adult coho salmon returns in the Klamath basin (Foott *et al.* 2010). Mortality rates from temporary and longer term exposures at various locations in the Klamath River vary between location, months, and years, but are consistently high (10-90 percent) (Bartholomew 2008). In addition, parasitic infections by *Parvicapsula minibicornis* have been detected in 65 percent of young of the year and 71 percent of yearling coho salmon in the mainstem Klamath River (Nichols *et al.* 2008). Although the prognosis of juvenile coho salmon infected with *P. minibicornis* is unknown, infections contribute to additional stresses to juveniles, which cumulatively decrease growth and survival. Adults in the Klamath basin are also affected by disease, primarily from the common pathogens *Ichthyopthirius multifilis* (Ich) and *Flavobacterium columnare* (columnaris) (NRC 2003). These pathogens were responsible

for the 2002 adult fish kill on the Klamath River (Guillen 2003; CDFG 2003; Belchik *et al.* 2004). Adult mortality from Ich and columnaris are not as common as juvenile mortality from *C. Shasta* or *P. minibicornis*. Although a large-scale fish kill has not occurred in the last decade, the potential for such an event still exists and is believed to remain a threat for this ESU. In summary, the prevalence of infection and disease continues to be an ongoing threat to the SONCC coho salmon ESU.

2.2.4.10 Predation

a. Sacramento pike minnow predation

At the time of the 1997 SONCC coho salmon listing, Sacramento pike minnow predation was considered a threat to coho salmon populations in the Eel River basin (62 FR 24588). The non-native Sacramento pike minnow is still observed throughout the Eel River basin and is a predator that impedes coho salmon recovery (Yoshima and Moyle 2010). No significant eradication efforts have been recently undertaken. Based on data collected in the Upper Eel River (PG&E 2010), the pike minnow population has decreased from its peak in the 1980s and 1990s and has continued to vary in size since new monitoring began in 2005. The decline in pike minnow abundance in the upper mainstem Eel River is believed to be a result of increased flows from the Potter Valley Project that began in 2005 (Jahn 2010). However, thousands of Sacramento pike minnow still threaten juvenile coho salmon survival on the mainstem and tributaries of the Eel River. In summary, predation from the Sacramento pike minnow continues to be a threat to the SONCC coho salmon ESU and is unlikely to have diminished significantly in the past decade.

b. Sea lions and harbor seals

At the time of the 1997 SONCC coho salmon listing, marine mammal predation was identified as a potential threat to the SONCC coho salmon ESU (62 FR 24588). California sea lions and Pacific harbor seals occur in most estuaries and rivers where coho salmon are present, are known predators of salmonids, and their numbers are increasing. Predation by these marine mammals may significantly influence salmonid abundance in some local populations when other prey species are absent, and where physical conditions lead to the concentration of salmonid adults and juveniles (Cooper and Johnson 1992). Although fishes form the principal food sources of many marine mammals, coho salmon appear to be a minor component of their diet (Roffe and Mate 1984; Brown and Mate 1983; Graybill 1981; Jameson and Kenyon 1977; Scheffer and Sperry 1931). Although there are likely more seals and sea lions now than existed a decade ago, there is no evidence that this threat of predation has increased the threat to SONCC coho salmon.

c. Hatchery fish predation

At the time of the 1997 SONCC coho salmon listing, predation from hatchery fish was not identified as a threat to SONCC coho salmon (62 FR 24588). Recent studies have raised concerns about the potential impacts of hatchery fish predation on natural coho salmon populations. Hatchery fish can exert predation pressure on juvenile coho salmon in certain watersheds. Released at larger sizes than naturally produced juveniles and in great quantity, hatchery-reared salmonids will often prey on naturally-produced juvenile coho salmon (Kostow

2009). There is evidence that predation by hatchery fish may result in the loss of tens of thousands of naturally produced coho salmon fry annually in some areas of the Trinity River (Naman 2008). Because hatchery production has not significantly changed, the threat from hatchery fish predation has likely remained unchanged in the past decade.

d. Predatory non-native species

At the time of the 1997 SONCC coho salmon listing, NMFS did not identify predation from non-native species as a threat to the SONCC coho salmon ESU (62 FR 24588). The invasive American bullfrog (*Rana catesbeiana*) is known to occur throughout the range of this ESU and it competes for food resources and/or preys on juvenile coho salmon (Garwood *et al.* 2010). Bullfrogs are highly predatory and are found in seasonal habitats where juvenile coho salmon rear, such as off-channel ponds, side channels, and alcoves. Brown trout (Salmo trutta) and striped bass (*Morone saxatilis*) are common non-native predators in many watersheds occupied by the ESU. In the Trinity River, for example, brown trout compose a substantial proportion of the fish observed by biologists during juvenile salmonid habitat use surveys (Martin 2009). Brown trout and striped bass, both piscivorous, likely consume naturally produced fry and juvenile coho salmon, but the amount is not known. Based on the available information, predatory invasive species have likely increased as a threat to the SONCC coho salmon ESU over the past decade.

2.2.4.11 Reduced Marine-Derived Nutrient Transport

Marine-derived nutrients are nutrients that are accumulated in the biomass of salmonids while they are in the ocean and are then transferred to their freshwater spawning sites where the salmon die. The return of salmonids to rivers makes a significant contribution to the flora and fauna of both terrestrial and riverine ecosystems (Gresh *et al.* 2000), and has been shown to be vital for the growth of juvenile salmonids (Bilby *et al.* 1996, 1998, Giannico and Hinch 2007, Wipfli *et al.* 1998, 2003). Evidence of the role of marine-derived nutrients and energy in ecosystems suggests this deficit is likely to result in an ecosystem failure contributing to the downward spiral of salmonid abundance (Bilby *et al.* 1996). Reduction of marine-derived nutrients to watersheds is a consequence of the past century of decline in salmon abundance (Gresh *et al.* 2000).

2.2.4.12 Small Population Size and Natural Stochastic Events

SONCC coho salmon populations have declined significantly (*e.g.*, Scott, Salmon, and Shasta River populations) and are facing an additional threat from the effects of small population size. Many populations, such as the Shasta River population, are at a high risk of extinction because of their small population size (*e.g.*, only 44, 62, and 115 spawners returned to the Shasta River in the 2010, 2011 and 2012 spawning seasons, respectively). With a majority of SONCC coho salmon populations at low abundance, random events become an increased and significant factor in the extinction process. (Shaffer 1981, McElhany *et al.* 2000, Fagan and Holmes 2006). In fact, time-to-extinction decreases logarithmically with decreasing population size (Lande 1993, Fagan and Holmes 2006). Population declines are likely to cause further declines, especially for small populations because stochastic factors exert more influence (Fagan and Holmes 2006). Many SONCC coho salmon ESU populations have declined to such a low point that they are

likely influenced by multiple, interacting processes that make recovery of the SONCC coho salmon ESU difficult. These random processes can create alterations in genetics, breeding structure, and population dynamics that may interfere with persistence of the species (Shaffer 1981, Lande 1993, McElhany *et al.* 2000, Reed *et al.* 2007).

Stochastic processes always occur; however, they don't always significantly influence population dynamics until populations are small. Due to the low abundance of most SONCC coho salmon ESU populations, stochastic pressure is likely to be one of the most significant threats to their persistence. Stochastic events have likely contributed to population instability and decline for many SONCC coho salmon ESU populations, which likely explain why recent adult returns remain low despite improved ocean conditions from 2007 to 2014, and significant reductions in bycatch mortality from commercial and recreational fishery closures enacted more than 15 years ago.

2.2.4.13 Ocean Conditions

Variability in ocean productivity has been shown to affect fisheries production both positively and negatively (Chavez *et al.* 2003). Beamish and Bouillion (1993) found a strong correlation between North Pacific salmon production and marine environmental factors from 1925 to 1989.

Coho salmon marine survival corresponds with periods of alternating cold and warm ocean conditions. Cold conditions are generally good for coho salmon, while warm conditions are not (Peterson *et al.* 2010). Unusually warm ocean surface temperatures and associated changes in coastal currents and upwelling, known as El Niño conditions result in ecosystem alterations such as reductions in primary and secondary productivity and changes in prey and predator species distributions. Coho salmon along the Oregon and California coast are likely to be sensitive to upwelling patterns because these regions lack extensive bays, straits, and estuaries, which could buffer adverse oceanographic effects. The paucity of high quality near-shore habitat, coupled with variable ocean conditions, makes freshwater rearing habitat essential for the survival and persistence of many coho salmon populations.

Data from hatchery fish at Cole Rivers Hatchery indicate extremely low marine survival for the 2005 and 2006 brood years (*i.e.*., 0.05 and 0.07 percent, respectively) compared with an average of approximately 2.2 percent between 2000 and 2004 (Williams *et al.* 2011). Strong upwelling in the spring of 2007 resulted in better ocean conditions (MacFarlane *et al.* 2008, Peterson *et al.* 2010) for the 2005 coho salmon brood year. Marine conditions in 2008 and 2009 were also favorable, with 2008 being the best in the last 13 years (NMFS 2013). Because salmon productivity and survival are correlated with ocean conditions (Pearcy 1992 *in* Zabel *et al.* 2006, Beamish and Bouillon 1993, Peterson *et al.* 2010), favorable marine conditions usually corresponds with increased marine survival. However, improved ocean conditions do not necessarily result in improved marine survival and higher adult returns for the SONCC coho salmon ESU. For instance, in 2008, adult spawner populations (2005 brood year) within the Oregon Coast coho salmon ESU rebounded from previous declines (Lewis *et al.* 2009), while many SONCC coho salmon ESU populations, including Rogue River populations declined to near record low numbers.

Bradford *et al.* (2000) found that the average coastal coho salmon population will be unable to sustain itself when marine survival rates fall below about three percent. Ocean conditions are not necessarily the only influence of marine survival, but if marine survival is below three percent, the SONCC coho salmon ESU will have difficulty sustaining itself. Therefore, poor ocean conditions and low marine survival pose a significant threat to the SONCC coho salmon ESU.

2.2.4.14 Global Climate Change

Climate change is likely to have negative implications for the conservation value of designated critical habitats in the Pacific Northwest (CIG 2004; Scheuerell and Williams 2005; Zabel *et al.* 2006; ISAB 2007, and Crozier *et al.* 2008). Average annual Northwest air temperatures have increased by approximately 1ºC since 1900, or about 50 percent more than the global average warming over the same period (ISAB 2007). The latest climate models project a warming of 0.1°C to 0.6 ºC per decade over the next century. According to the Independent Scientific Advisory Board's (ISAB) recurring reports (https://www.nwcouncil.org/fw/isab/), these effects may have the following physical impacts within approximately the next 40 years:

- Warmer air temperatures will result in a shift to more winter/spring rain and runoff, rather than snow that is stored until the spring/summer melt season.

- With a shift to more rain and less snow, snowpack will diminish in those areas that typically accumulate and store water until the spring/summer melt season.

- With a smaller snowpack, these watersheds will see their runoff diminished and exhausted earlier in the season, resulting in lower stream flows in the June through September period.

- River flows in general and peak river flows are likely to increase during the winter due to more precipitation falling as rain rather than snow.

Water temperatures will continue to rise, especially during the summer months when lower streamflow and warmer air temperatures will contribute to warming regional waters. These changes will not be spatially homogenous. Areas with elevations high enough to maintain temperatures well below freezing for most of the winter and early spring are expected to be less affected. Low-lying areas that have historically received scant precipitation contribute little to total streamflow and are likely to be more affected. These long-term effects may include, but are not limited to, depletion of cold water habitat, variation in quality and quantity of tributary rearing habitat, alterations to migration patterns, accelerated embryo development, premature emergence of fry, increased bio-energetic and disease stresses on fish, and increased competition among species. In addition, as climate change reduces the carrying capacity of habitat within the range of SONCC coho salmon, species viability may be more difficult to achieve (NMFS 2011). The reduced genetic diversity resulting from depressed population sizes may limit the ability of individual SONCC coho salmon to adapt to changing climatic conditions.

Climate change effects contributing to warming and reduced snowpack (Barr *et al.* 2010), an increase in the number of fire ignitions, and historic land management practices including timber

harvest and fire suppression activities have led to an increase in the number of large wildfires (1,000 acres or more) and the total area burned annually across the western US, within the SONNC coho ESU, and the Klamath-Trinity Mountains. Wildfire effects (*e.g.*, reduction or elimination of ground cover, root cohesion/strength decreases, and soil disturbance increases) lead to increases in mass-wasting and landsliding, especially debris flows and hyper-concentrated flows within critical habitat watersheds with moderate to high severity burned areas. Elevated levels of sediment erosion from surface erosion, mass-wasting, and landsliding are compounded by forest management actions including road networks, timber harvest activities, and historical fire suppression actions (Barr *et al.* 2010). The increase in wildfire and sediment erosion has led to a degradation of the PCEs and the conservation value of critical habitat across the SONCC coho ESU.

2.3 Environmental Baseline

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

2.3.1 Status of the Species and Critical Habitat in the Action Area

SONCC coho salmon ESU critical habitat within the Project action area includes the Beaver Creek, Elk Creek, Horse Creek-Klamath River, Humbug Creek-Klamath River, Indian Creek, Lower Scott River, North Fork Salmon River, Seiad Creek-Klamath River, South Fork Salmon River, Thompson Creek-Klamath River, and Ukonom Creek-Klamath River 5th field watersheds. Estuarine habitat will not be affected by the Project because of the distance between the Project and the Klamath River estuary (*i.e.*., 66 miles from the nearest point) will dilute any Project impacts to undetectable levels.

The Action Area is located in the Middle portion of the Klamath River Basin, which extends from Iron Gate Dam (IGD) downstream to the Trinity River, and covers approximately 3,000 square miles of the mainstem Mid Klamath River and its associated tributaries Although anadromous fish passage is currently blocked at IGD, coho salmon once populated the basin at least to the vicinity of and including Spencer Creek at river mile (RM) 228 (Hamilton *et al.* 2005). Today, SONCC coho salmon occupy a small fraction of their historical area (NRC 2004) due to migration barriers and habitat degradation.

Coho salmon were once numerous and widespread within the Klamath River basin (Snyder 1931). However, the small populations that remain occupy limited habitat within tributary watersheds and in the mainstem Klamath River below IGD (CDFG 2002b, NRC 2004). Coho salmon use of freshwater habitat is largely based on life-stage and season (Sandercock 1991, Quinn 2005). However, habitat use can also be influenced by the quality of existing habitat and watershed function, factors which will likely play a large role in determining coho salmon survival in the future.

The action area is within the Klamath Mountains geomorphic province (Irwin 1994) which is composed of a series of geologic terranes derived from accumulated oceanic crust and upper mantle, volcanic arcs, and rock of mixed origin. The steep, soil-covered mountainous terrain is underlain by a mixture of severely faulted and folded meta-sedimentary and meta-volcanic rocks interspersed by plutonic (granitic), volcanic, and sedimentary rocks. The highly weathered and erodible granitic rocks are chronic sources of sand and finer sediment to streams.

The majority of the action area's watersheds have steep soil-covered hillslopes that are at or near sediment mobilization thresholds (*i.e..*, highly prone to landslides), based on KNF cumulative watershed effects modeling results. The steep hillslopes and incised topography are a product of tectonic uplift and hillslope erosion from stream flow and past glacial activity. River incision and hillslope erosion from soil creep, surface erosion, mass-wasting, and landsliding have determined hillslope steepness, as well as the height of adjacent ridges and mountains (Larsen and MacDonald 2007, Roering 2004). Climate, biology, and lithology continue to determine both local hillslope soil production and erosion rates. Local hillslope stability is regulated by rainfall, hillslope steepness, frictional and cohesive/strength properties of the soils and roots, and subsurface hydrology (Hales et. al. 2009).

Creek channels in the action area contain a variety of step-pool and bar-pool-riffle reaches, as well as incised bedrock gorges created by upstream-propagating nick points. Stream channel form is strongly influenced by channel gradient and hillslope processes.

SONNC coho salmon critical habitat occurs in all the major tributary creeks to the Klamath River, Scott River, and North Fork Salmon River. The amount of SONCC coho salmon critical habitat exposed to effects from the 2014 Beaver Fire, Whites Fire, and Happy Camp Complex, is listed in Tables 1, 2, and 3 below. These three fires will be collectively referred to as the 2014 Westside Fires from this point forward.

Table 1. Extent of HUC 7 watersheds burned by the Beaver Fire, total linear miles of SONCC coho salmon critical habitat in each of those watersheds, and linear miles of SONCC coho salmon critical habitat within the Project action area in each watershed (KNF BA 2015).

2014 Beaver Fire HUC 7 Watersheds	**Acres Burned By Beaver Fire**	**Total Miles of SONCC Critical Habitat / Miles of SONCC Critical Habitat Within Project Action Area**
Bear Creek	0.9	1.7 / 0
Buckhorn Creek	3,028.9	2 / 0
Buckhorn Gulch - Beaver Creek	8,233.8	5.7 / 5.7
Collins Creek - Klamath River	2,301.2	5.6 / 1.9
Doggett Creek	6,317.0	1.2 / 0.9
Dona Creek - Klamath River	2,129.9	2.8 / 2.6
Dutch Creek	3,789.5	0.3 / 0.3
Jaynes Creek	229.8	1.5 / 0
Kohl Creek	4,053.4	0.9 / 0.9
Little Humbug Creek	3.3	0 / 0
Lower West Fork Beaver Creek	1,334.3	1.9 / 1.7
Lumgrey Creek	1,787.1	2.0 / 0
McKinney Creek	3.6	1.6 / 0.1
Miller Gulch – Klamath River	3,965.4	5.0 / 4.7
Quigleys Cove – Klamath River	3,406.3	6.5 / 3.4
Soda Creek–Beaver Creek	2,715.2	4.4 / 2.3
Vesa Creek	27.5	0/0
Grand Total	**43,327.1**	**43.1 / 24.5**

Table 2. Extent of HUC 7 watersheds burned by the Whites Fire, total linear miles of SONCC coho salmon critical habitat in each of those watersheds, and linear miles of SONCC coho salmon critical habitat within the Project action area in each watershed (KNF BA 2015).

2014 Whites Fire HUC 7 Watersheds	**Acres Burned By Whites Fire**	**Total Miles of SONCC Critical Habitat / Miles of SONCC Critical Habitat Within Project Action Area**
Big Creek	104.2	1.1 / 0
Eddy Gulch	178.3	2.7 / 0.2
Jackass Gulch	384.3	2.5 / 0
Jessups Gulch – North Fork Salmon River	328.2	2.6 / 0.2
Lower North Russian Creek	4,501.2	4.6 / 4.6
Lower South Russian River	2,137.9	2.1 / 2.1
Music Creek	3,285.8	0 / 0
Robinson Gulch – North Fork Salmon River	5,038	4.6 / 4.6
Shadow Creek	693.7	1.9 / 0
Sixmile Creek	885.9	0 / 0
Specimen Creek	164.1	2.2 / 0
Sugar Creek	234.6	4.0 / 0
Taylor Creek	2,973.2	0 / 0
Upper French Creek	1,307.8	8.5 / 0
Upper North Russian Creek	1,346.8	1.2 / 1.1
Upper South Russian Creek	5,142.4	1.0 / 1.0
Whites Gulch	8,308.2	1.6 / 1.6
Yellow Dog Creek – North Fork Salmon River	5,023.1	6.0 / 3.5
Grand Total	**42,037.9**	**46.6 / 18.9**

Table 3. Extent of HUC 7 watersheds burned by the Happy Camp Complex Fire, total linear miles of SONCC coho salmon critical habitat in each of those watersheds, and linear miles of SONCC coho salmon critical habitat within the Project action area in each watershed (KNF BA 2015).

2014 Happy Camp Complex Fire HUC 7 Watersheds	Acres Burned By Happy Camp Complex Fire	Total Miles of SONCC Critical Habitat / Miles of SONCC Critical Habitat Within Project Action Area
Bear Creek	5,139.0	1.7/0
Benjamin Creek-Klamath River	249.9	8.4 /0.8
Big Ferry - Swanson	2,400.7	4.9 /1.8
Bishop Creek – Elk Creek	701.4	4.5 /0.5
Caroline Creek – Klamath River	1,374.6	3.3 / 2.3
China Creek	4,298.0	1.7 / 1.6
Cliff Valley Creek	3,952.5	0 / 0
Cougar Creek – Elk Creek	3,764.5	5.6 / 5.6
Deep Creek – Scott River	1,951.5	4.4 / 3.4
Doolittle Creek	3,735.6	0 / 0
Franklin Gulch – Scott River	2,858.9	4.8 / 3.7
Fryingpan Creek-Klamath River	4,407.9	11.6 / 6.5
Granite Creek	221.4	0 / 0
Headwaters Elk Creek	2,531.6	0 / 0
Hoop and Devil – Elk Creek	1,937.2	4.4 / 3.9
Horse Creek	2,537.3	0 / 0
Lower East Fork Elk Creek	3,430.0	2.2 / 2.2
Lower Grider Creek	10,765.2	9.3 / 9.2
Lower Seiad Creek	2.9	2.9 / 0
McCarthy Creek – Scott River	6,112.8	5.4 / 4.5
Middle Creek	4,495.6	1.2 / 1.2
Middle Elk Creek	1,189.6	2.4 / 1.4
Negro Creek	11.2	0 / 0
North Fork Kelsey Creek	5,176.6	0.9 / 0.9
O'Neil Creek	2,429.2	0.9 / 0.9
Perkins Gulch – Indian Creek	23.6	2.2 / 0.2
Rainy Valley Creek	1,486.5	0 / 0
Rancheria Creek	4,374.5	0 / 0
Sambo Gulch – Klamath River	27.3	4.9 / 0.3
Schutts Gulch – Klamath River	2,176.2	5.2 / 4.0
South Fork Kelsey Creek	1,787.8	1.1 / 1.1
Tom Martin Creek – Klamath River	8,759.5	6.1 / 5.4
Toms Valley Creek – Elk Creek	9,327.2	5.2 / 5.2
Upper Canyon Creek	127.9	0 / 0
Upper East Fork Elk Creek	3,873.3	0 / 0
Upper Elk Creek	3,024.6	0 / 0
Upper Grider Creek	8,467.5	3.0 / 3.0
Walker Creek	7,592.7	4.2 / 4.0
West Grider Creek-Klamath River	9991.0	4.5 – 1.1
Grand Total	**116,938.6**	**167.6 / 61.8**

While the *Status of the Species* section discussed the viability of the SONCC coho salmon ESU as a whole, this section provides a more in-depth discussion of the extinction risk of the Upper Klamath River, and Middle Klamath River populations. These populations will be adversely affected by the proposed action. The Scott River and Salmon River populations are also within the action area, while SONCC coho salmon from the Shasta River population pass through the action area. These populations are described more briefly because, as described in the Effects of the Action (section 2.4), individuals from these populations are unlikely to experience significant effects from the Project.

Within the California portion of the SONCC coho salmon ESU, estimating the risk of extinction of a given coho salmon population is difficult since longstanding monitoring and abundance trends are largely unavailable. Williams *et al.* (2008) proposed biological viability criteria, including population abundance thresholds. The viability criteria developed by Williams *et al.* (2008) address and incorporate the underlying viability concepts (*i.e..*, abundance, productivity, diversity and spatial structure) outlined within McElhany *et al.* (2000), and are intended to provide a means by which population and ESU viability can be evaluated in the future when more population data become available. Comparing population estimates against population viability thresholds proposed by Williams *et al.* (2008) allow NMFS to make conservative assumptions concerning the current risk of extinction of Klamath River mainstem and tributary populations.

2.3.1.1 Upper Klamath River Coho Salmon Population

a. Summary

The Upper Klamath River coho salmon population has the following characteristics as described in the SONCC Coho Salmon Recovery Plan (NMFS 2014a): part of Interior Klamath Stratum; a core, functionally independent population[4]; at high extinction risk; the population is likely below the depensation threshold; 8,500 spawners are required to attain ESU Viability; 1,400 mi2 watershed (47 percent federal ownership); 425 intrinsic potential (IP)-km (264 IP-mi) (49 percent high); dominant land uses are timber harvest, grazing, and rural development; key limiting stresses are ‘barriers’ and ‘altered hydrologic function;’ and key limiting threats are ‘dams/diversions’ and ‘roads’ (NMFS 2014a). Exposure to Project effects in the Upper Klamath River may occur in the mainstem Klamath River, in refugia associated with tributaries to the mainstem Klamath River, and in all Klamath tributary habitat accessible to Upper Klamath River SONCC coho salmon.

b. Spatial Structure and Diversity

The Upper Klamath River population currently resides in approximately 64 miles of mainstem habitat and numerous tributaries to the mainstem Klamath River upstream of Portuguese Creek to Iron Gate Dam. Historically, the population was found upstream of the site of Iron Gate Dam to Spencer Creek. The PacifiCorp Hydroelectric Project, of which Iron Gate Dam is the lowest of

[4] Functionally Independent Populations are those with a high likelihood of persisting in isolation over a 100-year time scale and are not substantially altered by exchanges of individuals with other populations.

four mainstem dams, blocks access to approximately 76 miles of spawning, rearing and migratory habitat for SONCC coho salmon (USDOI and CDFG 2012). As a result, coho salmon within the Upper Klamath River population spawn and rear primarily within several of the larger tributaries between Portuguese Creek and Iron Gate Dam, namely Bogus, Horse, Beaver, and Seiad creeks.

A small proportion of the population spawns within the mainstem channel, primarily within the section of the Klamath River several miles below Iron Gate Dam. Coho salmon parr and smolts rear within the mainstem Klamath River by using thermal refugia near tributary confluences to survive the high water temperatures and poor water quality common to the Klamath River during summer months. Surveys by California Department of Fish and Wildlife (formerly CDFG) between 1979 to 1999 and 2000 to 2004 showed coho salmon moderately well distributed downstream of Iron Gate Dam. Juveniles were found in 25 of the 48 surveyed tributary streams, with sustained presence in Portuguese, Seiad, Grider, Beaver, Little Bogus, and Bogus creeks (Garwood 2012). Streams with coho salmon presence during both the 1979 to 1999 and 2000 to 2004 intervals included Grider, Seiad, Horse, Walker, Beaver, W. Fork Beaver, Cottonwood, Bogus, Little Bogus, and Dry creeks. The Karuk Tribe (2009) conducted juvenile surveys between 2002 and 2005, and found coho salmon using Tom Martin, Walker, Seiad, Grider, Beaver, Humbug, O'Neil, and Horse creeks. No juvenile coho salmon were found in Lumgrey, Willow, Bittenbender, Barkhouse, Empire, Cottonwood, Bogus, and Kuntz creeks during these surveys. The Karuk Tribe found adult coho salmon spawning in Fort Goff, Grider, Horse, and Seiad creeks, during surveys in 2013-2014 (Corum 2014).

Given that most of the fish in the population come from Iron Gate Hatchery and the fact that hatchery fish are also known to have reduced life history diversity (*e.g.*, all released as yearling smolts from one location), the overall life history diversity of the population is likely limited. The loss of habitat upstream of Iron Gate Dam and poor conditions in the mainstem between April and September also contribute to the loss of life history diversity. Smolt and adult migration is now confined to a short period of time when conditions in the mainstem are favorable and mainstem rearing and spawning is likely reduced from historic levels given the degradation of mainstem habitat.

In summary, the more restricted and fragmented the distribution of individuals within a population, and the more diversity, spatial distribution, and habitat access diverge from historical conditions, the greater the extinction risk. Williams *et al.* (2008) determined that at least 20 coho salmon per IP-km of habitat are needed (8,500 spawners total) to approximate the historical distribution of Upper Klamath River coho salmon and habitat. The current population is well below this, (as described above) and has a reduced genetic and life history diversity.

c. Population Size and Productivity

If a spawning population is too small, the survival and production of eggs or offspring may suffer because it may be difficult for spawners to find mates, or predation pressure may be too great. This situation accelerates a decline toward extinction. Williams *et al.* (2008) determined at least 425 coho salmon must spawn in the Upper Klamath River each year to avoid such effects

of extremely low population sizes (depensation). The low risk spawner threshold for the population is 8,500 spawners.

Based on juvenile surveys in the Upper Klamath between 2002 and 2005, there is low production in the Upper Klamath tributaries, with fewer than 200 juveniles found in most tributaries and most years (Karuk Tribe 2012). The greatest number of juveniles was just over 1000, in Horse Creek in 2005. In 2012-2013 and 2013-2014, the total observed coho salmon adults for surveyed streams (excluding Bogus Creek) was at least 20 and 80, respectively, with the majority of coho salmon found spawning in Seiad Creek (Corum 2014). Annual returns to Bogus Creek are significantly affected by hatchery strays (*i.e.*., 51 percent from 2004 to 2013) but have averaged 154 adult coho salmon during the 2004 to 2012 period (Knechtle and Chesney 2014). Walker Creek and Grider Creek represent tributaries that are important for non-natal rearing of juvenile coho salmon, and to a lesser extent spawning and rearing of natal fish. Though adult coho salmon can access these streams, the value of the IP habitat is low to moderate (NMFS 2014a) with spawning habitat sporadic and dispersed. Some adult coho salmon can and probably do spawn in Walker and Grider Creeks, but have not been observed during surveys (USFS and Karuk Tribe 2014). It is likely that less than 20 adults total return annually to Walker and Grider Creeks. Most recently, 2015/2016 spawning surveys have resulted in zero observations of adult coho salmon in Walker and Grider creeks (Grunbaum 2016). A potential natural barrier to fish passage is located 1.5 miles upstream from the mouth of Walker Creek with the majority of fish found in the lower 0.7 mile of Walker Creek. Grider Creek provides habitat in the lower 7.35 miles of the watershed for some adults and up to thousands of juvenile coho salmon, comprised of natal Grider Creek juvenile coho salmon as well as non-natal juvenile coho salmon from neighboring tributaries.

Tributary spawner surveys indicate low numbers of coho salmon (<100) in the remaining habitat. Using a variety of methods, including these data and an Intrinsic Potential (IP) database, Ackerman *et al.* (2006) developed run size approximations for tributaries in the Upper Klamath River reach. Ackerman *et al.* (2006) estimated the abundance of the Upper Klamath River population to be between 100 and 4,000 adults, far lower than the 8,500 spawners needed for this population to achieve a low extinction risk (Williams *et al.* 2008).

d. Extinction Risk

The Upper Klamath River population is at a high risk of extinction given its low population size and negative population growth rate. The population growth rate of the Upper Klamath population has not been estimated but given the current trends in spawner abundance and the high incidence of hatchery fish and inbreeding depression, population growth is likely negative. The combination of low population abundance and a negative population growth rate mean that the population is at an elevated risk of extinction. In addition, habitat is often not fully occupied, such that the high risk criteria described by Williams et al (2008) are met or exceeded. NMFS' determination of population extinction risk is also based on the available information about population productivity, spatial structure, and diversity, described above.

e. Role in SONCC Coho Salmon ESU Viability

The Upper Klamath River population is a core, functionally independent population within the Interior Klamath River diversity stratum; historically having had a high likelihood of persisting in isolation over 100-year time scales, and with population dynamics or extinction risk over a 100-year time period that are not substantially altered by exchanges of individuals with other populations (Williams *et al.* 2006). To contribute to stratum and ESU viability, the Upper Klamath River core population needs to have at least 8,500 spawners. Sufficient spawner densities are needed to maintain connectivity and diversity within the stratum and continue to represent critical components of the evolutionary legacy of the ESU. Besides its role in achieving demographic goals and objectives for recovery, as a core population the Upper Klamath population may serve as a source of spawner strays for nearby populations. At present, the capacity of the Upper Klamath coho salmon population to provide recruits to adjacent independent populations is limited due to its low spawner abundance. Conversely, recruits straying from the nearby populations in the Klamath basin may enhance recovery of the Upper Klamath River population. Additionally, Upper Klamath River tributaries, refugia, and mainstem habitat function as migratory and rearing habitat for fish from populations located upstream (*i.e.*., Scott and Shasta). Therefore, restoration of the Upper Klamath River is important for recovery of these populations, too.

2.3.1.2 Middle Klamath River Coho Salmon Population

a. Summary

The Middle Klamath River coho salmon population has the following characteristics as described in the SONCC Coho Salmon Recovery Plan (NMFS 2014): part of Interior Klamath Stratum; a non-core 1, potentially independent population[5]; at moderate extinction risk; the population is likely above the depensation threshold of 450 spawners; 3,900 spawners are required to attain ESU viability; 1,038 mi2 watershed (98 percent federal ownership); 113 IP-km (70 IP-mi) (4 percent high); dominant land use is Forest Service public land; key limiting stresses are 'impaired water quality' and 'lack of floodplain and channel structure;' and key limiting threats are 'high severity fire' and 'dam/diversions' (NMFS 2014a). Exposure to Project effects in the Middle Klamath River may occur in the mainstem Klamath River, in refugia associated with tributaries to the mainstem Klamath River, and in all Klamath tributary habitat accessible to Middle Klamath River SONCC coho salmon.

b. Spatial Structure and Diversity

There are several monitoring efforts in the Middle Klamath River, including: 1) fish populations, 2) stream flow, 3) water quality, 4) physical habitat, and 5) restoration sites. These monitoring efforts have taken place in many tributaries of the Klamath River since 1986, and have provided information on coho salmon distribution and abundance as well as habitat condition and restoration effectiveness.

[5] Potentially Independent Populations have a high likelihood of persisting in isolation over a 100-year time scale, but are too strongly influenced by immigration from other populations to exhibit independent dynamics.

Juvenile coho salmon surveys have been conducted over the past several decades by various parties including the Karuk Tribe, Mid Klamath Watershed Council, and USFS. These surveys have found coho salmon juveniles rearing in the majority of the large tributaries to the mainstem Klamath River, most commonly in the lower reaches of such tributaries, including the lower 12.3 miles of Elk Creek. In addition, coho salmon have been observed spawning in side channels, tributary mouths, and shoreline margins of the mainstem Klamath River between Beaver Creek (RM 161) and Independence Creek (RM 94) (Magneson and Gough 2006). Williams *et al.* (2008) determined that at least 34 coho salmon per-IP-km of habitat are needed (3,900 spawners) for the Middle Klamath coho salmon population to be at low risk of extinction. Adults and juveniles appear to be well distributed throughout the Middle Klamath; however, use of some spawning and rearing areas is restricted by water quality, flow, access, and sediment issues.

Little is known about the genetic and life history diversity of the population, but diversity is expected to be limited because of the depressed population size. The Middle Klamath River coho salmon population spatial distribution appears to be good, but since many of the Middle Klamath tributaries are used for non-natal rearing too little is known for its natal spatial structure and diversity to be evaluated.

c. Population Size and Productivity

Little data exist on the Middle Klamath coho salmon population, but runs are thought to be extremely reduced compared to historical levels. Regional biologists estimate that the total population size is around 1,000-1,500 in strong run years and 0-500 in weaker run years (Ackerman *et al.* 2006). A few tributaries in the Middle Klamath (*e.g.*, Slate, Boise, Red Cap, Clear, Camp, and Indian Creeks) support significant returns of coho salmon; however total spawner abundance and population productivity is unknown. The Karuk Tribe found at least 64 coho salmon redds and 22 adult coho salmon in Middle Klamath tributaries in the 2013-2014 spawning season (Corum 2014). Tributaries with observed coho salmon spawners or redds in 2013-2014 included Aikens, Camp, China, East Fork Elk, Elk, Independence, Indian, Mill (tributary to Indian), South Fork Clear, and Titus creeks (Corum 2014). Juvenile counts indicate that productivity is relatively low, with less than 12,000 juvenile coho salmon found between 2002 and 2009 during surveys of Middle Klamath tributaries (USFS 2009). Outmigrant trapping on Red Cap and Camp Creeks during the late spring and early summer by the USFS exhibited consistent use of these Middle Klamath River tributaries by young-of-the-year (YOY) and age-1 coho salmon. Based on adult returns to other Klamath River populations, the 2004/2007/2010 brood year is likely a relatively stronger year class than the other two (*i.e.*., 2003/2006/2009 and 2002/2005/2008) (Ackerman *et al.* 2006).

Generally the returns are more consistent between years in Middle Klamath tributaries than in other populations such as the Scott or Shasta rivers, which have very weak year classes most years (Chesney and Knechtle 2013).

d. Extinction Risk

Williams *et al.* (2008) determined at least 113 coho salmon must spawn in the Middle Klamath each year to avoid the effects of extremely low population sizes. Based on the available data, the

Middle Klamath River coho salmon population likely has an average spawner abundance of 200-600 individuals, and is at moderate risk of extinction given the low population size and negative population growth rate (Ackerman *et al.* 2006). Based on current estimates, the population is likely above depensation, but well below the low-risk threshold of 3,900 spawners. NMFS' determination of population extinction risk is based on the viability criteria provided by Williams *et al.* (2008), as well as the available information on spatial structure and diversity described above.

e. Role in SONCC Coho Salmon ESU Viability

The Middle Klamath River population is a non-core, Potentially Independent population within the Interior Klamath River diversity stratum, historically having had a high likelihood of persisting in isolation over 100-year time scales, but strongly influenced by immigration from other populations (Williams *et al.* 2006). The Middle Klamath River population is strongly influenced by upstream populations. Adult strays from these populations spawn and interact with coho salmon in the Middle Klamath River. To contribute to stratum and ESU viability, the Middle Klamath River non-core population needs to at least attain the low-risk threshold of 3,900 spawners. Sufficient spawner densities are needed to maintain connectivity and diversity within the stratum and to continue to represent critical components of the evolutionary legacy of the ESU. Furthermore, the Middle Klamath River population corridor will contribute toward stratum and ESU viability by providing rearing, migratory, and refugial habitat to other populations in the Klamath River basin.

2.3.1.3 Salmon River Coho Salmon Population

a. Summary

The Salmon River coho salmon population has the following characteristics as described by the SONCC Coho Salmon Recovery Plan (NMFS 2014a): part of Interior Klamath Stratum; a non-core 1, potentially independent population; at high extinction risk; the population is likely above the depensation threshold; 450 spawners are required to attain ESU Viability; 751 mi2 watershed (99 percent federal ownership); 115 IP-km (71 IP-mi) (2 percent high); dominant land uses are wilderness, conservation, and forest vegetation management via commercial thinning and fuels treatment; key limiting stresses are 'lack of floodplain and channel structure' and 'degraded riparian condition;' and key limiting threats are 'climate change' (*e.g.* elevated water temperatures and lower summer base flows) and 'high severity fire' (NMFS 2014a). Exposure to Project effects in the Salmon River may occur in the mainstem and North Fork Salmon rivers, in refugia associated with tributaries to the mainstem and North Fork Salmon rivers, including North Russian and South Russian creeks, and in all Klamath River tributary habitat accessible to Salmon River SONCC coho salmon. This exposure is expected to be small, however, when compared to SONCC coho salmon exposure in the Upper Klamath River and Mid Klamath River populations.

b. Spatial Structure and Diversity

Twelve percent of the 1,414 miles of stream within the Salmon River watershed are able to support anadromous salmonids, due to the mountainous topography and associated hydrology of the landscape (Elder *et al.* 2002). Coho salmon habitat includes the mainstem Salmon River, Wooley Creek, the North Fork and South Fork Salmon Rivers, and the lower reaches of a few smaller tributaries.

Juvenile coho salmon have been found rearing in most of the available tributary habitat with moderate or high IP values. These streams are tributaries to the South Fork Salmon (Knownothing and Methodist Creek), at least nine tributaries to the North Fork Salmon River, and in mainstem Salmon River tributaries of Nordheimer and Butler creeks (SRRC 2008). Williams *et al.* (2008) determined that at least 35 coho salmon per IP-km of habitat are needed (4,000 low-risk spawner threshold) to approximate the historical distribution of Salmon River coho salmon and habitat. Based on current spawning densities and locations, the Salmon River population's spatial structure and diversity appear limited compared to historical conditions.

Young of the year (YOY) and yearling abundance is also low in the Salmon River, indicating that production is low. Between 2002 and 2004, only 112 YOY and 2 yearlings were captured during outmigrant trapping in the lower Salmon River at RKM 1.5 (Sartori 2006). Juveniles have been found utilizing the lower reaches of many tributary streams during both the winter and summer; however, abundance data is unavailable (SRRC 2010). Some juveniles likely originate from outside the Salmon River and rear in the Salmon River (USFS 2009).

c. Extinction Risk

The Salmon River population is at high risk of extinction. NMFS' determination of population extinction risk is based on the viability criteria provided by Williams *et al.* (2008), as well as the available information on spatial structure and diversity described above.

d. Role in SONCC Coho Salmon ESU Viability

The Salmon River population is a non-core, Potentially Independent population within the Interior Klamath River diversity stratum; historically having had a high likelihood of persisting in isolation over 100-year time scales, but strongly influenced by immigration from other populations such that the Salmon River population did not exhibit independent dynamics (Williams *et al.* 2006). The Salmon River population remains strongly influenced by upstream populations. Adult strays from these populations spawn and interact with coho salmon in the Salmon River. To contribute to stratum and ESU viability, the Salmon River non-core population should have at least 450 spawners. Sufficient spawner densities are needed to maintain connectivity and diversity within the stratum and continue to represent critical components of the evolutionary legacy of the ESU. Furthermore, the Salmon River population area will contribute toward stratum and ESU viability by providing rearing, migratory, and refugia habitat to other Interior Klamath River populations.

2.3.1.4 Scott River Coho Salmon Population

a. Summary

The Scott River coho salmon population has the following characteristics as described the SONCC Coho Salmon Recovery Plan (NMFS 2014a): part of Interior Klamath Stratum; a core, functionally independent population; at moderate extinction risk; the population is likely above the depensation threshold; 6,500 spawners are required to attain ESU Viability; 813.4 mi2 watershed (37 percent federal ownership); 250 IP-km (155 IP-mi) (78 percent high); dominant land uses are agriculture, ranching, forest vegetation management via commercial thinning and fuels treatment; and key limiting stresses are 'altered hydrologic function' and "degraded riparian forest condition'; and key limiting threats are 'agricultural practices' and 'dams/diversions' (NMFS 2014a). Exposure to Project effects in the Scott River may occur in the lower Scott River, in refugia associated with tributaries to the lower Scott River, and in all Klamath River tributary habitat accessible to Scott River SONCC coho salmon. This exposure is expected to be small, however, when compared to SONCC coho salmon exposure in the Upper Klamath River and Mid Klamath River populations.

b. Spatial Structure and Diversity

The historical diversity and complexity of the physical and environmental conditions found within the Scott River basin have contributed to the evolutionary legacy of coho salmon in the SONCC ESU, and contributed to this population being considered a Functionally Independent population (Williams *et al.* 2008). Juvenile fish have recently been found rearing in the mainstem Scott River, East Fork Scott River, South Fork Scott River, Shackleford Creek and eleven tributaries to the Scott River (Shasta Scott Recovery Team 2003, Yokel 2006, CDFG 2008, Calfish 2013). SONCC coho salmon within Tompkins and Mill (Scott Bar) creeks, and in the lower Scott River, may be affected by Project impacts. Adult coho salmon surveys of the Scott River and its tributaries since 2001, indicate that the eleven most productive tributaries to the Scott River (East Fork Scott River, South Fork Scott River, Sugar Creek, French Creek, Miners Creek, Etna Creek, Kidder Creek, Patterson Creek, Shackleford Creek, Mill Creek, and Canyon Creek) consistently sustain rearing salmon juveniles in limited areas (Maurer 2005, Cramer Fish Sciences *et al.* 2010).

There have only been three confirmed observations of hatchery origin coho salmon recoveries in the Scott River. CDFW estimated the portion of hatchery origin coho salmon in the Scott River at 0.81 percent (Knechtle and Chesney 2013). Straying of non-natal SONCC coho salmon in the Scott River basin does not appear to be substantial, and should not detract from its status as the most productive natural stock in the upper Klamath River basin (Garza 2012).

c. Population Size and Productivity

NMFS determined at least 242 coho salmon must spawn in the Scott River each year to avoid the adverse effects of extremely low population sizes. Adult spawning surveys and fish counting weir information that restarted in 2007 indicate adult spawning coho salmon numbers approaching 1,000 or more every third brood year, with abundance numbers ranging from 60 to

355 during the other two brood years. The number of smolts produced per returning adult female provides a measure of freshwater survival in the Scott River Basin (Table 4). When redd and juvenile abundance is below carrying capacity, the number of smolts produced per adult can be used to infer habitat condition, and trends between years, for coho salmon (Knechtle and Chesney 2015). These data confirm small, though increasing numbers of returning adults in two of the three brood years, with the third brood year being of relatively larger size. Productivity continues to vary considerably between brood years during a decade of internally comparable observations, not yet providing a clearly discernable trend.

Table 4. Estimated number of smolts produced per returning adult SONCC coho salmon spawner.

Adult Return Year	Adult Estimate	Adult Female Estimate	Smolt Year	Smolt Point Estimate	Smolts Produced per Returning Adult Female
2007	1622	860	2009	62,207	72.33
2008	63	32	2010	2,174	67.94
2009	81	41	2011	275	6.71
2010	927	640	2012	50,315	78.62
2011	355	170	2013	7,927	46.63
2012	201	86	2014	5,708	66.37
Average		56.43 Smolts Produced per Returning Adult Female			

d. Extinction Risk

The Scott River population is at moderate risk of extinction with returning adults remaining well below recovery targets (6,500 spawners) as described in the SONCC Coho Salmon Recovery Plan (2014a). NMFS' determination of population extinction risk is based on the viability criteria provided by Williams *et al.* (2008) as well as the available information on spatial structure and diversity described above.

e. Role in SONCC Coho Salmon ESU Viability

The Scott River population is a core, functionally independent population within the Interior Klamath River diversity stratum, historically having had a high likelihood of persisting in isolation over 100-year time scales, and with population dynamics or extinction risk over a 100-year time period that are not substantially altered by exchanges of individuals with other populations (Williams *et al.* 2006). To contribute to stratum and ESU viability, the Scott River core population needs to have at least 6,500 spawners. Sufficient spawner densities are needed to maintain connectivity and diversity within the stratum and continue to represent critical components of the evolutionary legacy of the ESU. Besides its role in achieving demographic goals and objectives for recovery, as a core population the Scott River population may serve as a stronghold for recovery, being a source of spawner strays for nearby populations in the Klamath Basin.

2.3.1.5 Shasta River Coho Salmon Population

a. Summary

The Shasta River system produces outmigrant coho salmon smolts that hold and rear in thermal refugia within the Project action area and, thus, that may be affected by Project activities. The Shasta River coho salmon population has the following characteristics: part of Interior Klamath Stratum; a core, functionally independent population; at high extinction risk; the population is likely below the depensation threshold; 4,700 spawners are required to attain ESU Viability; 793 mi2 watershed (27 percent federal ownership); 144 IP-km (90 IP-mi) (80 percent high); dominant land uses are agriculture, ranching, and moderate timber harvest; key limiting stresses are 'impaired water quality' and 'altered hydrologic function'; and key limiting threats are 'agricultural practices' and 'dams/diversions' (NMFS 2014a). Shasta River population exposure to Project impacts may occur in the mainstem Klamath River, in refugia associated with tributaries to the mainstem Klamath River, and in all Klamath River tributary habitat accessible to Shasta River SONCC coho salmon. This exposure, via non-natal rearing of Shasta River-origin coho salmon, is expected to be small, however, when compared to SONCC coho salmon exposure in the Upper Klamath River and Mid Klamath River populations.

b. *Spatial Structure and Diversity*

The Shasta River population is considered a Functionally Independent population within the SONCC coho salmon ESU (Williams *et al.* 2006). Historical instream river conditions, fostered by unique cold spring complexes, created abundant summer rearing and off channel overwintering habitat that were favorable for production of coho salmon in the Shasta River basin.

The current distribution of coho salmon spawners is concentrated in the mainstem Shasta River from river mile 32 to about river mile 36, Big Springs Creek, lower Parks Creek, and in the Shasta River Canyon (river mile 0 to 7). Juvenile rearing is also occurring in these same areas, and occasionally in lower Yreka Creek (Garwood 2012) and the upper Little Shasta River (Whelan, J., pers. comm. 2006). This spatial distribution is currently restricted from the historical range, remaining concentrated in the mainstem Shasta River from river mile 32 to about river mile 36, Big Springs Creek, lower Parks Creek, and in the Shasta River Canyon.

The diversity of the population is threatened by hatcheries. Recent findings by NMFS Southwest Fisheries Science Center suggest that hatchery and natural fish have already interbred in upper Klamath Basin tributaries near Iron Gate Hatchery (CDFW 2013), particularly in the Shasta River basin. The total impacts of hatchery strays on populations like that of the Shasta River are not well understood. However, known straying data and preliminary genetic typing indicate that hatchery releases have negatively affected natural populations.

c. Population Size and Productivity

The number of spawners in all three year classes is low, well below the depensation threshold. Productivity may also be impaired. Recent comparisons of estimated Shasta River yearling coho

salmon production to returning adult Shasta River coho salmon have ranged from 4.4 to 46.6 (Chesney and Knechtle 2013, Table 5). By brood year, the number of yearlings produced per returning adult has been trending downwards, suggesting that in-river conditions have not improved sufficiently to initiate recovery of the Shasta River coho salmon population.

Table 5. Estimated number of smolts produced per returning adult SONCC coho salmon spawner.

Adult Brood Year	Adult Estimate	Yearling Year	Yearling Point Estimate	Yearlings Produced Per Adult
2001	291	2003	11,052	38
2002	86	2004	1,799	20.9
2003	187	2005	2,054	11
2004	373	2006	10,833	29
2005	69	2007	1,178	17.1
2006	47	2008	208	4.4
2007	255	2009	5,396	21.2
2008	31	2010	169	5.6
2009	9	2011	19	2.1
2010	44	2012	2049	46.6
Average				**19.62**

Weir counts conducted by CDFW indicate that the minimum number of adult spawning coho salmon have varied between 0 to 400 for most years, with a high of approximately 900 returning adults in 1978 (Chesney and Knechtle 2013; note: These data may not account for entire adult coho salmon brood year numbers, as weirs were sometimes removed [due to high flows] before all coho salmon spawners had entered the Shasta River). These brood year population estimates are low, and have not trended upward over time.

d. Extinction Risk

The Shasta River population is at high risk of extinction given the low and unstable population, and because the ratio of the three consecutive years of lowest abundance within the last twelve years to the amount of IP-km in the watershed is less than one, the criterion described by Williams *et al.* (2008). NMFS' determination of population extinction risk is based on the viability criteria provided by Williams *et al.* (2008).

e. Role in SONCC Coho Salmon ESU Viability

The Shasta River population is a core, Functionally Independent population within the Interior Klamath River diversity stratum, historically having had a high likelihood of persisting in isolation over 100-year time scales, and with population dynamics or extinction risk over a 100-year time period that are not substantially altered by exchanges of individuals with other populations (Williams *et al.* 2006). To contribute to stratum and ESU viability, the Shasta River core population should have at least 4,700 spawners. Sufficient spawner densities are needed to maintain connectivity and diversity within the stratum and continue to represent critical

components of the evolutionary legacy of the ESU. Besides its role in achieving demographic goals and objectives for recovery, the Shasta River population may also serve as a source of spawner strays for nearby coastal populations. At present, the capacity of the Shasta River coho salmon population to provide recruits to adjacent independent populations is limited due to its low spawner abundance. Conversely, recruits straying from the nearby Scott River and Upper Klamath River may enhance recovery of the Shasta River population**.**

2.3.2. Factors Affecting the Species and Critical Habitat in the Action Area

Lands in the action area are used primarily for timber production, grazing on allotments, and recreation. The action area is mostly undeveloped, but it has received a great number of management activities in the past. A few homes are established on private property, generally along creeks and rivers at lower elevations. Fish habitat in the action area has been affected by: sediment erosion and passage barriers from: road-derived sediment mobilization and loss of floodplains from streamside roads; alteration of stream banks; reduction of shade and large wood debris recruitment to streams from past logging activities; and alteration of stream flows from PacifiCorp dams, located on the mainstem Klamath River upstream from the action area.

Timber harvest has occurred in much of the Project action area, beginning in the 1800s and continuing into the 21st Century. The KNF has also conducted prescribed burning within the action area during the past fifteen years (approximately 8,000 acres out of the 218,000 acres affected by 2014 Westside Fires). The KNF also completed shaded fuel breaks, clearing strips of understory vegetation to prevent expansion of wildfires, during the same period. In 2013-2014, salvage harvest was completed on approximately 260 acres of KNF-managed land in the North Fork Salmon River watershed. The KNF has also obliterated/rehabilitated many miles of roads and numerous road/stream crossings in the Project action area since 1996-1997 flood damage.

The KNF tracks watershed management actions and natural disturbances such as fire using equivalent roaded area (ERA, Laurie and Elder 2011, 2013) for all KNF-managed lands. ERA is an accounting of the natural and management related landscape disturbances using GIS polygons and disturbance and recovery coefficients (Elder and Reichert 2004). Figure 1 plots the cumulative frequency distribution of percent ERA for all KNF-managed watersheds, including the action area. Numerous studies evaluating the effects of land management on downstream resources (*e.g.*, Klein et al 2008) have found that as ERA or equivalent clearcut area (a similar measure) increases, so does sediment erosion as well as instream sediment transport and turbidity. The cumulative frequency distribution in Figure 1 represents baseline conditions for the KNF-managed watersheds with respect to ERA.

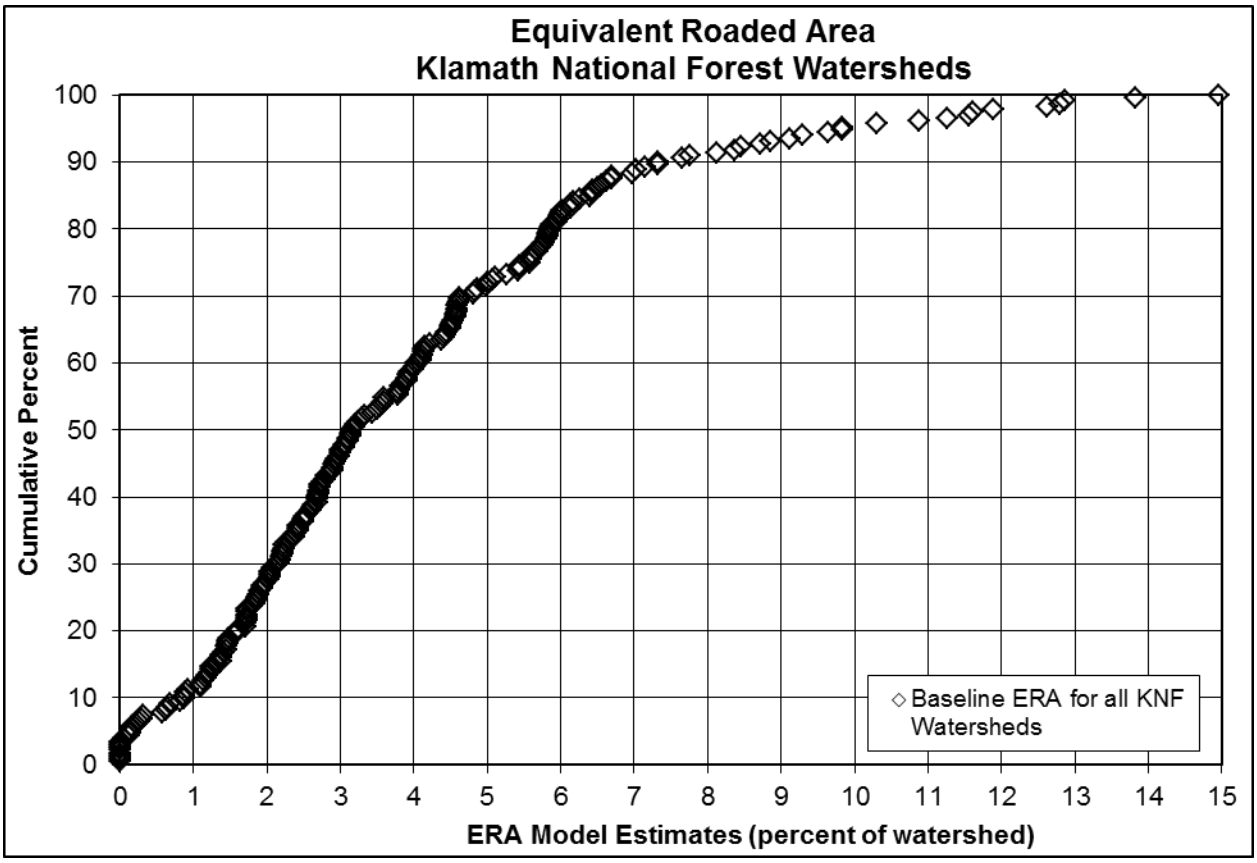

Figure 1. Percent of each Klamath National Forest watershed in equivalent roaded area (data from Laurie and Elder 2011; 2013).

Mountain slopes in much of the action area are prone to slope failures due to tectonic disturbance, steep hillslopes, sensitive soil types, and precipitation regime. Debris flows are relatively common in the action area during large rain and rain-on-snow events (Cover *et al.* 2008). Stream reaches affected by past debris flows generally have elevated fine sediment levels, aggraded channels, reduced pool frequency, and early successional riparian vegetation (Mondry 2004, Cover *et al.* 2008). Sizable slope failures and debris flows occurred throughout the action area during both the December 1996 to January 1997 and the December 2005 to January 2006 storms. These failures and flows were concentrated in the Happy Camp Complex area, where forest roads had a large direct influence on hillslope erosion and flood processes (de la Fuente and Elder 1998, de la Fuente *et al.* 2006). The debris flows resulted in extreme amounts of sediment deposition, channel and bank scouring, while the majority of instream large organic debris was washed out. At least half of the slope failures identified in 1996-1997 were directly or indirectly triggered by roads constructed across geologically unstable areas (de la Fuente and Elder 1998). A contributing factor to all the road related failures was surface water drainage that caused surface runoff to be concentrated on unstable fills.

Streambed fine sediment deposition is a product of watershed hillslope condition, stream channel and floodplain configuration (*e.g.*, wide or narrow, steep or flat), fluvial sediment transport regimes and the local depositional environment. High quantities of fine sediment in stream channels can degrade salmonid habitat and food webs (*e.g.*, Suttle *et al*., 2004), thereby

adversely affecting egg/juvenile fish behavior and survival. For example, increases in fine sediment can reduce coho salmon survival to emergence by altering inter-gravel channel bed topography and porosity. Numerous fine sediment measures and indices have been used to characterize stream channel conditions (*e.g.*, Lisle and Hilton 1999) and to determine aquatic habitat quality (*e.g.*, Chapman 1987).

Using several fine sediment measures, the KNF developed an in-channel sediment monitoring plan to meet monitoring requirements in the Klamath, Scott, Shasta, and Salmon River Total Maximum Daily Load allocations and associated memoranda of understanding (Laurie and Elder 2011). The North Coast Regional Water Quality Control Board (NCRWQCB 2005, 2006, 2010) listed all tributary creeks to the Scott, Salmon, and Klamath Rivers within the action area as impaired, *i.e.*., not meeting water quality standards and supporting beneficial uses for sediment and temperature. The KNF's fine sediment monitoring plan serves to: determine if KNF-managed streams are meeting water quality standards and supporting beneficial uses, including cold water fisheries (NCRWQCB 2009a, 2009b); and determine the extent to which management actions are affecting the fine sediment levels in stream channels. KNF monitoring data is used in this analysis to describe critical habitat baseline conditions (*i.e.*., PCE substrate), and the potential effects of the proposed action on this PCE.

The KNF sampled stream reaches in 20 reference and 59 managed watersheds within the KNF, to: measure the volume of fine sediment in pools, and then divided this by the volume of each pool (V*); determine the percent of surface fine sediment (<2 mm) on riffles; and determine the percent of subsurface fine sediment (<6.35mm and <0.85mm) in potential spawning substrate. Lisle and Hilton (1999) found that V* is an effective estimate of excess fine sediment in stream channels, while also tracking temporal and spatial variations in fine sediment loading. The percent of fine sediment on top of riffles is commonly used in a similar way (Lisle and Hilton 1999). Increases in both riffle surface fine sediment and V* have been shown to reduce juvenile salmon cover, to alter salmon behavior, and to change aquatic invertebrate composition (Suttle *et. al*. 2004). Fine sediment in pools (V*) is highly mobile and Lisle and Hilton (1999) noted that such fines typically scour and refill pools several times in a normal water year. Figure 2 displays reference and managed stream V* data. Variations between reference and repeat reference data in Figure 2 captures the changing nature of pool fine sediment volumes identified by Lisle and Hilton (1999): from repeated pool scour and filling that occurs during most flow events. In spite of this variation, the managed watershed V* data show that managed watersheds have higher pool fine sediment levels than reference watersheds. Figure 2 also shows that most V* values are below 0.21, the level set by the NCRWQCB (2006) for achieving the fine sediment water quality standard. V* measurements in a few sampled streams, indicated in the upper right portion of Figure 2 and which include some streams in the action area, show that these streams deviate strongly, and potentially to the detriment of riparian habitat quality, from reference stream V* data. As mentioned previously, increases in pool fine sediment have been shown to impair salmonid growth, food availability, and survival (*e.g.*, Suttle *et. al*. 2004).

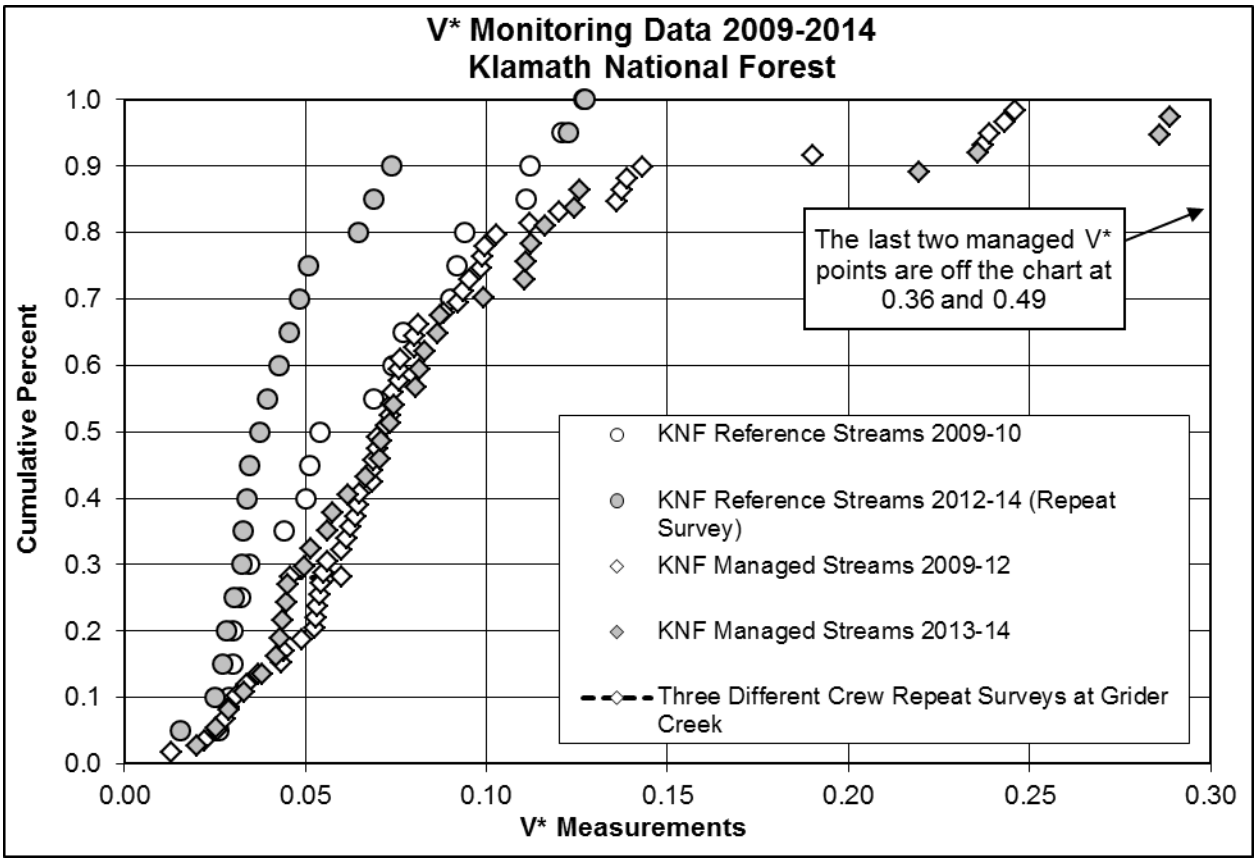

Figure 2. Klamath National Forest reference and managed watershed/stream pool fine sediment (V*) measurements, 2009-2014.

To complement V* and percent riffle surface fines monitoring, the KNF also measures percent sediment fines in streambed substrate, as the latter is often used to assess coho salmon spawning gravel quality (Koski 1966, Tagart 1984, Cederholm *et al.* 1980). Plots of cumulative frequency distributions for <0.85 mm and <6.35 mm sediment size classes (Figures 3 and 4) show increases in fine sediment in managed watershed streams versus reference watershed streams. The KNF's watershed sediment yield modeling offers support that managed watershed streams mobilize more fine sediment to in-channel substrate than do reference watershed streams.

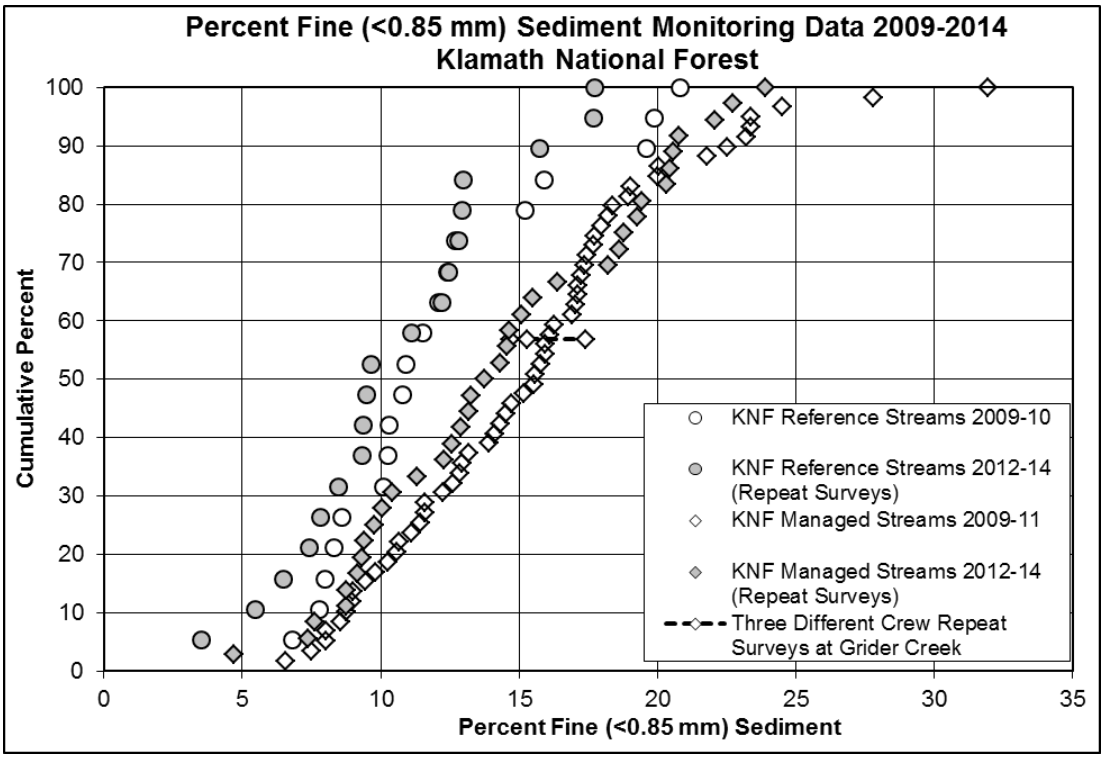

Figure 3. Klamath National Forest reference and managed watershed/stream percent fine sediment (< 0.85 mm) in channel substrate, 2009-2014.

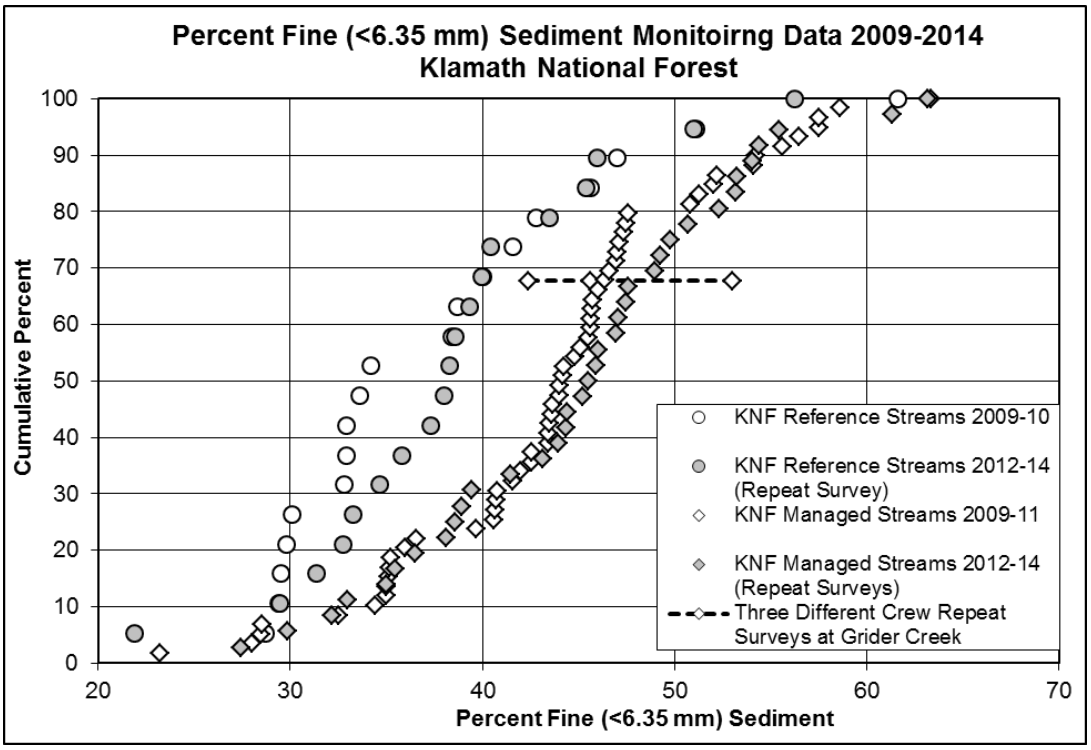

Figure 4. Klamath National Forest reference and managed watershed/stream percent fine sediment (<6.35 mm) in channel substrate, 2009-2014.

2.3.2.1 Effects from the 2014 Westside Fires

Effects of human activities on the environmental baseline in the action area have been exacerbated by effects from the 2014 Westside Fires. These fires caused moderate to high severity damage to soils and vegetation on approximately half of the area that burned (USFS 2015h). Fire consumed most of the smaller plants and organic material on the soil surface, and killed an estimated 80 percent of mature trees. Loss of vegetation and organic material results in a decreased ability of the landscape to absorb rainwater or snowmelt and reduced evapotranspiration, ultimately, increasing water yield (*i.e.*., runoff from a drainage basin). Erosion potential in the burned areas area is relatively high due to the loss of organic matter and steep topography. The 2014 Westside Fires made the landscape more vulnerable to surface erosion and soil movement, due to the loss of ground cover, reduced soil cohesion from the loss of rooted plants, and increased water yield. Logging activities near streams on private land coupled with effects of the fire are likely to have reduced the availability and quality of spawning and rearing areas in portions of the action area where private timber salvage has already occurred. Fish habitat is likely to be altered by the 2014 Westside Fires for a decade or more into the future.

Soon after the 2014 Westside Fires were contained, KNF staff surveyed the burned area to assess the fire effects and they developed Burned Area Emergency Rehabilitation (BAER) plans to reduce suppression and suppression rehabilitation-related effects in fire-affected areas. Following BAER plan recommendations, the KNF improved road drainage on miles of roads and road-stream crossings, to help accommodate increased surface runoff. BAER actions that were completed yielded sediment reduction benefits that were verified during NMFS/KNF joint Project site visits on August 15 and 16, 2015. Numerous dipped and rocked road crossings at both intermittent and flowing streams that had sustained debris or hyper-concentrated flows during a July 5, 2015, storm did not fail, and even served to detain sediment on their surfaces. Many of these crossings would likely have failed without BAER treatment (Appendix A below, Figure 8a). Thus, these BAER actions helped roads and crossings better withstand the debris flows which occurred in the wake of the July-August 2015 summer storms, which are described below.

2.3.2.2 Summer Storms and Emergency Road Repair/Stabilization Effects on SONCC Coho Salmon and Critical Habitat in the Action Area

In July and early August 2015, localized and intense thunderstorms occurred in several watersheds within the Project Action Area, in many cases overlapping with steep slopes and areas heavily burned in 2014. The KNF Watershed staff produced a July-August 2015 Storm Report (USFS 2015f) to summarize these storms and resultant debris flows, focusing on where KNF roads were affected and how BAER and other road storm-proofing actions had performed in minimizing road failures and in protecting water quality. SONCC coho salmon critical habitat that was affected by debris flows associated with these natural events are contained in a KNF report to NMFS on SONCC coho salmon critical habitat conditions after these summer 2014 storm events (USFS 2015g), and are described below.

The summer 2015 thunderstorms triggered sediment-laden debris flows at the sites described above, resulting in substrate aggradation and turbidity within SONCC coho salmon critical habitat in the North Fork Salmon River, South Russian Creek, Whites Gulch, Beaver Creek, Walker Creek, Grider Creek, Elk Creek, lower Scott River, and the mainstem Klamath River. The sediment that was delivered to these creeks and rivers was composed of sand, silt, ash and other fines, along with material up to the size of small boulders. In many locations, the debris flow resulted in complete infilling of pools, leaving a thick lenses of sediment on top of the former streambed. Elevated turbidity was associated with these July 2015 debris flow events, and it will persist as stream flow continues to incise through streambed sediment lenses that were deposited, winnowing out the fines. This winnowing process could be completed in as short a time as several high flow events, or it could take years depending on: 1) the size of peak flows that occur in the next few years, and 2) the amount of new excess sediment that is delivered to stream channels during elevated peak flow events. It is likely that there will be additional 2014 fire-related sediment-laden debris flows, as well as deep-seated landslides and landslide-related debris flows, for a decade or more to come especially in light of current strong El Niño climate forecasts for 2015-2016. Past equatorial counter current events have been associated with large storms, sediment erosion, and landslide events in 1965-66, 1972-73, 1982-83, and 1997-98 (Figure 5). All modeled sea surface temperature anomalies predict a strong event, reaching its peak in late 2015 and continuing through winter/early spring 2016 (http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.html). These precipitation events will continue to deliver excess sediment to SONCC coho salmon critical habitat to lower gradient reaches downstream, delaying and mediating the recovery of water clarity and pool quality.

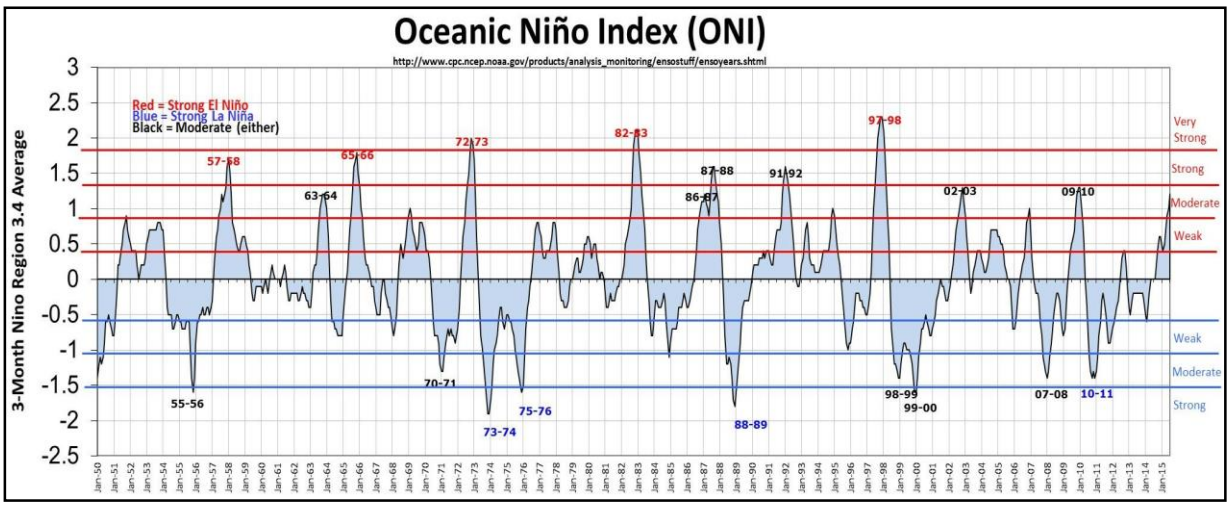

Figure 5. NOAA's three-month running average of the Oceanic Nino Index. The current three-month (July-September 2015) average, not displayed in this figure, is within the strong band. Note: In July 2015, NOAA downgraded the 1967-68, 1968-69, 1979-80, 1987-88, 1999-2000, and 2010-11 events one category, based on a new method for measuring sea surface temperatures.

The 2015 summer storms accelerated recruitment of large wood into SONCC coho salmon critical habitat, carrying fire-killed trees of many size classes in debris flows downslope into stream channels. This downslope and downstream large wood recruitment process to salmonid habitat is also expected to continue for a decade or more, helping to mitigate the paucity of large

woody debris in stream channels throughout the Project Action Area.

KNF's emergency response focused on road repair/stabilization including cleaning of culverts in dry channels, removing sediment and debris from roadways, and stockpiling this material outside of RRs. These emergency actions required work in live streams at the following two locations: South Russian Creek, where the closest emergency work was approximately 400 feet upstream from SONCC coho salmon critical habitat; and at the Walker Creek twin culverts (Appendix A, Figure 4a), where the closest emergency work was approximately 800 feet upstream from SONCC coho salmon critical habitat. Based on juvenile salmonid monitoring information (Grunbaum 2015), it is unlikely that SONCC coho salmon were present in these two reaches at the time of the storm events and, due to the channel aggradation disturbance (Appendix A, Figure 4b and Figure 4c), no fish were present or in close proximity downstream during the emergency road repair/stabilization.

Juvenile coho salmon likely experienced highly turbid water quality conditions and degraded instream habitat resulting from the effects of the storm in Walker Creek, Grider Creek, , Beaver Creek, , and Elk Creek, based on our knowledge of coho presence in these tributaries (Grunbaum 2015, USFS and Karuk Tribe 2014).

Ongoing climate change may alter SONCC coho salmon critical habitat, including critical habitat in the action area, by intensifying impacts associated with progressively more extreme long-term weather. For example, suitable freshwater habitat availability for juvenile coho salmon rearing and migration is expected to decrease in the future due to climate warming (Mote *et al.* 2003, Battin *et al.* 2007). Thus, competition for limited thermal refuge areas will increase. Bartholow (2005) found a warming trend of 0.5 °C/decade in the Klamath River and a decrease in average length of river with temperatures below 15 °C (8.2 km/decade), underscoring the importance of mainstem Klamath thermal refugia areas. However, hatchery releases are expected to remain constant during this period of shrinking freshwater habitat availability. This may increase the detrimental impacts to naturally produced coho salmon from density-dependent mechanisms in the freshwater environment. If warming continues, hatcheries will likely continue to have adverse impacts on the effective use of habitats by naturally produced coho salmon, if shared use of these habitats by natural and hatchery stocks exceed capacity limitations and food supplies. In spite of these hatchery-related risks to Klamath coho salmon populations, including those in the action area, hatchery releases are likely to continue. This is due to the significantly depressed status of the Upper Klamath, Scott, and Shasta populations, to which hatchery releases of coho salmon can contribute towards coho salmon abundance, one of the VSP criteria (NMFS and USFWS 2013).

2.4 Effects of the Action

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. As noted above, due to the comprehensive manner in which activities have been included in the proposed action, NMFS does not anticipate any interrelated or interdependent actions associated with the proposed action.

The proposed Project salvage harvest, and Project activities associated with it, potentially affect SONCC coho salmon critical habitat through hydrologic alterations, increased sediment erosion and transport to streams, and altered ecological recovery of the watershed. The effects analysis that follows is organized by these three mechanisms. Neither the salvage harvest units nor associated harvest infrastructure include stream reaches designated as critical habitat, and no Project temporary roads cross stream segments designated as critical habitat. Thus, effects of salvage harvest on critical habitat will occur downstream from proposed Project activities.

Apart from salvage harvest, effects to SONCC coho salmon critical habitat may also result from other Project activities, as follows:

(1) decreased habitat availability at the site level at and immediately downstream from water drafting sites, coincident with drafting activities;
(2) increased water temperatures due to loss of stream shading at the site level from hazard tree felling and brushing out of drafting access points, as well as increased water temperatures downstream from tributary water drafting sites during active pumping;
(3) decreased water quality from chemical spills associated with the operation of mechanized equipment near stream channels; and
(4) decreased large woody debris recruitment/availability associated with hazard tree removal.

Such effects to critical habitat from water drafting, hazard tree felling/removal, brushing out, and mechanized equipment operation will also be analyzed below.

2.4.1 Effects to Critical Habitat

2.4.1.1 Altered Hydrologic Function

The proposed action will result in effects to hydrology caused by ground disturbances from timber salvage harvest and yarding, construction of landings and temporary roads, and road hauling. Hydrologic processes in the action area have and continue to be greatly influenced by effects of the 2014 Westside Fires. Fires alter watershed hydrology by changing soil properties and reducing vegetative ground cover, mature trees, and organic surface materials such as logs, needles, and leaf litter (McIver and Starr 2000, McIver and McNeil 2001). Soils properties are changed when fires are hot enough to destroy organic materials in the soils, which likely occurred in most of the high-severity burn areas, and in isolated portions of areas of lower severity. Bare mineral soils that result from complete destruction of organic matter generally have lower cohesion and soil porosity than soils that contain organic matter, and bare mineral soils sometimes become water-resistant/hydrophobic post fire. These changes to soils, vegetation, and ground cover decrease the capacity of burned areas to accommodate water from precipitation or snow melt and they also increase the susceptibility of the soil to erosion. Soils subjected to fire become saturated more easily, and water runs off faster and in larger volumes compared to pre-fire conditions. When soils are saturated, runoff occurs as overland flow. The increased volume of overland flow in burned areas accelerates erosion and delivers a larger amount of sediment and water to streams (Ice *et al.* 2004).

Uncharacteristically large or severe fires, such as the 2014 Westside Fires, can cause major stream reorganization that alters the configuration of pools and riffles, and changes the size and distribution of gravels in the watershed. When fires significantly alter watershed hydrology, fish habitat is generally in poorer condition immediately following the fire and for at least several years thereafter. However, the fire effects are not entirely negative. Ecological disturbance by fires and the long-term geomorphic effects of fire on stream channels are integral parts of aquatic ecosystems on which anadromous fish depend (Benda *et al.* 2003), such as reconfiguring bars and banks within the stream channel providing a surface for new riparian vegetation establishment.

Timber salvage harvest can cause hydrologic changes that are similar in nature to those caused by wildland fire. Salvage harvest effects and fire effects are, therefore, additive. While effects of fire on physical characteristics of streams are well-studied, there is little information available concerning the effects of post-fire salvage harvest. Post-fire salvage harvest generally adds to the effects of fire on water and sediment yields, and salvage harvest can also affect the rate that the vegetative community recovers. Harvest activities affect water and sediment yields primarily though soil compaction and channelizing surface runoff in tire tracks, skid trails, or ruts created by logs that are yarded by dragging across the ground. Ground-based yarding systems (tractors and skidders) and, to a lesser degree, cable systems can cause significant soil disturbance and compaction (Beschta et. al. 2004).

The susceptibility of soils to compaction varies with different soil types. The dominant soils within the Project action area are mostly sandy loams or loams with gravelly to extremely gravelly texture modifiers, indicating high natural infiltration rates, and high rock content in many areas. These soils range from shallow to deep, reflecting a wide range of soil productivity and soil hydrologic groups. Specific dominant soils include the Clallam, Holland, Gilligan, Deadwood, and Jayar. Compaction ratings are moderate for these soils. Post-fire field monitoring indicated that approximately 1,500 acres of the Project Action Area's 218,000 acres are not meeting desired conditions for soil stability. The areas not meeting the desired condition have high erosion hazard ratings (EHR) due to the 2014 Westside Fires, which combusted organic matter on top of the soil surface. Soil disturbance resulting in bare soil (*i.e.*., having less than 30 percent cover) generally results in high EHRs if slopes are greater than 20 percent (USFS 2015h).

Soil compaction has the ability to increase peak flows in the action area, affecting critical habitat PCEs (streamflow). If excessive, peak flows can increase sediment delivery to critical habitat downslope or downstream. The effects of compaction on peak flows were not quantified in the BA, but with a moderate soil compaction rating and PDFs to minimize soil effects, Project-related soil compaction will be minimized. Also, the proposed action requires streamside buffers between streams and harvest units, and tracked equipment is required for yarding in the tractor units. Streamside buffers help mitigate effects of soil compaction by intercepting overland flows from salvage harvest units. Tracked vehicles distribute weight over a larger area than wheeled vehicles, minimizing soil compaction. Additionally soil compaction mitigation measures recommended by Reynolds et. al. (2011) will be incorporated to the proposed action. These include avoiding use of rubber-tired skidders, scheduling logging when soils are dry or covered

with deep snow, stopping equipment operation where soil is wet or very moist, placing a protective layer of logging slash before trafficking, designating skid trails or optimizing the yarding pattern. As a result of Project design, soil compaction from Project activities is not likely to cause a significant increase in water yield.

Large, high-severity fires such as the 2014 Westside Fires generally cause significant increases in water yield and peak flows from loss of vegetation, organic matter on soils, and the creation of water-resistant soils. Water yield and peak flows are likely to gradually return to pre-fire conditions as vegetation becomes reestablished over the next decade or more. The proposed action adds a relatively small increase in surface runoff from soil compaction by ground based logging equipment and temporary roads, and by concentrating runoff on skid trails, underneath cable systems, and at drains associated with temporary roads. The removal of dead and dying trees adds little to the hydrologic changes caused by the 2014 Westside Fires, since these trees no longer remove water by transpiration and burned canopies lack needles to intercept precipitation.

As described in the Environmental Baseline (Section 2.3.2.1) the 2014 Westside Fire effects on water yield and peak flows are anticipated to continue for a decade or more. Based on our analysis above, NMFS expects minor, immeasurable additional effects to water yield resulting from Project activities. Thus, the proposed action's effect on critical habitat condition in the action area from changes in water yields or peak flows is insignificant.

2.4.1.2 Increased Sediment Erosion and Turbidity

a. Increased Sediment Erosion

Shifts in forest management, climate, and biological resources can lead to changes in short-term hillslope erosion rates, and unintended consequences to downstream resources. Shifts in climate and fire regime can alter rainfall magnitude, duration, frequency, and intensity, as well as the frictional and cohesive properties of soils, roots, and subsurface hydrology. As described above in the Environmental Baseline (Section 2.3.2.2) the 2014 Westside Fires removed ground surface organic litter, reduced soil porosity, created hydrophobic soil layers, and reduced root strength. Larger, high severity burn patches likely require longer recovery periods than indicated, because local seed sources were combusted and must come from other areas.

Increased erosion leads to higher rates of downstream sedimentation, increased suspended sediment in streams, and turbidity (Ryan-Burkett *et al.* 2011) which affect critical habitat PCEs. Predicting the quantities of sediment erosion following a fire is difficult, given the variable configuration of landscapes and areas burned within them, as well as the intensity, frequency, magnitude, and duration of future precipitation events. After examining paired rainfall and runoff data from burned areas, Moody (2013) identified a 30-minute maximum rainfall intensity threshold, approximately 7.5 mm per hour, above which runoff substantially increases. This corresponds well with the runoff and debris flow events that occurred in response to the intense July 2015 storm in the action area.

The BAER reports (USFS 2014), and subsequent Project specialists' reports, described the risk of fire and management-related effects to SONCC coho salmon critical habitat as high to very

high. Even with the BAER recommendations implemented in 2014-2015, there remains an elevated risk to critical habitat in the action area from sediment erosion as described above in Environmental Baseline section 2.3.2.3. This elevated sediment erosion is based on topography, precipitation regime, and the extent and magnitude of burn severity of the 2014 Westside Fires. These may all contribute to elevated landsliding potential (USFS 2015d, USFS 2014), which may be exacerbated by future storms, such as the strong El Nino-associated precipitation forecast for 2015-2016 (NWS 2015). The July 5, 2015 rainstorm (USFS 2015f, NMFS field observations) and the December 26 to January 3, 1997, rain-on-snow storm (Cover et al 2008, Mondry 2004) provide examples of how storm-induced sediment erosion and debris flows, on top of recently burned slopes, can significantly alter critical habitat downslope in the action area. A discussion specific to the effects of the Proposed Action on large scale sediment erosion from landsliding is contained in section 2.4.1.3.

NMFS evaluated modeling data supplied by KNF to evaluate watershed disturbance and sediment yield resulting from the Proposed Action. The KNF uses three cumulative watershed effects (CWE) models to estimate watershed disturbance and sediment yield from surface erosion and landsliding, caused by past, ongoing, and any proposed action of interest: 1) a surface erosion model that uses a modified Universal Soil Loss Equation (USLE, Wischmeier and Smith 1965), 2) a mass wasting/landsliding (GEO) model that estimates sediment delivered to the system during a 10-year recurrence interval storm, and 3) a watershed disturbance model that translates all natural and management related landscape disturbances into equivalent roaded area (ERA). NMFS acknowledges that CWE modeling is an overestimate of effects relating to watershed disturbance, because modeling output did not exclude RR acreage from salvage harvest treatment units, which will, in fact, be avoided during all Project salvage harvest. Therefore, effects related to watershed disturbance are over-estimated, and may be as much as doubled (Bousfield 2015), in CWE modeling, erring on the side of caution in estimating erosion/slide potential. Although the KNF (Laurie and Elder 2011) found reasonable regression relationships between the KNF's three CWE models and the four streambed fine sediment data sets collected in reference and managed watersheds (Table 12 found in Laurie and Elder 2011), when all of the KNF's streambed fine sediment monitoring data (Laurie and Elder 2011, 2013) was used, the regression relationships between USLE and GEO model outputs and the <0.85 mm and <6.35 mm sediment monitoring data were weak or non-existent. Though there are relationships between ERA and the other three fine streambed sediment parameters, the strongest relationship was between ERA and streambed <0.85 mm sediment (Figure B, $R^2 = 0.37$). Given the strongest significant relationship is between ERA and fine sediment, NMFS utilizes ERA in this effects analysis. Additionally, Klamath National Forest has agreed to work with NMFS to further develop relationships between the three CWE models and the streambed fine sediment parameters through monitoring of the action (see Terms and Conditions).

Positive causal relationships were found between landscape disturbance measures, ERA (Figure 6) and road density (Figure 7), and the percent of substrate sediment <0.85 mm in the sampled reference and managed watershed streams.

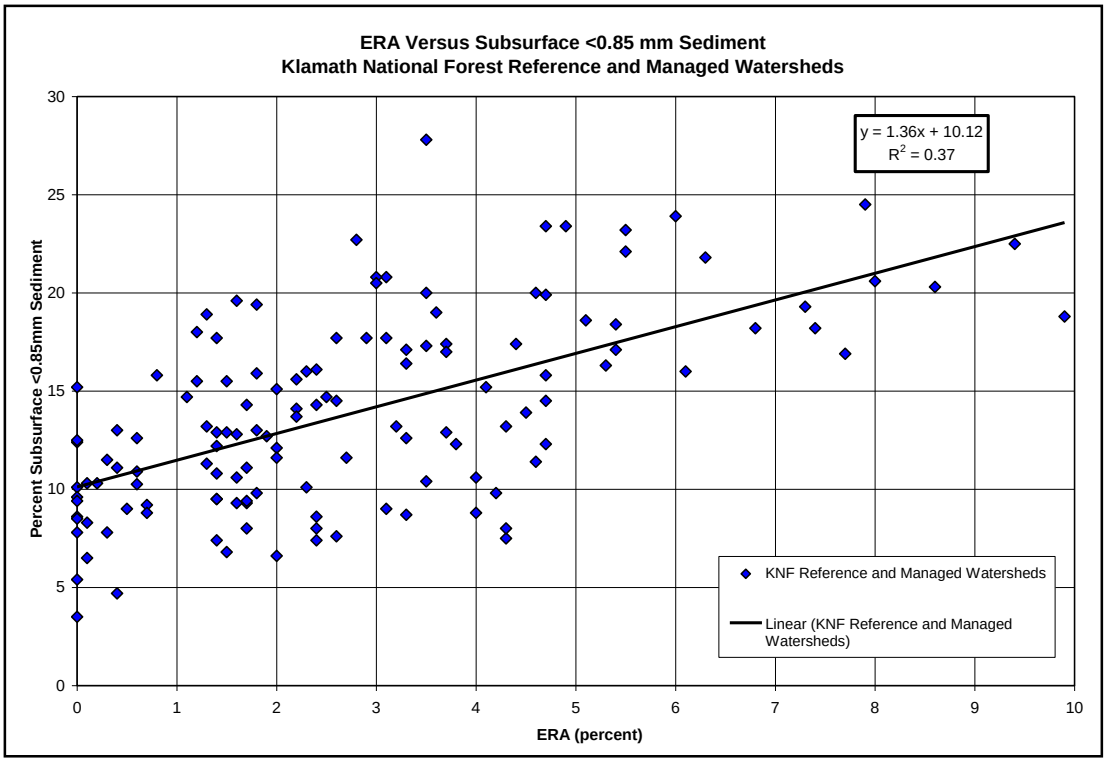

Figure 6. Equivalent Roaded Area for the reference and managed watersheds where substrate <0.85 mm sediment was measured (data from Laurie and Elder 2011, 2013).

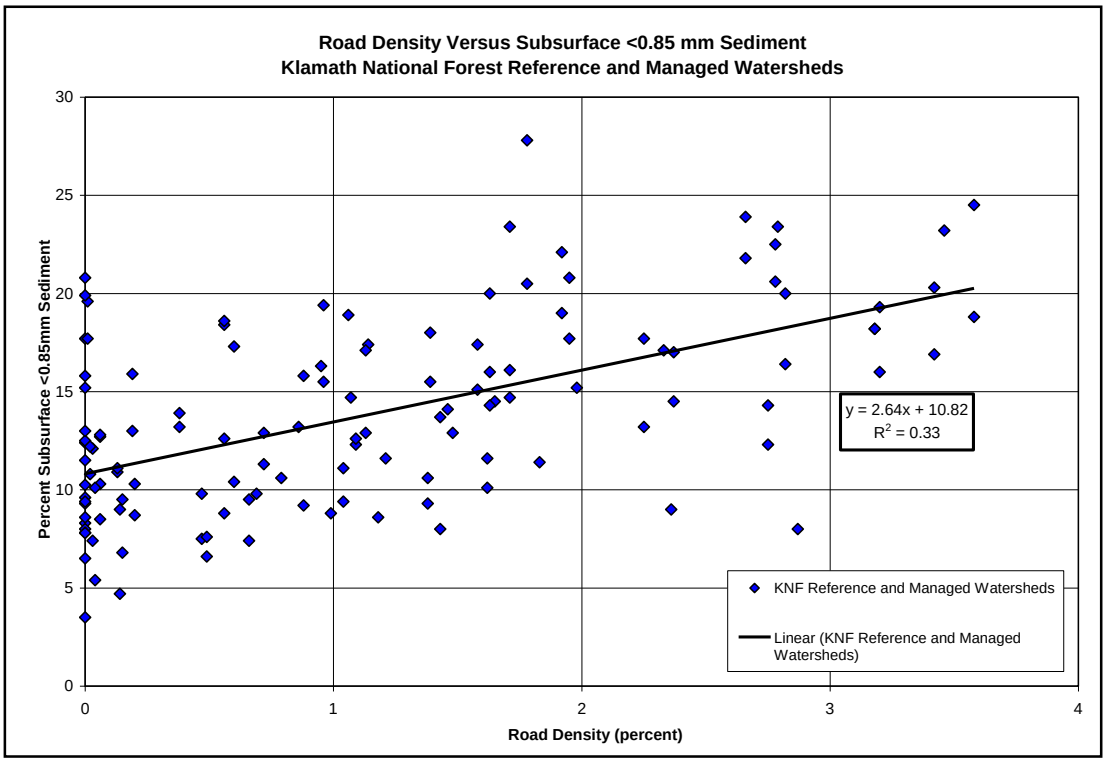

Figure 7. Road density for the reference and managed watersheds where substrate <0.85 mm sediment was measured (data from Laurie and Elder 2011, 2013 and KNF GIS data).

Shifts in ERA associated with the Project (Figure 7) are expected to result in increased fine sediment input to streams in the Action Area. Although the KNF will attempt to prevent and mitigate sediment erosion as a result of their management actions (*e.g.*, BMPs), Project related management actions including road maintenance and usage (*e.g.*, equipment and log hauling) are known to chronically increase streambed fine sediment levels (Figures 2, 3, and 4). Estimating the quantities of fine sediment increases is difficult given the large range of variability in the ERA to streambed fine sediment levels relationship (Figure 6) and the lack of further analysis.

To relate how the potential changes in substrate <0.85 mm sediments associated with land disturbances affect critical habitat and coho, the relationship developed by Jenson *et al.* (2009) for percent <0.85mm sediment versus percent coho survival to emergence (Figure 13) is used in combination with the relationships in Figures 6 and 7. Figures 8 and 9 place the KNF's reference and managed stream <0.85 mm sediment monitoring data along Jenson *et al.*'s (2009) regression curve of <0.85 mm sediment versus egg to fry survival developed during a meta-analysis. The wide dashed line in Figures 8 and 9 represents the North Coast Regional Water Quality Control Board's (NCRWQCB 2006) water quality standard attainment value of 14 percent fine sediment. The other two lines represent the 85th percentiles of the reference watershed data for the two sampling time periods (Laurie and Elder 2013). The implications are that the reference watershed data represents an obtainable desired condition distribution and the 85th percentile values define a lower limit.

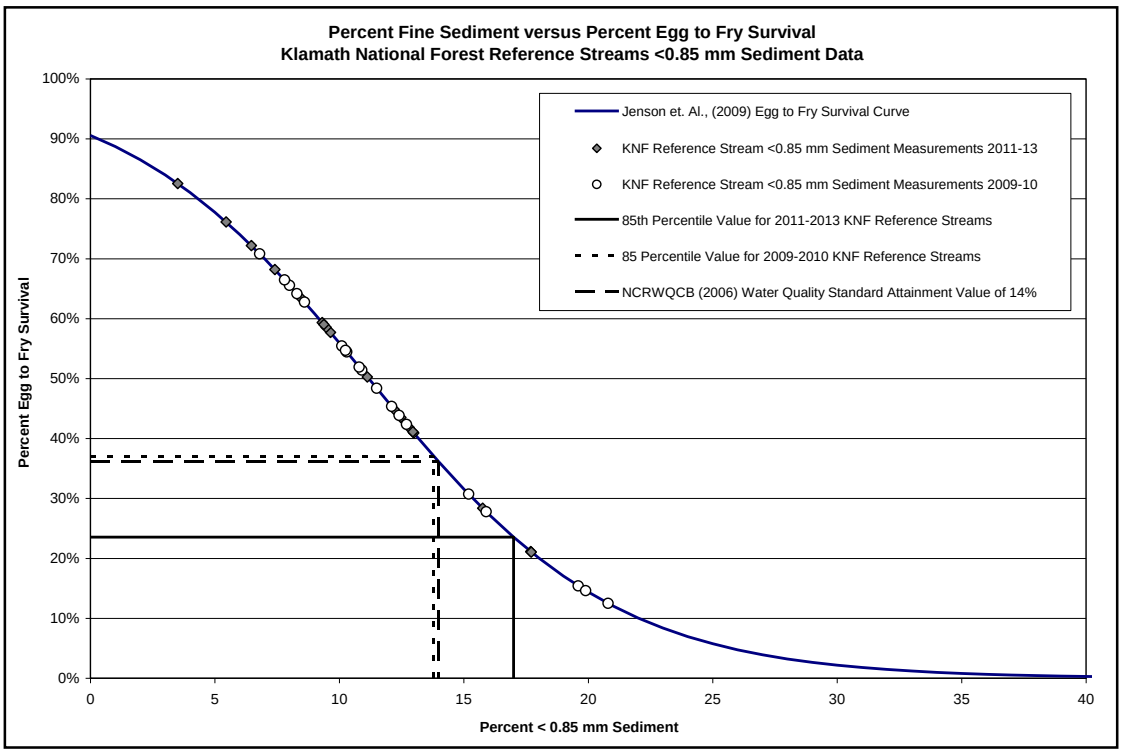

Figure 8. Jenson *et al.*'s, (2009) <0.85 mm sediment versus egg to fry survival regression curve and the Klamath National Forest <0.85 mm sediment monitoring data, from reference streams predictions using Jenson *et al.*'s, (2009) regression equation.

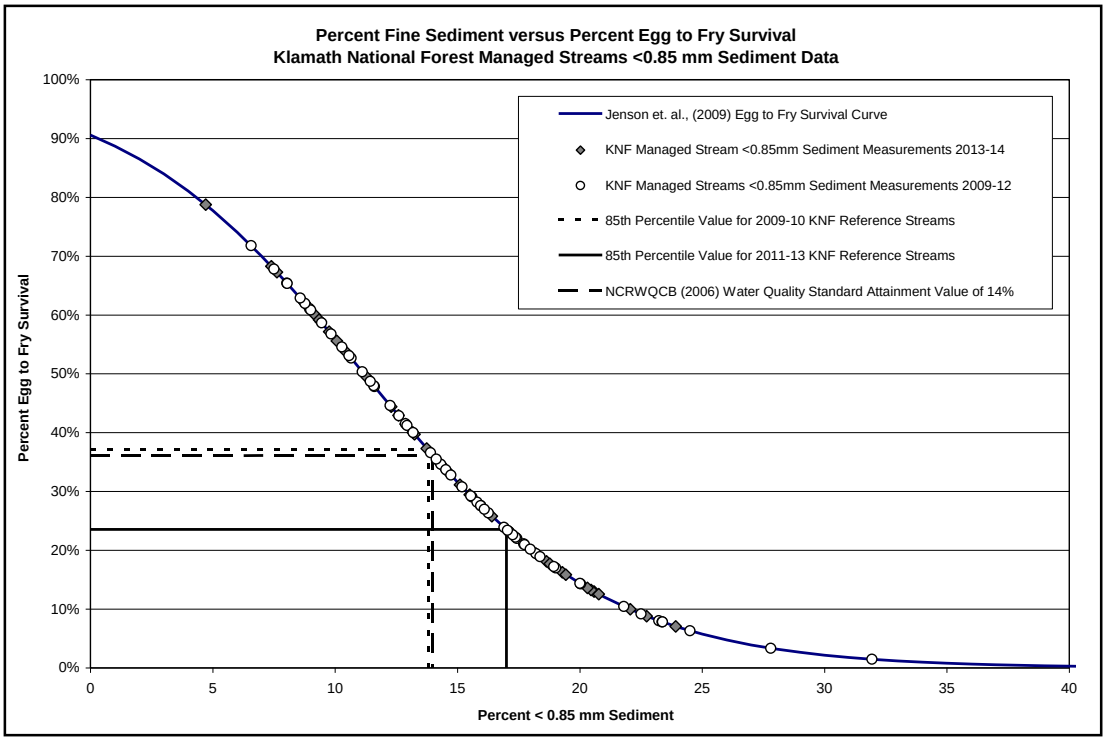

Figure 9. Jenson *et al*.'s, (2009) <0.85 mm sediment versus egg to fry survival regression curve and the Klamath National Forest <0.85 mm sediment monitoring data, from managed streams predictions using Jenson *et al*.'s, (2009) regression equation.

Table 6 lists the Baseline and Project related ERA values for affected 7th field watersheds with critical habitat. The substrate percent <0.85 mm sediment and percent coho survival to emergence values were estimated using the regression equations from Figures 6 and 8. The shifts along the percent <0.85 mm sediment versus percent survival to emergence regression curve for all but three of the watersheds in Table 6 will likely move the distribution farther away from the reference watershed distribution in Figure 8.

Table 6. Equivalent roaded area for Project affected watersheds and the estimated change of survival to emergence of coho salmon

	Baseline					Project					
Watershed	**Watershed Area (acres)**	**ERA (acres)**	**ERA/ Watershed Area (percent)**	**Estimated Percent <0.85 mm Sediment**	**Estimated Percent Survival to Emergence***	**ERA (acres)**	**ERA/ Watershed Area (percent)**	**ERA Baseline + Project (% increase ERA)**	**Estimated Percent <0.85 mm Sediment**	**Estimated Percent Survival to Emergence**	**Estimated Shift in % Survival to Emergence***
Bear Creek	6,698	308	4.6	16.4	N/A	2.3	0	4.6	16.4	25.69	N/A
Benjamin Creek-Klamath River	9,998	386	3.9	15.4	N/A	7.9	0.1	3.9	15.5	29.46	N/A
Big Creek	2,735	0	0	10.1	N/A	0.4	0	0	10.1	55.16	N/A
Big Ferry-Swanson	7,612	785	10.3	24.1	N/A	13.8	0.2	10.5	24.4	6.44	N/A
Bishop Creek-Elk Creek	9,253	424	4.6	16.3	N/A	14.4	0.2	4.7	16.6	25.14	N/A
Buckhorn Creek	9,118	611	6.7	19.2	N/A	16.1	0.2	6.9	19.5	15.68	N/A
Buckhorn Gulch-Beaver Creek	8,234	810	9.8	23.5	N/A	36.9	0.4	10.3	24.1	6.79	N/A
Caroline Creek-Klamath River	1,801	82	4.6	16.3	N/A	12	0.7	5.2	17.2	22.64	N/A
China Creek	6,189	346	5.6	17.7	N/A	32.7	0.5	6.1	18.4	18.68	N/A
Cliff Valley Creek – Grider Creek	3,952	96	2.4	13.4	38.7	17	0.4	2.9	14	35.98	-2.76
Collins Creek-Klamath River	7,845	401	5.1	17.1	N/A	10.2	0.1	5.2	17.2	22.6	N/A
Cougar Creek-Elk Creek	6,918	225	3.2	14.5	N/A	-18.2	-0.3	3	14.2	35.22	N/A
Deep Creek-Scott River	3,798	158	4.2	15.8	N/A	1.7	0	4.2	15.8	28.02	N/A
Doggett Creek	7,701	1,152	15	30.5	N/A	20.1	0.3	15.2	30.8	1.84	N/A
Dona Creek-Klamath River	4,380	340	7.8	20.7	N/A	0.8	0	7.8	20.7	12.66	N/A
Doolittle Creek	4,050	182	4.5	16.2	N/A	12.4	0.3	4.8	16.6	24.79	N/A
Dutch Creek	3,827	431	11.3	25.5	N/A	22.7	0.6	11.9	26.3	4.5	N/A
Eddy Gulch	4,425	199	4.5	16.2	N/A	7.5	0.2	4.7	16.5	25.48	N/A
Franklin Gulch-Scott River	6,450	213	3.3	14.6	N/A	10	0.2	3.5	14.8	32.34	N/A
Fryingpan Creek-Klamath River	7,578	475	6.3	18.6	N/A	53.8	0.7	7	19.6	15.35	N/A
Horse Creek	2,537	162	6.4	18.8	N/A	3.9	0.2	6.5	19	16.93	N/A

Jaynes Canyon	7,009	612	8.7	22	N/A	2	0	8.8	22	9.99	N/A
Kohl Creek	*3,537*	455	12.9	27.6	N/A	7.9	0.2	13.1	27.9	3.25	N/A
Lower East Fork Elk Creek	3,430	141	4.1	15.7	N/A	-5.9	-0.2	3.9	15.5	29.49	N/A
Lower Grider Creek	10,768	519	4.8	16.7	24.7	71	0.7	5.5	17.6	21.46	-3.22
Lower North Russian Creek	4,501	268	6	18.2	N/A	75.8	1.7	7.6	20.5	13.1	N/A
Lower South Russian Creek	2,138	107	5	16.9	N/A	3.5	0.2	5.2	17.1	22.97	N/A
Lower West Fork Beaver Creek	4,044	397	9.8	23.5	N/A	1.4	0	9.9	23.5	7.57	N/A
Lumgrey Creek	5,496	210	3.8	15.3	N/A	4.9	0.1	3.9	15.4	29.66	N/A
McCarthy Creek-Scott River	11,611	565	4.9	16.7	N/A	4.7	0	4.9	16.8	24.24	N/A
Middle Creek	4,496	216	4.8	16.7	N/A	30.6	0.7	5.5	17.6	21.42	N/A
Miller Gulch-Klamath River	6,557	235	3.6	15	N/A	24.2	0.4	3.9	15.5	29.41	N/A
Music Creek	3,286	203	6.2	18.5	N/A	2.2	0.1	6.2	18.6	18.14	N/A
North Fork Kelsey Creek	5,177	114	2.2	13.1	N/A	0.2	0	2.2	13.1	40.18	N/A
O'Neil Creek	2,429	149	6.1	18.5	N/A	21.7	0.9	7	19.7	15.14	N/A
Quigleys Cove-Klamath River	6,162	309	5	16.9	N/A	43.2	0.7	5.7	17.9	20.4	N/A
Rancheria Creek	4,374	269	6.1	18.5	N/A	11.8	0.3	6.4	18.8	17.44	N/A
Robinson Gulch-N Fork Salmon R	5,202	344	6.6	19.1	N/A	11.9	0.2	6.8	19.4	15.8	N/A
Schutts Gulch-Klamath River	6,692	353	5.3	17.3	N/A	6.6	0.1	5.4	17.4	21.97	N/A
Shadow Creek	5,690	310	5.4	17.5	N/A	36.4	0.6	6.1	18.4	18.79	N/A
Sixmile Creek	4,049	70	1.7	12.5	N/A	8.9	0.2	2	12.8	41.94	N/A
Soda Creek-Beaver Creek	7,370	623	8.4	21.6	N/A	0.4	0	8.5	21.6	10.76	N/A
South Fork Kelsey Creek	6,199	97	1.6	12.3	N/A	0.2	0	1.6	12.3	44.5	N/A
Taylor Creek	4,016	161	4	15.6	N/A	2.5	0.1	4.1	15.7	28.72	N/A
Tom Martin Creek-Klamath River	10,690	490	4.6	16.3	N/A	53.2	0.5	5.1	17	23.4	N/A
Tompkins Creek	9,327	373	4	15.6	N/A	50.4	0.5	4.5	16.3	26.17	N/A
Upper East Fork Elk Creek	3,873	178	4.6	16.4	N/A	-2.9	-0.1	4.5	16.3	26.2	N/A
Upper Elk Creek	3,025	122	4	15.6	N/A	9.4	0.3	4.3	16	27.19	N/A
Upper Grider Creek	8,467	264	3.1	14.4	34.4	39.8	0.5	3.6	15	31.55	-2.86
Upper North Russian Creek	3,130	88	2.8	13.9	N/A	69	2.2	5	16.9	23.72	N/A

Upper South Russian Creek	6,396	172	2.7	13.8	N/A	1.7	0	2.7	13.8	36.96	N/A
Walker Creek	7,635	496	6.5	19	17.1	41.6	0.5	7	19.7	15.08	-2.03
West Grider Creek-Klamath River	4,026	165	4.1	15.7	28.5	14.5	0.4	4.5	16.2	26.54	-1.98
Whites Gulch	8,576	467	5.4	17.5	N/A	236.5	2.8	8.2	21.3	11.45	N/A
Yellow Dog Creek-N Fork Salmon	9,239	173	1.9	12.7	N/A	71.9	0.8	2.6	13.7	37.35	N/A

*Cells containing “N/A” represent watersheds where coho salmon spawning has not been documented

Although the amount of ERA (and sediment) will increase as a result of the Project in all but one of the watersheds listed in Table 6, Project activities are designed to minimize sediment increases. For example, salvage harvest units are generally small, dispersed and located in hydrologically disconnected landscape positions, outside and away from areas at risk of slope failure. Salvage harvest in those units is expected to mobilize little sediment and is far enough upslope and upstream that only minor amounts may reach SONCC coho salmon critical habitat. Project designs like these, that minimize effects of sediment delivery to streams are not modeled in the ERA analysis and therefore are expected to result in reduced sediment effects relative to modeled results.

The increased delivery of fine sediment has the potential to adversely affect multiple PCE's including space (volume of pools), abundance of prey resources, and quality of spawning substrate. Because of the small increase in fine sediment projected (max of 3.8% in one watershed with the remaining increases lower), and the likely overestimations of the ERA analysis, NMFS believes that the magnitude of increased sediment delivery will have a negligible effect on key elements of juvenile coho salmon rearing habitat, including volume of pools, habitat complexity and abundance of prey resources. However, adverse effects to critical habitat are expected as a result of a reduction in quality of spawning substrate. The accumulation of fine sediments within the interstitial spaces of spawning substrate will reduce the value of the critical habitat in watersheds where the Project is projected to increase fine sediment (Table 6).

Though adverse effects to critical habitat are expected in some of the described watersheds (Table 6), NMFS expects the Project will, in the long term, following activities such as legacy sediment site treatment and reforestation activities, reduce sediment deliveries resulting from wildfire effects.

Increased Turbidity

Airborne dust associated with Project ground-based, skyline, helicopter logging, and log hauling activities may increase suspended sediment (*i.e.*., turbidity) in streams. Turbidity may also result from soil disturbance associated with temporary road and road/stream crossing (re)construction, landing (re)construction and use (*e.g.*, new landings L043, L044, and DZ23, DZ03, L090, and DZ10 located in RRs), and Legacy site treatments. Elevated turbidity may cause a decrease in dissolved oxygen levels (*e.g.*, mineral oxidation, detritus decomposition), and increased suspended sediment in the water column.

Project-generated airborne dust, associated primarily with mechanized equipment operation, will be minimized by dust abatement along roads used during Project implementation. Proposed Project dust abatement has demonstrated success in minimizing airborne dust during previous similar projects, and is expected to result in only localized, fleeting, insignificant increases in suspended sediment and fine sediment precipitation onto Project streambed surfaces.

NMFS has observational data from a mid-Klamath River tributary to estimate the downstream distance where Project-related suspended sediment disperses: stream dewatering and rewatering at a Caltrans double culvert replacement project on lower O'Neil Creek (Humphrey 2014).

Caltrans monitored turbidity on November 10 and 11, 2006, while the final culvert on O'Neil Creek was removed and water was returned to the newly constructed streambed. The reported maximum value of 9.97 mg/L nephelometric turbidity units (NTUs) was well below the 27 mg/L NTUs suspended sediment concentration believed to affect the ability of juvenile salmonids to forage for food (Klein 2003). The temporary small amount of suspended sediment mobilized from the crossing site became diluted to undetectable levels and dispersed about 300 feet downstream, before entering the Klamath River. NMFS also used a study by Royer *et al.* (1999) as a relevant analogue to estimate mobilized sediment precipitation/dispersal. Royer *et al.* determined that suspended sediments in the water column dropped within 320 meters (1,050 feet) of suction dredging activity using a ten-inch dredge, to levels similar to those upstream of the dredge. Though river conditions in the Royer *et al.* (1999) study are markedly different than the tributaries in the Project area, NMFS believes that this study provides a highly conservative approximation of sediment transport that errs on the side of the species. Flows in tributary streams within the Project area during Project implementation are smaller than Forty-mile River, which was used in Royer *et al.* study. Any suspended sediment will quickly settle to the tributary stream bottoms (*i.e.*., within 300 feet of any instream activities) before they could significantly affect SONCC coho salmon critical habitat. Additionally, the sediment plume from a ten-inch suction dredge in high flow conditions would be orders of magnitude larger and last longer than potential plumes resulting from Project instream and near-stream activities.

Designated critical habitat for SONCC coho salmon in the action area is not likely to be adversely affected as a result of turbidity because the exposure to the habitat is expected to be small. Project activities causing ground disturbance (*i.e.*., salvage harvest operations, associated road and road/stream crossing work) will be located upstream and 300 feet or more away from SONCC coho salmon critical habitat. Log hauling will occur on roads 300 feet or more away from critical habitat except in a few rare instances in which PDFs, BMPs, and WWOS will minimize effects of turbidity at those locations. Project salvage harvest units will be dispersed over a large area, while site-specific impacts will be small and restricted to the reach scale, with only 2.5 percent of the Project action area to be salvage harvested. Additionally, PDFs, BMPS, and WWOS (USFS 2002) will preclude or quickly arrest Project-related suspended sediment mobilization before it can adversely affect SONCC coho salmon critical habitat downstream.

2.4.1.3 Increased Risk of Landslides

In section 2.4.1.2 we provide NMFS' rationale for utilizing ERA to evaluate sediment delivery resulting from Project effects on critical habitat. ERA however serves less utility for us to evaluate the potential risks of mass wasting resulting from Project effects, and the resultant effects of mass wasting (*i.e.*., landslides) on critical habitat. Therefore, NMFS analyzes this risk separately.

The effects from Project activities could, if coupled with major precipitation event(s), contribute to the risk of landslides and/or debris flows. Sediment erosion rates, including landslides, substantially increase following wildfires (Moody *et al*. 2013, Miller *et al.* 2003). Additionally, forest management involving timber harvest, fire suppression, and road system use can exacerbate climate and fire regime effects. The Project Geology Report (USFS 2015d) states that in the Klamath Mountains about half of soil reinforcement from tree roots is lost within two

to three years of the tree's death, and that nearly three-fourths is lost within eight years, based on research by Ziemer (1981). A key consideration in determining the duration of elevated landslide risk after a wildfire is the length of time it takes to get conifer forests re-established on hillslopes. Once a conifer forest becomes established, the soil strength from root support increases quickly, and then levels off after about 20 years (Abe and Ziemer 1991). Numerous studies, including Ziemer 1981, Schmidt *et al.* 2001, Imaizumi *et al*. 2008, and Roering *et al*. 2003, have documented an exponential decay in root strength following clear cutting or fire, followed by logarithmic new growth. Root strength may vary by species, age, and density, while shifts in vegetation composition can lead to slower recoveries in root strength (Schmidt *et al*., 2001, Roering *et al*. 2003, Figure 10).

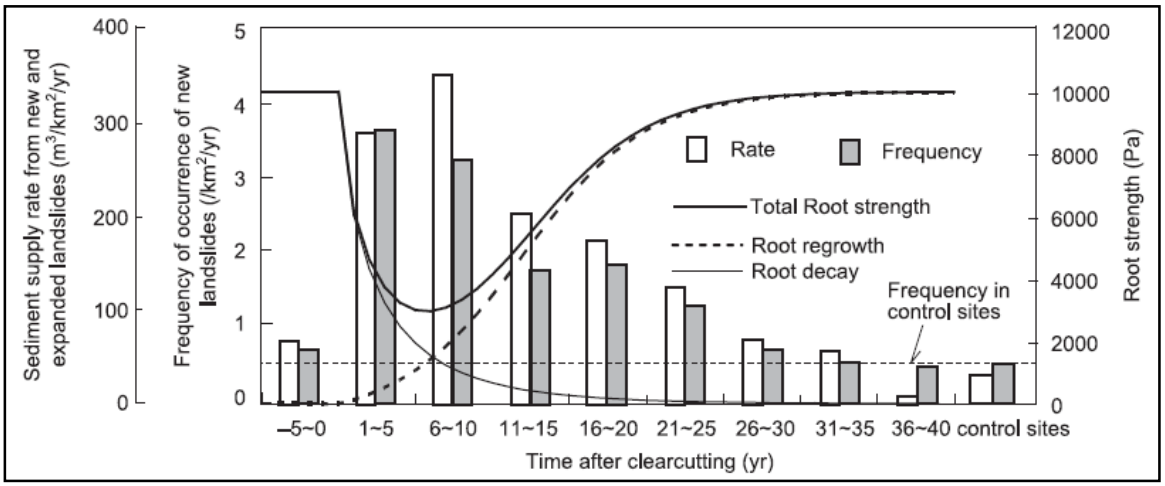

Figure 10. Rate and frequency of landsliding following timber harvest (clear cutting) compared to Sidle's (1992) root strength model for decay and regrowth (modified from Imaizumi *et al.* 2008). Landslide rates vary depending on rainfall magnitude and intensity. The graph highlights the temporal extent of elevated landslide risk, as identified by the Klamath National Forest Geological Report Westside Fire Recovery Project (USFS 2015d), and demonstrated during July-August 2015 storm-induced debris flows.

Klamath National Forest staff (de la Fuente and Elder 1998, de la Fuente et. al. 2006) examined landsliding that occurred on the KNF lands during the regional December 26, 1996 through January 3, 1997, rain-on-snow event. The largest effects observed occurred in the Walker, Grider, Elk, Tompkins, Kelsey, Deep, and Ukonom Creek watersheds. That storm initiated 1,543 landslides that scoured upper channel reaches, removed riparian vegetation, and deposited sediment and large woody debris in downstream channels (Mondry 2004). As discussed previously in the Environmental Baseline (section 2.3.2.3), the majority of landslides were associated with roads, historic harvest units, previous fire areas, and earthflows. A preponderance of landslides occurred in the Grider, Walker and Elk Creek watersheds which had areas of high burn severity following 1987 fires (KNF press release July 20, 2015). Recent field observations of debris flows caused by the July-August 2015 rainstorm(s) confirmed extensive, concentrated overland flow from 2014 burned areas resulting in hyper-concentrated sediment laden flows that extended intermittent stream channels upslope, re-mobilized older debris flow deposits downslope, deposited sediment and woody debris in downstream channels, and restructured channels and floodplains. Much of what was observed in Grider and Walker Creeks appears similar to the 1996-1997 flood effects documented by Mondry (2004) and Lisle *et al*. (1981) in those same watersheds.

Uncertainty about Project-related effects on designated critical habitat is increasing with current strong El Niño climate forecasts for 2015-2016 (Figure 5). A large precipitation event such as that created by an El Niño, would increase the likelihood of landsliding in the action area. However, in the case of such event, Project activities would increase the landslide risk only a minor amount when compared to the risk associated with the 2014 Westside Fires.

There are four Project activities connected with salvage harvest that might affect landslide risk as described above: reopening of decommissioned roads; use of temporary roads on existing roadbeds; construction of new temporary roads; and the construction of new landings (USFS 2015d), Appendix A, Figures 2a – 2f). Removing dead trees from the landscape does not hasten root decay and therefore has a negligible effect to landslide risk. Roads and landings modify natural drainage networks and accelerate erosion processes (Furniss *et al.* 1991). Changes to the hillslope through road and landing construction and use can result from undercutting and/or increasing the weight in unstable areas from earthwork. There will be no new temporary roads or landings constructed on toe zones of dormant landslides, active landslides, inner gorges, or in RRs. Slope stability on these surfaces is the most susceptible to earthwork. PDF Watershed-20 restricts excess material from temporary roads, landings, and other actions from being stored on active landslides. This will minimize the potential for landslide re-activation due to increased weight. Poor drainage on Project roads and landings can concentrate water on hillslopes, which can exacerbate existing unstable lands or create new landslides. The cessation of the road use, including temporary roads, per WWOS (USFS 2002) and PDF Watershed-1, will minimize any rutting or furrowing that can concentrate water on road surfaces and adjacent hillslopes. Also, PDF Watershed-22 requires the hydrologic stabilization of all temporary roads, which includes control of the drainage on roadbeds, while PDF Watershed-23 requires new landings to be configured for long-term drainage to establish natural runoff patterns.

Though these standards and PDFs minimize the effects to landslide risk, they do not eliminate them. The likelihood of a landslide or slope failure at the site scale will be temporarily increased where temporary road activities and/or new landing construction occur (*i.e.*., landings L043, L044, and DZ23, DZ03, L090, and DZ10 located in RRs). This increase in landslide risk is expected to be greatest during Project implementation, will remain above pre-Project risk levels through the first winter after stabilization, then will return to pre-Project risk levels or below in watersheds were Legacy sites treatments have been completed (A. Bell 2015). Hydrologic stabilization, which includes removal of culverts and fills at stream crossings, out-sloping of road surfaces, obliteration of temporary road segments, and erosion and sedimentation control structures will all be maintained and repaired on all roads and landings used in the Project, per guidance in the Forest Service Handbook 2409.15 R5 Supplement (USFS 2015a). This stabilization work will help ensure that effects caused by Project roads and landing work remain localized, are likely to be contained/buffered by mechanized equipment exclusion zones and RR buffers protecting stream channels, and are unlikely to increase the likelihood of a slope failure.

Additionally, to avoid exacerbating landslide occurrence, no Project salvage harvest will occur on active landslides or toe zones of dormant landslides, except for salvage harvest units 5, 23, 32, 39, 55, 56, 57, 59, 64, 226, 268, 406, 520, 524, 525, and 530 (Table 2, found in USFS 2015b). These exceptions were field reviewed by the USFS geologist (USFS 2015d). The geologist

determined that these salvage harvest unit sites: 1) showed no indication of movement for at least ten years, which includes the precipitation events of late 2005 and early 2006, having intensities ranging from 10 to 25 year flood events across the KNF (Bell 2015); 2) are generally small in size; 3) are not subject to ground-based harvest operations; 4) would benefit from planting to hasten the return of soil stability; 5) are sometimes associated with road-caused fill failures/slips which are known and have been extensively mapped; and 6) are not expected to affect slope stability, as the latter has been reduced almost exclusively by the preceding wildland fire-related tree mortality (USFS 2015d).

The likelihood of the action causing slope failures will be minimized by locating roads on land types that do not have high mass failure potential. PDFs that help minimize the risk of concentrating runoff from roads and landings downslope include: out-sloping roads; construction of slash filter windrows; using temporary roads for only one season wherever possible; and obliterating/decommissioning temporary roads as soon as harvest activities are completed.

If landslides were to occur in the action area, it would likely be a result of a large precipitation event. In this scenario, many landslides would likely be triggered in the action area due to the instability created by the 2014 Westside Fires and as documented in the 1996/1997 rain-on-snow event and resulting 1,543 landslides post 1987 fires. In the case of a large precipitation event, project activities would likely only contribute a minor amount to the overall landslide risk and not rise to the level of adverse effects to SONCC coho salmon their critical habitat. Although the Project may temporarily increase the landslide risk by a minor amount in the first years following salvage harvest and the associated road construction, Project activities such as fuels treatment, planting, and legacy sediment site treatments, are all expected to reduce the long term duration of this elevated landslide risk from approximately 80 years down to 30-40 years.

2.4.1.4. Altered Watershed Recovery

Natural vegetation recovery in burned areas may be slowed by salvage harvest through mechanisms that include: injuring or removing naturally regenerated seedlings (Donato *et al.* 2006) or root collar sprouts; compacting soils; reducing organic matter and soil moisture; and increasing temperature from loss of shading (Karr et al 2004). Vegetation in areas with moderate severity fire effects are vulnerable to delayed recovery by salvage harvest since these areas are likely to have retained trees that provide a seed source, and these areas have also maintained some soil productivity. Most Project salvage harvest has been designed to occur in high fire severity areas. The action is likely to have a minor negative effect on natural vegetation recovery in areas of low and very low severity fire effects since there is little salvage harvest opportunity there. Soil disturbance from post-fire salvage harvest generally slows the recovery of forest vegetation and pre-fire watershed processes (Beschta *et al.* 2004). However, Project planting will accelerate recovery of trees and root strength, while there will be little to no effect on the recovery of riparian vegetation due to wide Project RR buffers. With the application of riparian buffers, soil cover protection, and revegetation activities, the proposed action may accelerate watershed recovery, or at least not cause significant delays in recovery of processes that affect streams.

2.4.1.5 Decreased Habitat Availability Due to Water Drafting

During Project water drafting at designated drafting sites, there could be rapid changes or sustained reductions in surface flow, resulting in reduced habitat availability for SONCC coho salmon. In order to reduce or eliminate these potential effects, the USFS will follow BMP 2.5, Water Source Development and Utilization, which provides direction specific to water drafting (USFS 2011). This direction ensures that water drafting may only occur when bypass stream flows can be sustained at 1.5 cubic feet per second for fish bearing streams. Additionally, when occurring in SONCC coho salmon critical habitat, Project water drafting will comply with NOAA Water Drafting Specifications (2001). These specifications require that drafting pumping rates do not exceed ten percent of the stream flow, that drafting does not result in obvious draw-downs of either upstream or downstream pools, and that there are only short-term, localized, insignificant decreases in SONCC coho salmon critical habitat availability.

When upland instream flows become too small to permit water drafting in compliance with Project water drafting specifications, the KNF, Karuk Tribe, and NMFS, having collaboratively monitored Project water drafting conditions, will assist KNF representatives in deciding where to shift Project water drafting so that it is not likely to adversely affect SONCC coho salmon critical habitat. As with drafting at upland sites, Project water drafting that is shifted to downslope sites along larger rivers (*i.e..,* Salmon and Klamath rivers) will take place at designated drafting sites where flows are expected to allow compliance with water drafting specifications. Instream flows in these larger rivers during the anticipated period of Project water drafting are expected to sustain maximum allowable engine/tender pumping rates of 350 gallons per minute (NMFS 2001) with no more than short-term, localized, insignificant decreases in SONCC coho salmon critical habitat availability.

2.4.1.6 Increased Water Temperature

The loss of canopy cover over streams can cause increases in stream temperatures (Beschta *et al.* 1987) when shade from tree canopies is reduced. Project hazard tree felling along 12 linear miles of roads within 200 feet of SONCC coho salmon critical habitat (USFS 2015b) may cause some localized reduction in effective canopy shade over stream channels. However, prior to roadside hazard tree felling, Karuk Tribe, USFS, or NMFS fisheries biologists confirmed that the hazard tree mark downslope of all roads adjacent to SONCC coho salmon critical habitat (*i.e..,* Beaver Creek, Walker Creek, Grider Creek, China Creek, Little Horse Creek, East Fork Elk Creek, Cougar Creek, Tompkins Creek, North Russian Creek, North Fork Salmon River, and Whites Gulch) is in compliance with Region 5 Hazard Tree Guidelines (USFS 2012). Hazard trees to be felled occur occasionally along roadways. Felling of large numbers of trees located near each other was not noted during review of the hazard tree mark. Additionally, the Project design feature stipulating that "trees without fire damage will not be felled unless they are an immediate hazard" will ensure that stream shade provided by living tree canopies will generally be retained. Hazard trees that are felled in RRs will almost exclusively be fire-killed trees that no longer provide significant canopy shade over stream channels. This hazard tree felling where roads and RRs intersect will occur in a dispersed manner throughout the Project action area, and affect just 2.2 percent of all stream channel habitat within the Project (USFS 2015c). This dispersed, low impact, and limited felling may result in small, localized increases in solar

radiation onto waterways, but it will not cause detectable changes in stream water temperature, either at the site or downstream. Thus, hazard tree felling is not expected to result in detectable increases in adjacent stream water temperatures, including SONCC coho salmon critical habitat.

Project water drafting from designated upland tributary drafting sites may reduce instream flows, potentially resulting in increased water temperatures at and immediately downstream from tributary drafting sites during active pumping. However, as described above all Project water drafting will comply with NOAA Water Drafting Specifications (2001), and pumping rates will not exceed ten percent of the stream flow nor result in obvious draw-downs of either upstream or downstream pools. The time required to complete a water drafting event is mediated by the time needed to fill the water tanker. At the maximum pumping rate permitted by NMFS Water Drafting Specifications (350 gallons per minute, 2001), a 2,000 gallon tanker will fill in under 6 minutes, and a 5,000 gallon tanker will fill in less than 15 minutes (Meneks 2014). The brevity of episodic drafting will, therefore, not result in thermal loading of the waterway either from direct sunlight or high ambient temperatures. The same requirements apply to water drafting from larger streams and rivers, where effects from water drafting on water temperature are expected to be discountable. Therefore, Project water drafting is expected to result on no more than short-term, localized, insignificant increases in water temperature, including in SONCC coho salmon critical habitat.

In providing access to water drafting points, removal of riparian vegetation providing effective canopy shade over stream channels is expected to be confined to brushing out single-lane water drafting access ways and insignificantly small in scale, resulting in insignificant effects to water temperature where SONCC coho salmon may be present.

2.4.1.7 Decreased Water Quality from Chemical Spills

Fuel, lubricants and other toxic chemicals drips and/or spills from Project mechanized equipment operation have the potential to introduce small amounts of hydrocarbon contaminants into riparian habitat. Equipment setbacks and exclusion zones provide a riparian buffer on either side of the both perennial and intermittent stream channels for Project actions. BMP 2.11 requires that all fueling and maintenance of heavy equipment will occur at least 200 feet from waterways, and that fuel containment systems will be in place on landings in case of leaks/spills. BMP 2.11 also requires that oil-absorbing mats be used under equipment being serviced to prevent petroleum-based products from contaminating soil and water resources. The use of poorly maintained or “leaky” vehicles and equipment is not permitted during the Project.

Temporary road/stream crossing work and Legacy site treatments will use heavy equipment (*e.g.*, backhoes, excavators) to complete the work. These sites occur in the channel of ephemeral, intermittent, or perennial streams in six locations. In these sensitive locations where Project actions intersect watercourses, KNF contracting officers (*i.e.*., KNF employees) will monitor equipment regularly to ensure that fuels and lubricants remain secure. Due to the small volume of contaminants likely to be leaked or spilled, intervening buffer distances away from adjacent streams channels, and other Project resource protective measures, effects of chemical contamination to water quality is expected to be insignificant.

2.4.1.8 Decreased Availability of Large Woody Debris

The only Project activity that could have any impact on large wood in RRs is hazard tree removal where roads intersect RRs. Hazard trees will be identified, felled, and removed, as needed for safety, in compliance with Region 5 Hazard Tree Guidelines (USFS 2012) and PDF Watershed-12. Hazard trees greater than 26 inches dbh will be retained on site if they are felled within one site tree height distance from all streams, whether perennial or intermittent. Similarly, such trees will be retained on site when they are located downslope of a road in a position from which, if felled, they would contact a fish-bearing stream. This retention will ensure that, with the exception of trees posing a continuing hazard after felling, nearly all felled hazard trees will be available for subsequent recruitment to downslope and stream riparian habitat. Trees without fire damage will not be felled unless they are an immediate hazard. All hazard trees felled within 25 feet of any stream channel will be retained on site, unless such felled trees pose a threat to safety or accessibility. During 2015, Karuk Tribe, USFS, or NMFS fisheries biologists reviewed the Project hazard trees marked for felling downslope of roads adjacent to critical habitat and confirmed the marking is in compliance with Region 5 Hazard Tree Guidelines (USFS 2012). This review exercise was completed in Beaver Creek, Walker Creek, Grider Creek, China Creek, Little Horse Creek, East Fork Elk Creek, Cougar Creek, Tompkins Creek, North Russian Creek, North Fork Salmon River, and Whites Gulch. Hazard trees to be felled occur occasionally along roadways, but proposed felling of large numbers of trees located near each other was not noted during review of the hazard tree mark. Additionally, the wildlife PDF stipulating that "trees without fire damage will not be felled unless they are an immediate hazard" will ensure that living trees be retained whenever possible, enhancing longer-term recruitment of large wood to streams. This hazard tree felling where roads and RRs intersect will occur within 2,256 acres, affecting 2.2 percent of all stream channels in the Project action area (USFS 2015c). Such dispersed and limited felling, with removal of felled trees only where they are a deemed a continuing hazard may, nevertheless, result in small, localized decreases in large wood recruitment to waterways. But given the enormous natural recruitment of 2014 fire-killed trees that are and will continue to be delivered to stream channels in the Project action area, and the afore-mentioned hazard tree removal restrictions in RRs, the Project will have no more than an insignificant effect on large woody debris recruitment to Project streams, including SONCC coho salmon critical habitat.

2.4.1.9 Effects to Critical Habitat Summary

The Primary Constituent Elements (PCEs) are physical and biological features essential to SONCC coho salmon that are listed in the designation of coho salmon critical habitat (64 FR 86). These PCEs are substrate/sediment, water quality and quantity, water temperature, water velocity, cover/shelter/food (macro-invertebrates), riparian vegetation, space, and safe passage (*e.g.*, culverts). Riparian vegetation provides shade, stream bank stability nutrient and chemical regulation, and a source of large woody debris or organic matter. The quality of riparian areas "is intrinsically related to the quality of riparian and upland areas and of inaccessible headwater or intermittent streams which provide key habitat elements (*e.g.*, large wood debris, gravel, water quality) crucial for coho salmon in downstream reaches" (FR Vol. 64 No. 86 24059).

Increased sediment erosion as a result of the Proposed Project (mostly from salvage harvest) is estimated using the ERA model described in Section 2.4.1.2. Table 6 describes up to a 3.8% increase in fine sediment delivery. The delivery of fine sediment is expected to adversely affect critical habitat by reducing the quality of the substrate necessary for spawning coho salmon.

Additionally, there are expected to be small, localized, short-term road/stream crossing treatment-related effects to aquatic habitat in portions of streams upslope from SONCC coho salmon critical habitat, including: altered hydrology, increased turbidity, reduced large wood recruitment, and decreased water quality. These isolated and quickly attenuating effects are expected to have even smaller impacts on designated critical habitat. These effects are expected to have an insignificant effect to SONCC coho salmon critical habitat.

Salvage harvest represents the project activity that will contribute the most amount of sediment and result in adverse effects to designated critical habitat. BMPs, PDFs, and WWOSs described in the above sections indicate that sediment delivery to streams as a result of the Project will be minimized through planting in portions of the landscape to accelerate establishment of root structures and stabilize soil. Additionally, legacy site treatment at 165 locations will further reduce the delivery of sediment to the Klamath National Forest streams. Finally, a comparison of the area burned in 2014 (~218,000 acres), and the proportion included in salvage units (~5,760 acres) confirms that the Project excludes the majority of the Project area from salvage harvest, allowing post-fire reestablishment of forest and riparian habitat function to occur naturally there.

2.4.2 Effects to Individuals

In this section, NMFS first analyzes the effects of increased sediment erosion and turbidity. Individual fish will be exposed in only a fraction of the total watersheds where Project Activities are planned to occur. Table 6 represents the watersheds where critical habitat occurs within the action area, however only some of those watersheds have documented coho salmon presence (USFS and Karuk Tribe 2014). Additionally, adverse effects to fish are only expected as a result of sediment erosion. Sediment erosion, as described above in Section 2.4.1.2 will only occur at a significant rate as a result of salvage harvest activities such as road and landing construction and use. Below, Table 7 describes the expected watersheds where individuals will be exposed. Starting in Section 2.4.4.2, NMFS analyzes effects to individuals as a result of water drafting which may occur throughout the Action Area, not just in the two watersheds (Grider and Walker) identified in Table 7.

Table 7. Expected watersheds where SONCC coho salmon may be exposed to Project effects

Watershed	Salvage Harvest Proposed? (Y/N)	SONCC coho salmon use in 7th field subwatershed	Exposure to Sediment Erosion? (Y/N)	Justification
Bear Creek	No			
Benjamin Creek-Klamath River	No			
Big Creek	No			
Big Ferry-Swanson	No			
Bishop Creek-Elk Creek	No			
Buckhorn Creek	No			
Buckhorn Gulch-Beaver Creek	No			
Caroline Creek-Klamath River	No			
China Creek - Scott River	No			
Cliff Valley Creek -Grider Creek	Yes	spawning/rearing	Yes.	10 skyline and helicopter units upslope; 0.4 mile from critical habitat in Cliff Valley Creek
Collins Creek-Klamath River	No			
Cougar Creek-Elk Creek	No			
Deep Creek-Scott River	No			
Doggett Creek	No			
Dona Creek-Klamath River	No			
Doolittle Creek	No			
Dutch Creek	No			
Eddy Gulch	No			
Franklin Gulch-Scott River	No			
Fryingpan Creek-Klamath River	No			
(Little) Horse Creek	No			
Jaynes Canyon	No			
Kohl Creek	No			
Lower East Fork Elk Creek	Yes	spawning/rearing	No.	4 skyline and heli units upslope with no hydrologic connection to perennial steams; 0.5 mile from critical habitat in East Fork Elk Creek; functional RR
Lower Grider Creek	Yes	spawning/rearing	Yes.	10 skyline and helicopter units upslope; 700 feet from critical habitat in lower Grider Creek
Lower North Russian Creek	No			
Lower South Russian Creek	No			
Lower West Fork Beaver Creek	No			
Lumgrey Creek	No			

McCarthy Creek-Scott River	No			
Middle Creek	No			
Miller Gulch-Klamath River	No			
Music Creek	No			
North Fork Kelsey Creek	No			
O'Neil Creek	Yes	rearing	No.	5 skyline and heli units upslope; no hydrologic connection; 1 mile from critical habitat in lower O'Neil Creek
Quigleys Cove-Klamath River	No			
Rancheria Creek	No			
Robinson Gulch-N Fork Salmon R	No			
Schutts Gulch-Klamath River	No			
Shadow Creek	No			
Sixmile Creek	No			
Soda Creek-Beaver Creek	No			
South Fork Kelsey Creek	No			
Taylor Creek	No			
Tom Martin Creek-Klamath River	Yes	rearing	No.	2 skyline units on ridge top above Tom Martin Creek; no hydrologic connection; 2.5 miles away from Tom Martin Creek/mainstem Klamath River confluence.
Tompkins Creek	Yes	spawning/rearing	No.	8 skyline and heli units upslope; no hydrologic connection; 1000 feet or more away from Tompkins Creek.
Upper East Fork Elk Creek	No			
Upper Elk Creek	Yes	rearing	No.	9 skyline and heli units upslope; no hydrologic connection; 1.25 miles from critical habitat in lower Little Elk Creek; functional RRs
Upper Grider Creek	Yes	spawning/rearing	Yes.	10 skyline and helicopter units on ridge top above Upper Grider Creek; 1 mile from critical habitat in upper Grider Creek
Upper North Russian Creek	No			
Upper South Russian Creek	No			
Walker Creek	Yes	spawning/rearing	Yes.	Many skyline and heli units upslope along Walker Creek; 700 feet from critical habitat in Walker Creek
West Grider Creek-Klamath River	Yes	spawning/rearing	No.	1 skyline unit on ridge top above West Grider Creek; no hydrologic connection; 1.25 miles from critical habitat in West Grider Creek
Whites Gulch	Yes	rearing	No.	4 skyline units upslope; no hydrologic connection; 2000 feet from critical habitat in Whites Gulch
Yellow Dog Creek-N Fork Salmon	No			

*Although the 7th field watersheds include portions of the mainstem rivers where the confluence occurs, this table only evaluates the fish use and exposure within the tributary. All effects of sediment erosion are expected to be discountable at the confluence with the mainstem river where higher volumes of water sufficiently dilute the effect

2.4.2.1 Increased Sediment Erosion and Turbidity

The addition of fine streambed sediment may adversely affect coho salmon by a variety of mechanisms. Exposure to suspended sediments in the water column has the potential to reduce dissolved oxygen levels, and to foul or abrade fish gill structures. These conditions can reduce respiration capacity in fish, elevating stress levels. In Section 2.4.1.2 NMFS determined that suspended sediment as a result of dust from the Project would likely result in only localized, fleeting, insignificant increases in turbidity from suspended sediment. Similarly, Project activities causing ground disturbance (*i.e.*, salvage harvest operations, associated road and road/stream crossing work, log hauling) in nearly all cases will be located upstream and 300 feet or more away from areas that are occupied by coho salmon. As described in Section 2.4.1.2, the amount of sediment entering watercourses from Project activities will likely be very small and any resulting turbidity will quickly disperse to background levels. Therefore NMFS expects that any turbidity encountered by coho salmon downstream as a result of Project activities will be very low and will have a negligible effect on individual coho salmon.

Fine sediment may be deposited in pools, reducing the overall space necessary for rearing juveniles and holding or resting adult coho salmon. By filling pools, juvenile and adult coho salmon may be forced to disperse from territories, which can displace fish into less suitable habitat and/or increase competition and predation, decreasing chances of survival and spawning success. Additionally, fine sediment may be deposited in spawning habitat, filling the interstitial gravel spaces and suffocating redds, killing salmon eggs. Fine sediment also creates less suitable substrate for macroinvertebrates which represent an important component of the coho salmon prey base. By decreasing food availability, the growth and survival of juvenile coho salmon may be diminished.

Above, Table 7 shows that SONCC coho salmon will only be exposed to sediment effects in Grider and Walker creeks. Coho salmon use these watersheds to spawn and rear year round. Additionally, non-natal fish from neighboring populations such as the Shasta and Scott Rivers are expected to use these watersheds for summer and winter rearing habitat.

a. *Egg through emergence life history stage*

As described in Table 6 of Section 2.4.1.2, the estimated sediment erosion that will occur as a result of the Project has the potential to decrease survival of in-gravel SONCC coho salmon. Below, Table 8 shows the reduced rate of survival to emergence in the watersheds where coho salmon are present and will be exposed to Project effects. NMFS expects that a small number of in-gravel eggs and/or alevins will be killed as a result of sediment delivery to Grider and Walker creeks.

Table 8[1]. Reduced survival at emergence as a result of fine sediment delivery from Project activities

Watershed	Project ERA (acres)	Reduced Survival to Emergence (%)
Cliff Valley Creek – Grider	17	-2.76
Lower Grider Creek	71	-3.22
Upper Grider Creek	39.8	-2.86
Walker Creek	41.6	-2.03

[1]This table represents a subset of Table 6 from Section 2.4.1.2

b. *Fry to smolt juvenile life history stages*

Juvenile SONCC coho salmon utilize Grider and Walker creeks as natal and non-natal rearing habitat, and have the potential to be exposed to fine sediment as a result of Project activities. As mentioned in Section 2.3.1 *Status of the Species in the Action Area*, recurring juvenile salmonid surveys during the 2002 to 2014 period, including after the large 2013 coho salmon brood year, resulted in juvenile coho salmon observations in the stream reaches described below in Table 9. Although large numbers of fish have been observed in some of these reaches, the majority of the observed fish in Grider and Walker Creeks are non-natal rearing individuals from neighboring populations. Because these fish enter these creeks during the summer to escape warm mainstem temperatures, the greatest densities of fish will remain in the lower reaches of the tributaries during the summer and potentially through the winter.

The ERA analysis described in Table 6, estimates the percent increase in fine sediment (<0.85mm) that is expected to enter the stream as a result of Project activities. Below, Table 10 shows these estimations in the stream reaches occupied by SONCC coho salmon. The addition of fine sediment is not expected to be greater than 1% in any occupied watershed. Additionally, the ERA analysis is a meta-analysis at the watershed scale. The analysis does not take into account the proximity of individuals to ground disturbing activities. Therefore, NMFS expects effects of sediment erosion to be minimized the further away fish are from Project activities. Most Project activities are located upstream, sometimes many miles from occupied habitat. Sediment cycling through these watersheds will be largely attenuated by the time it reaches the juvenile coho salmon in the lower reaches of Grider and Walker creeks. Furthermore, coho salmon will be able to relocate to more suitable habitat if necessary. For these reasons, effects to juvenile SONCC coho salmon are expected to be insignificant.

Table 9. Number of juvenile coho salmon observed during 2014 surveys

Location	Extent Surveyed	Individuals Observed
Grider Creek	Lower 7.35 mi.	250
Walker Creek	Lower 2.11 mi	250

Table 10. Amount of fine sediment expected to enter the stream in locations where juvenile coho salmon will be exposed as a result of increased ERA in the Action Area

Watershed	Project ERA (acres)	Estimated Percent Increase <0.85mm Sediment
Cliff Valley Creek – Grider	17	0.6
Lower Grider Creek	71	1.0
Upper Grider Creek	39.8	0.6
Walker Creek	41.6	0.7

c. *Adult life history stage*

Spawning surveys in Grider and Walker creeks have been sporadic over time and limited by winter weather conditions making it difficult to estimate the number of adult coho salmon present in the reaches. Although it is possible for adult coho salmon to access and spawn in the lower section of Grider and Walker Creek, the value of the IP habitat is low to moderate (NMFS 2014a) meaning it does not provide high quality spawning habitat considering factors such as gradient and stream flow. Additionally, spawning surveys in 2015/2016 have resulted in no observations of adult coho salmon in these reaches as described in section 2.3.1.1. Therefore, NMFS expects that Grider and Walker creeks will have low numbers of adult coho salmon (*i.e.*, less than 20) that are likely to annually return. Although the increased delivery of fine sediment will temporarily add a minor amount of sediment to adult holding pools (Table 10), this small amount of sediment is not expected to decrease the volume of pools in a meaningful way. Additionally, adult coho salmon will be able to relocate to reaches where they can successfully hold if necessary. Effects of fine sediment to adult SONCC coho salmon in Grider and Walker creeks are expected to be negligible.

d. *Summary*

The number of SONCC coho salmon present in Grider and Walker creeks that are most likely to be affected by Project-mobilized sediment is expected to be very small but cannot be predicted with any certainty. We expect there to be some loss of eggs/alevins in the Upper Klamath population unit, where Grider and Walker creeks are located, as a result of sediment erosion from Project activities. Although juvenile coho salmon from the Shasta River, Upper Klamath River, and Scott River population may be exposed to effects of Project activities in Grider and Walker creeks, those effects are expected to be insignificant. NMFS expects that individuals from the Salmon River and Middle Klamath River population units will not be exposed to sediment delivery as a result of the Project since they are not occupying the streams where habitat effects occur in that watershed, nor are juveniles expected to migrate upstream to Grider or Walker creeks where exposure is occurring. Effects to adult coho salmon are expected to be negligible due to the minor amount of fine sediment delivered to streams and the ability of adults to move to more suitable habitat.

2.4.2.2 Effects Related to Water Drafting

During water drafting, SONCC coho salmon juveniles are likely to be present in the action area

in cool water refugia in accessible, lower reaches of tributaries to the Klamath, Scott, and North Fork Salmon Rivers. Effects from project water drafting may include: increased stress from *noise and vibration*, sediment-related gill abrasion and respiratory distress from *increased turbidity*, increased metabolic stress from *reduced water quality*, and *impingement and/or entrainment* associated with water drafting.

To avoid water drafting impacts, drafting sites that are not likely to have rearing SONCC coho salmon juveniles present will be prioritized for use, including sites on the mainstem Klamath, Scott, and Salmon rivers. Priority will also be given to drafting sites with warm water temperatures (*e.g.*, daily temperature maxima greater than 21 degrees Celsius) that are routinely avoided by SONCC coho salmon. Water drafting from tributaries and colder water sources, especially in their lower reaches, will be avoided, particularly during late summer and early fall when fish survival is most dependent upon these thermal refugia. Project-related water drafting will be collaboratively monitored by Karuk Tribe, USFS, and NMFS biologists, and shifted away from streams when their base flows no longer sustain drafting-related water withdrawal consistent with all Project water drafting standards. Water storage facilities such as foldable tanks will be encouraged and will target sites with moderate flows that may be subject to recurrent drafting use, and that simultaneously support rearing SONCC coho salmon (*e.g.*, lower Walker Creek). The following creeks will be avoided, due to their small size, small summer base flows, and consistent presence of rearing SONCC coho salmon - Tom Martin, O'Neil, Little Horse, and China creeks.

a. Noise and Vibration

At Project water drafting sites where SONCC coho salmon are present during water drafting, fish are likely to exhibit avoidance behavior caused by the noise and vibration associated with screened intake placement/removal and pump operation. This avoidance response is similar to that caused by natural disturbance (*e.g.*, vegetation and rock movement, predator presence, etc.). Observation of salmonids during water drafting studies using NMFS-compliant fish exclusion screens demonstrate that such avoidance behavior lasts only a few seconds during screen placement and at the start of pump operation and is, thus, an insignificant impact. Juvenile salmonids quickly resume normal swimming and foraging behavior in proximity to fish screen surfaces while drafting operations proceed. Salmonids again exhibit insignificant amount of avoidance behavior for a few seconds when water drafting screens are removed from streams, quickly resuming normal swimming and foraging behavior thereafter (NOAA-USFS 2009, see Appendix A, Figure 6).

b. Increased Turbidity

Individual SONCC coho salmon may be exposed to small, brief suspended sediment plumes in the water column at water drafting sites during hand placement and removal of fish exclusion screens and hoses. Exposure to suspended sediments in the water column has the potential to reduce dissolved oxygen levels, and to foul or abrade fish gill structures. These conditions can reduce respiration capacity in fish, elevating stress levels. The likelihood of suspended sediment being present in sufficient concentration or long enough to cause significant effects on individual SONCC coho salmon is extremely unlikely. This is because any sediment mobilized by hand

placement and removal of fish exclusion screens and hoses will be localized, small, and will return to ambient conditions in a few seconds. Therefore, potential effects to individual SONCC coho salmon from elevated turbidity associated with Project water drafting will be insignificant.

c. Reduced Water Quality

PDFs Watershed-4 (*i.e.*., mechanized equipment will be excluded from all RRs associated with stream channels) and Watershed-24 (*i.e.*., refueling will not take place within RRs, except at designated landings in locations that are most disconnected from water resources; a spill containment kit will be in place where refueling and servicing take place (BMP 2.11) in the event of a spill) will reduce the risk of contaminants entering any action area waterway, including where SONCC coho salmon may be present. Fuel or lubricant spills may occur during the course of Project implementation, but any such spills are expected to be confined to localized areas distant and hydrologically disconnected from waterways, including anywhere that SONCC coho salmon may be present.

Removal of riparian vegetation providing effective canopy shade over stream channels is expected to be confined to brushing out single-lane water drafting access ways and insignificantly small in scale, resulting in insignificant effects to water temperature where SONCC coho salmon may be present.

d. Impingement/Entrainment of Individual Fish

Project water drafting activities have the potential to impinge or entrain juvenile SONCC coho salmon when occurring within its designated critical habitat. Such water drafting will utilize approved fish exclusion screens as outlined in NMFS Water Drafting Specifications (NMFS 2001), while also complying with PDF Watershed-34 and BMP 2.5. Following NMFS Water Drafting Specifications (2001), including having sufficiently large screen surface areas and sufficiently small screen mesh openings, will make the potential of impinging or entraining juvenile SONCC coho salmon during Project water drafting discountable (see Appendix A, Figure 6).

2.5 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). 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.

Wherever the 2014 Beaver Fire burned at moderate to high severity, salvage harvest has occurred, is occurring, or is planned on private land in the Beaver Creek watershed of the action area. This amounts to several thousand acres. It is possible that private salvage harvest activities cause more severe effects than the proposed action, since salvage harvest that has already been completed may not follow many of the precautionary measures that are part of the proposed action. Since there is no Project salvage harvest proposed in the Beaver Creek

watershed, the only area where Project and private salvage harvest impacts may overlap is in the mainstem Klamath River downstream from Beaver Creek. Project-related effects mobilized downslope and downstream to the mainstem Klamath River are expected to be insignificantly small and undetectable from those associated with effects from both the environmental baseline and future effects from actions on private lands that have occurred since the 2014 Beaver Fire.

No known specific and reasonably certain future State or private actions or activities are expected to occur within the action area, other than those ongoing activities already discussed as part of the *Environmental Baseline*.

2.6 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 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5), taking into account the status of the species and critical habitat (section 2.2), 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) reduce the value of designated or proposed critical habitat for the conservation of the species.

a. Numbers

NMFS estimates the effects of salvage harvest, which will result in adverse effects to individual SONCC coho salmon will last for approximately ten years, capturing the weather patterns shown in Figure 5 and providing enough time for storm systems to move through the action area and cycle the sediment out of the affected streams through scour and transport mechanisms. Over the course of this time, all three cohorts of coho salmon may be impacted during their egg/alevin life stage as described in Section 2.4.2.1. We use ERA to evaluate whether the Project will reduce the survival rate of in-gravel SONCC coho salmon redds by increasing the amount of fine streambed sediment and ultimately reducing the percent survival at emergence. Based on the anticipated effects of the action and our understanding of the spatial distribution of coho salmon, NMFS concludes only one population of coho salmon (Upper Klamath River) is expected to be exposed to effects which take place in the Grider and Walker Creek watersheds.

As discussed in Section 2.3.1 *Status of the Species in the Action Area*, the Upper Klamath River coho salmon population has a high risk of extinction. The abundance estimates for the population fall below the levels needed to achieve a low risk of extinction. The Proposed Action will result in adverse effects to individuals in two watersheds used by the population, Grider and Walker Creek. NMFS expects the Proposed Action will result in a small decrease in the rate of survival at emergence in these two watersheds, affecting all three cohorts of coho salmon. In the *Environmental Baseline* section, we describe Grider Creek and Walker Creek as having limited spawning habitat and functioning primarily as rearing habitat for non-natal juvenile coho salmon from neighboring populations. Given the low levels of exposure to coho salmon in the Upper Klamath River population and the small rate of reduced survival of individuals, we expect the small reduction in egg survival is unlikely result in a reduction or hindrance to the future growth

of the population size of the Upper Klamath River SONCC coho salmon population. In addition, we expect long term benefits to the population's size from reforestation and legacy site treatments that improve baseline conditions.

b. *Reproduction*

As discussed above, NMFS estimates the Proposed Action will result in a reduced rate of survival at emergence for SONCC coho salmon due to increased delivery of fine sediment from Project activities. The likelihood of adult coho returning to Grider and Walker creeks is low as evidenced by recent spawning surveys (2015/2016) finding zero adults in these locations (Grunbaum 2016). However, if adults do spawn in Grider or Walker creeks, reproduction success will be only slightly reduced (3.8% reduced egg survival equating to 95 eggs within an average redd containing 2,500 eggs). This reduced reproduction success will affect three cohorts of coho salmon in the Upper Klamath population, specifically those individuals that spawn in the Walker Creek and Grider Creek watersheds. These adverse effects are expected to last approximately ten years as weather patterns cycle through, moving the sediment out of the system. Given that there is only a slight reduction in annual reproduction success in Grider and Walker creeks as a result of salvage harvest activities and where there is a low likelihood of spawners, NMFS expects that there will be negligible effects to annual reproduction at the ESU scale.

Because project activities such as tree planting (beginning in 2016) and treatment of legacy sediment sites (beginning in 2019) are proposed, NMFS expects that the baseline conditions will improve in the long term. Specifically, the long term risk of landsliding from wildfires and other means of sediment delivery will be reduced as a result of the proposed Project.

c. Distribution

Project effects are not anticipated to affect access to habitats or create barriers to migration. NMFS expects that the distribution and spatial structure of the Upper Klamath, Mid Klamath, Scott, and Salmon River populations will be maintained or improved as a result of long term beneficial actions through project activities that minimize landslide risk and sediment delivery to streams.

d. Conservation Value of Critical Habitat

The proposed action will occur in a setting where fish habitat has already experienced significant changes from the 2014 Westside Fires, and these fires will continue to affect fish habitat for years to come due to the large areas of damaged soil and vegetation leading to high erosion potential and increased water yield (see Section 2.3.2 Environmental Baseline of the Action Area). We discussed in Section 2.4 Effects of the Action, how the proposed action adds to the effects of the fires by altering the runoff and erosion from salvage harvest units and temporary roads. As a result, we determined that there will be adverse effects to designated critical habitat in many 7th field watersheds (Table 6) due to sediment erosion and delivery of fines to those streams. The change in percent fine sediment estimated to enter each of the critical habitat streams is a small amount. At a maximum a 3.8% increase is expected (Whites Gulch). Several

streams have an estimated decrease in fine sediment delivery as a result of legacy site treatments (Cougar Creek – Elk Creek, Lower East Fork Elk Creek, and Upper East Fork Elk Creek). The average change in sediment delivery as a result of the Proposed Action is about 0.5%, indicating that the magnitude of the adverse effects to critical habitat is small. Although the delivery of sediment could affect several PCEs including space, food, and substrate, NMFS determined that only the quality of substrate for spawning coho would be adversely affected by Project activities.

Critical habitat in the Scott River, Upper Klamath River, Middle Klamath River, and Salmon River coho salmon population areas will be adversely affected for up to ten years. Additionally, juvenile fish from the Shasta River population unit rely on the habitat in these watersheds for non- natal rearing. Given the KNF's prior experience with repairing and improving drainage to prevent landslides, outsloping roads to disperse water, and applying standard engineering requirements for constructing and maintaining unpaved roads and crossings, NMFS believes that soil disturbance from the two years of Project salvage harvest, will be managed to minimize the risk of slope failures that are larger or more numerous than would occur naturally. While some minor adverse impacts to SONCC coho salmon designated critical habitat will last up to an estimated ten years, NMFS believes the proposed action is not likely to reduce the value of the critical habitat for the conservation and recovery of SONCC coho salmon.

The likely increase in long term sediment delivery from the 2014 fires that contributes to the currently degraded baseline conditions, will be reduced from pre-project levels as a result of reforestation and legacy sediment site treatments. Therefore, the fully-implemented project will actually improve the baseline conditions in the Action Area and increase the conservation value of the habitat in the long term.

d. Summary

While factoring in environmental baseline conditions of the action area, the status of the Upper Klamath River coho salmon population, the status of the SONCC coho salmon ESU, and the cumulative effects, NMFS believes the proposed action is not likely to increase the extinction risk of the population or reduce the conservation value of the designated critical habitat. Therefore, the proposed action is not likely to increase the extinction risk of the Interior Klamath Diversity Stratum or the SONCC coho salmon ESU or result in adverse modification of the critical habitat.

2.7 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, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of SONCC coho salmon or destroy or adversely modify its designated critical habitat.

2.8 Incidental Take Statement

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

2.8.1 Amount or Extent of Take

Over the term of the proposed action, NMFS anticipates the proposed action will result in incidental take in the form of reduced survival rates of in-gravel coho salmon in Grider and Walker creeks. Quantifying the amount of incidental take of coho salmon in these creeks is difficult since the Project's primary mechanism for affecting coho salmon is through sediment inputs across a wide range of area in Grider and Walker Creeks which will occur in addition to sediment inputs resulting from the 2014 wildfires. Translating effects to instream habitat into definitive numbers of fish taken cannot be done at this time. Finding dead or impaired specimens is unlikely because of the small size of the coho salmon at the life stages affected, the dynamic nature of riverine systems, and the likelihood that scavengers will consume any dead salmon before they can be counted.

Therefore, NMFS uses the amount of Project generated fine sediments in streams as a surrogate for the amount of incidental take. For estimating incidental take from Project generated sediment inputs, NMFS uses the relationship of Project related ERA as an indicator of the anticipated increase of streambed fine sediments (<0.85 mm), and coho survival to emergence.

Based on this surrogate, the incidental take of in-gravel coho salmon will be exceeded if ERA as described in Table 11 is increased by a significant amount (5% or more, to take into account model variability). Project ERA may be exceeded if harvest units are changed in such a way that the footprint is increased or other Project changes affect underlying assumptions of the model (*e.g.* length of roaded area, salvage harvest activities, etc.). The Forest Service will be required to report to NMFS any changes to the Project that affect modeled Project ERA acres (see Term and Conditions 2g).

Table 11[1]. Extent of take as described in the form of reduced survival at emergence

Watershed	Project ERA (acres)	Reduced Survival to Emergence (%)
Cliff Valley Creek – Grider	17	-2.76
Lower Grider Creek	71	-3.22
Upper Grider Creek	39.8	-2.86
Walker Creek	41.6	-2.03

[1]Table 11 is a sub-set of Table 6, section 2.4.2.1.

2.8.2 Effect of the Take

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

2.8.3 Reasonable and Prudent Measures (RPMs)

"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).

NMFS believes that the RPMs and terms and conditions described below are necessary and appropriate to minimize the likelihood of incidental take of listed species due to completion of the proposed action.

The KNF shall comply with the following RPMs:

1. Minimize hydrologic effects of the action on SONCC coho salmon.

2. Minimize soil erosion and sediment transport into watersheds used by SONCC coho salmon.

3. Implement a monitoring and reporting program to further understand the effects of the Project and minimize the likelihood of incidental take of coho salmon.

2.8.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the KNF or any applicant must comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). The KNF 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 incidental take statement (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 lapse.

1. The following terms and conditions implement reasonable and prudent measure 1 - *minimize hydrologic effects of the action on SONCC coho salmon.*

   a. Design the drainage features associated with temporary roads, landings, and spoils disposal sites in a manner that disperses runoff from these surfaces as much as possible, or which routes the runoff into existing channels that can accommodate the additional discharge while minimizing sediment delivery to downslope streams.

   b. Prior to temporary road construction, submit to NMFS a topographic map of the planned road alignment and locations of road drainage features (water bars, dips, rock aprons, *etc*.), and then ensure that the plans are implemented as intended by placing markers on the ground at the exact locations where drainage features will be constructed.

   c. Maintain stockpiles of fresh crushed rock and certified weed free rice straw at secure and strategic locations within the Project, for immediate use in rocking haul road surfaces sufficiently to preclude conditions that exceed Wet Weather Operations Standards (*i.e.*, Watershed-1).

   d. Inspect all temporary roads and the six landings in RRs, while they are on the landscape, to identify rills or gullies after each rainfall event that are large enough to generate surface runoff from road surfaces, and then ensure completion of necessary improvement or repair of ditches, cross drains, and outsloped surfaces to prevent further development of rills or gullies (*i.e.*, Watershed-5, expanded to include temporary roads).

2. The following terms and conditions implement reasonable and prudent measure 2 - *minimize soil erosion and sediment transport into watersheds used by SONCC coho salmon.*

   a. Immediately, after completing tractor-based salvage harvest, inspect skid trails leading to and within salvage harvest units, to ensure that soil cover standards (Table 4-2, USFS 1994) are met and, if not, provide soil cover (*i.e.*. mulch, slash, etc.) where needed to meet these soil cover standards (Watershed-26 and Soils-1, expanded to include skid trails leading to harvest units).

   b. Do not allow skid trails within salvage harvest units to overwinter without completing erosion minimization measures described in 2.a.

   c. Ensure that mulch/slash and water bars that meet soil cover standards remain within cable-yarding corridors and on skid trails in tractor yarded units at Project completion (Watershed-29 that meets soil cover standards (table 4-2, USFS 1994), and Watershed-26).

   d. Avoid using temporary roads for more than one operational season, but if over wintering any temporary road is unavoidable, winterize such road according to

relevant Project design features (*i.e.*, Watershed-22, expanded for more than one season of use).

e. Provide critical/rolling dips with rocked aprons along Project roads wherever stream capture or diversion potential exists.

f. Make concerted efforts to implement Legacy (sediment) site treatments as soon as possible, to help offset effects from Project implementation;

g. If KNF determines that Project ERA is being exceeded in any of the four subwatersheds of interest (Table 11) during salvage harvest operations, based on increases to modeled Project ERA acreage resulting from increased temporary road length, increased salvage harvest unit size, etc., the KNF shall contact NMFS immediately, to reinitiate consultation.

3. The following terms and conditions implement reasonable and prudent measure 3 - *Implement a monitoring and reporting program to further understand the effects of the Project and minimize the likelihood of incidental take of coho salmon.*

a. During the next few months, the KNF and NMFS will further investigate the relationships between the CWE models (ERA, USLE, and GEO) and the streambed fine sediment parameters (V*, <0.85 mm, and <6.35 mm sediments). We hypothesize that certain disturbances (*e.g.*, roads) likely have a greater explanatory role in predicting streambed fine sediment, and that there may also be a time lag between ground disturbance, storms, and sediment erosion and deposition that may further refine these relationships. For example, the ERA categories cover all disturbances within the watersheds (*e.g.*, roads, fire, and timber harvest) and estimate disturbance based on GIS polygons, USFS disturbance coefficients, and recovery rates. Klein *et al.* (2008) found that with turbidity and ECA, there was a 10-plus year lag in sediment erosion and deposition.

b. The KNF will institute "storm patrols" during wet weather periods, to identify drainage malfunctions, sediment mobilization, and/or slope failures that occur within salvage harvest units or downslope from temporary roads, landings, or harvest units. The KNF will then provide detailed information, as soon as possible, about the location and amount/extent of sediment mobilized in the action area, and the resulting effects on riparian habitat downslope/downstream. The KNF will propose measures to mitigate or rehabilitate Project-related slope failures or other adverse erosion events. The KNF will monitor streambed fine sediment in SONCC coho salmon critical habitat located downslope/downstream from Project activities, whenever there are two-year or greater storm events.

c. If prior to Project implementation, KNF-monitored stream reaches located downslope/downstream from Project activities contain substrate fines that equal or exceed the water quality attainment value of approximately 14 percent fines (< 0.85 mm fine sediment, RWQCB 2006), corresponding to survival to emergence values of

less than 37 percent (Figure 14), the KNF will contact NMFS and propose further mitigations to reduce fine sediment loading where it has been identified.

d. Maintain a log of any actions taken to mitigate or rehabilitate Project-related slope failures, for at least one year after completion of all Project activities.

e. Maintain a log of each post-rainfall inspection of temporary roads and landings, and record any remedial actions taken to prevent further development of rills or gullies, for at least one year after completion of all Project activities.

f. Provide a summary report to NMFS of the above monitoring activities annually by December 31, beginning in the first year that project implementation begins. Reports shall be sent to: Don Flickinger, NMFS, Yreka Office, 1711 South Main Street, Yreka, California 96097.

2.9 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).

The following recommendations are discretionary measures that NMFS believes are consistent with this direction and, therefore, should be carried out by the KNF:

1. To mitigate the effects of climate change on ESA-listed SONCC coho salmon, follow recommendations by the Independent Scientific Advisory Board (ISAB 2007) to plan now for future climate conditions, by implementing protective mainstem Klamath River and tributary habitat restoration measures. In particular, implement projects to: protect or restore riparian buffers, wetlands, and floodplains; remove barriers to aquatic species passage; and enhance late summer and fall tributary stream flows; and

2. Notify NMFS when and where the KNF carries out these recommendations so that NMFS can track and update environmental baseline conditions in all affected watersheds.

2.10 Reinitiation of Consultation

This concludes formal consultation for the Westside Fire Recovery Project.

As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) the amount or extent of incidental taking specified in the incidental take statement is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat

that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

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

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effects include the direct or indirect physical, chemical, or biological alterations 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 EFH, 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 KNF and descriptions of EFH for Pacific coast salmon (PFMC 1999) contained in the fishery management plans developed by the Pacific Fishery Management Council (PFMC) and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The proposed action affects EFH for Chinook and coho salmon in the mainstem Klamath River and the 7th field watersheds (tributaries) described in Table 5 of the Biological Opinion.

3.2 Adverse Effects on Essential Fish Habitat

The proposed action will occur in a setting where fish habitat has likely experienced significant changes from the 2014 Westside Fires, and these fires will continue to affect fish habitat both negatively and positively for years to come. The proposed action adds to the effects of the fire by altering the runoff and erosion from salvage harvest, and road and landing use during salvage harvest. Timber salvage harvest activities are unlikely to cause significant effects on EFH since most of the hydrologic and geomorphic functions of the timber were lost when the trees were killed or mortally damaged. Although the Project is expected to result in adverse effects to EFH through sediment delivery, those effects are expected to be minor in the context of baseline conditions.

The largest risk of adverse effects to EFH from the action stems from salvage harvest and associated temporary road construction and use in steep, high-severity burn areas, primarily in lower Grider and Walker creeks. Surface runoff from roads and areas where soils are disturbed could potentially overload downslope areas with excess water, causing a mass failure. The risk of mass failures increases where temporary roads are constructed in a manner that prevents surface runoff from being concentrated or routes it onto unstable slopes. The survey and design

details needed to ensure that temporary roads will not increase the likelihood of a slope failure are included in standard KNF project design features. Standard KNF road design practices will include site specific outsloping of roads, construction of slash filter windrows, using temporary roads for only one season wherever possible, and obliterating/decommissioning temporary roads as soon as harvest activities are completed, and staking of dips or other drainage features before starting earthwork. The possibility of the Project causing a slope failure will be minimized by following Project minimization measures, BMPs, PDFs, and WWOS (USFS 2002).

The Biological Opinion used ERA (Table 6) to estimate the amount of fine sediment (<0.85mm) that would be added to the stream as a result of the Proposed Project. Although only a small amount of sediment (up to 3.8% increase in fines) is expected to enter the streams located in the Action Area, this increase represents an adverse impact to EFH and may last up to ten years.

3.3 Essential Fish Habitat Conservation Recommendations

Due to the comprehensive nature of Project minimization measures, BMPs, PDFs, and WWOS (USFS 2002), NMFS has no EFH conservation recommendations to provide.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the Federal agency must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation from NMFS. As no EFH conservation recommendations have been provided, there is no need for a response.

3.5 Supplemental Consultation

The KNF 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 & PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended user of this opinion is the KNF. Other interested users include, but are not limited to, the U.S. Fish and Wildlife Service and the Karuk Tribe. Individual copies of this opinion have been provided to the KNF, U.S. Fish and Wildlife Service, and the Karuk Tribe. This opinion will be posted on the Public Consultation

Tracking System web site (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts). The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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6. APPENDIX A

Figure 1a. Westside Fire Recovery Project Map, NW portion of Happy Camp Complex

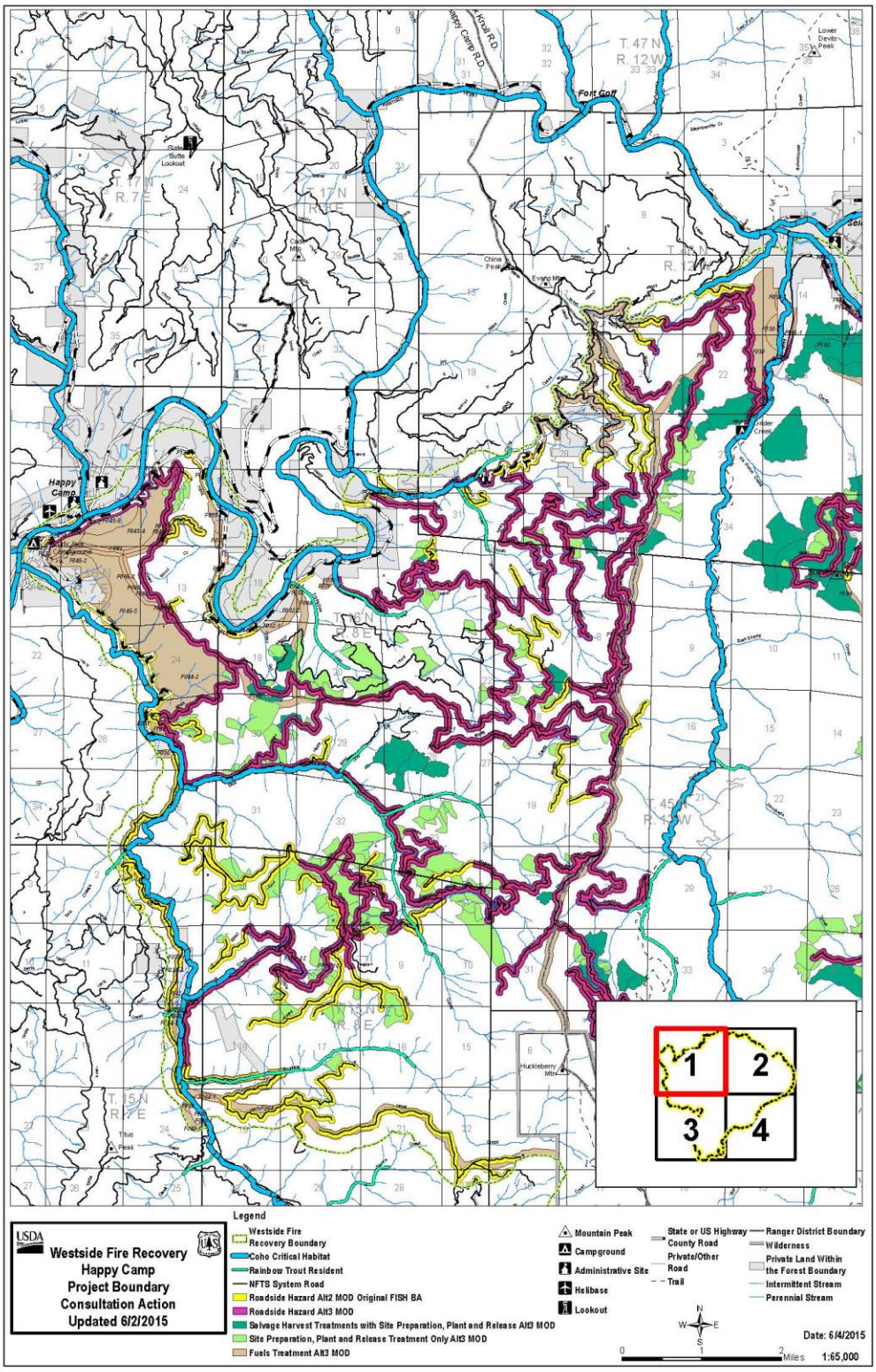

Figure 1b. Westside Fire Recovery Project Map, NE portion of Happy Camp Complex

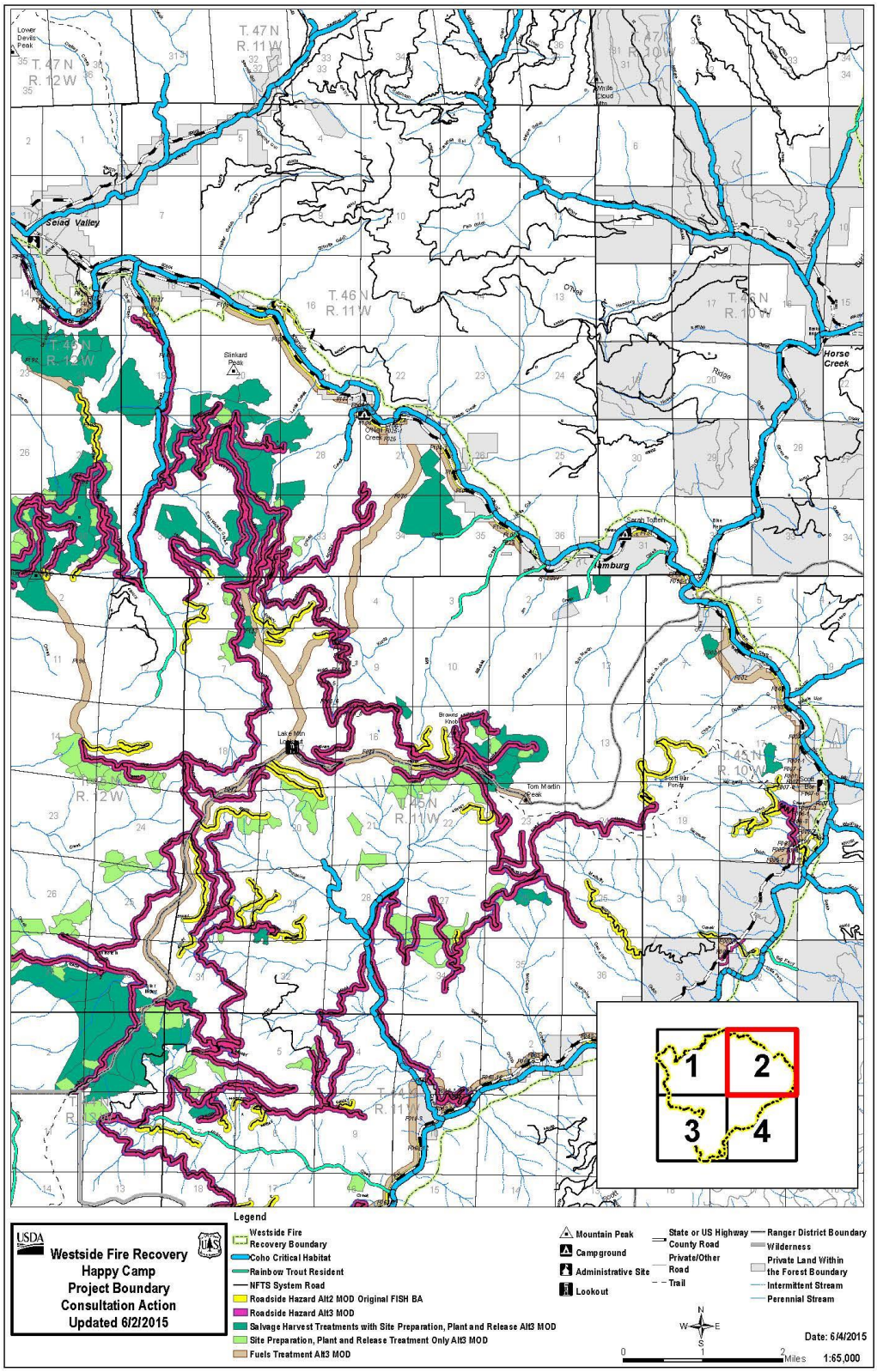

Figure 1c. Westside Fire Recovery Project Map, SW portion of Happy Camp Complex

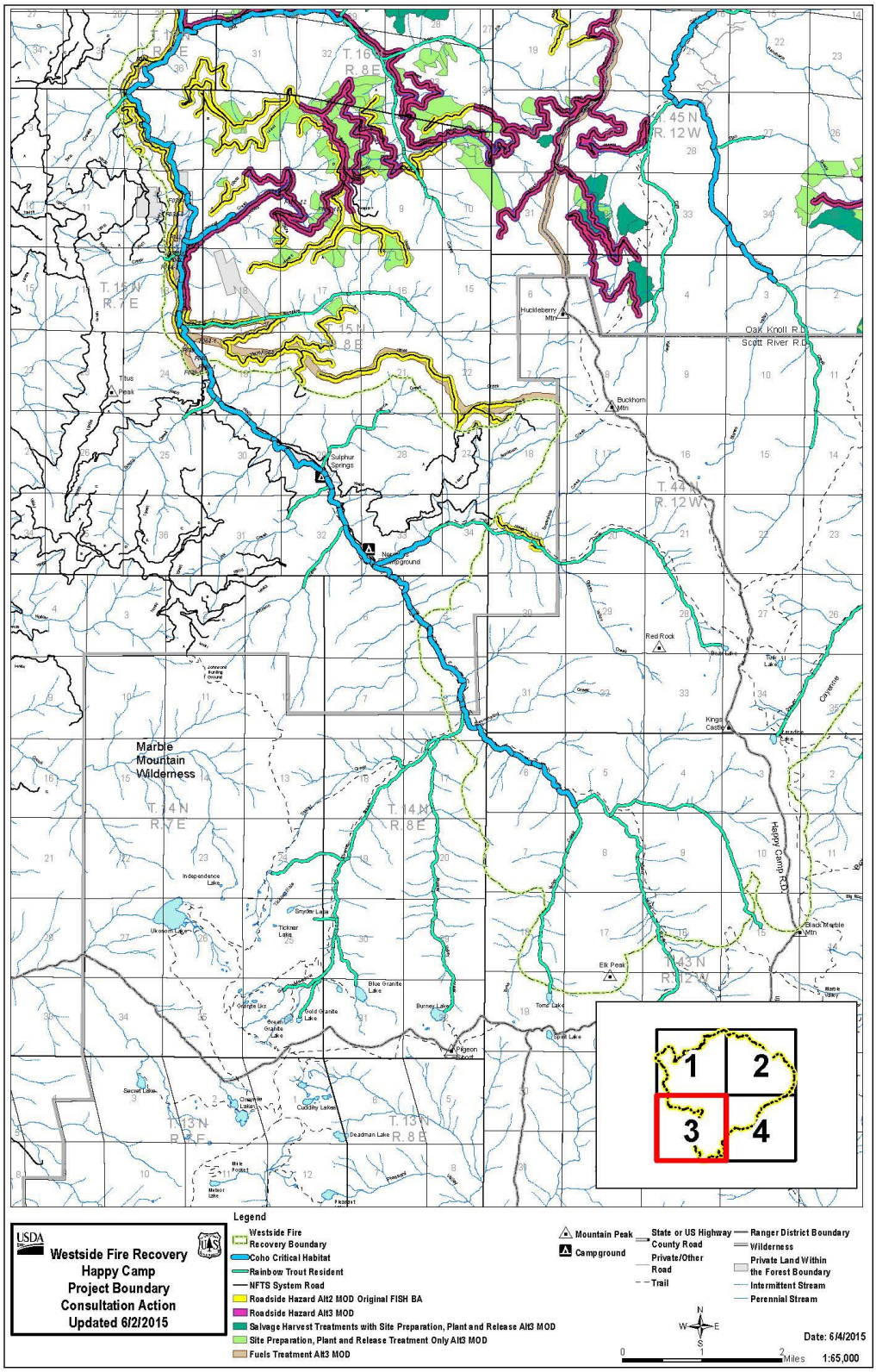

Figure 1d. Westside Fire Recovery Project Map, SE portion of Happy Camp Complex

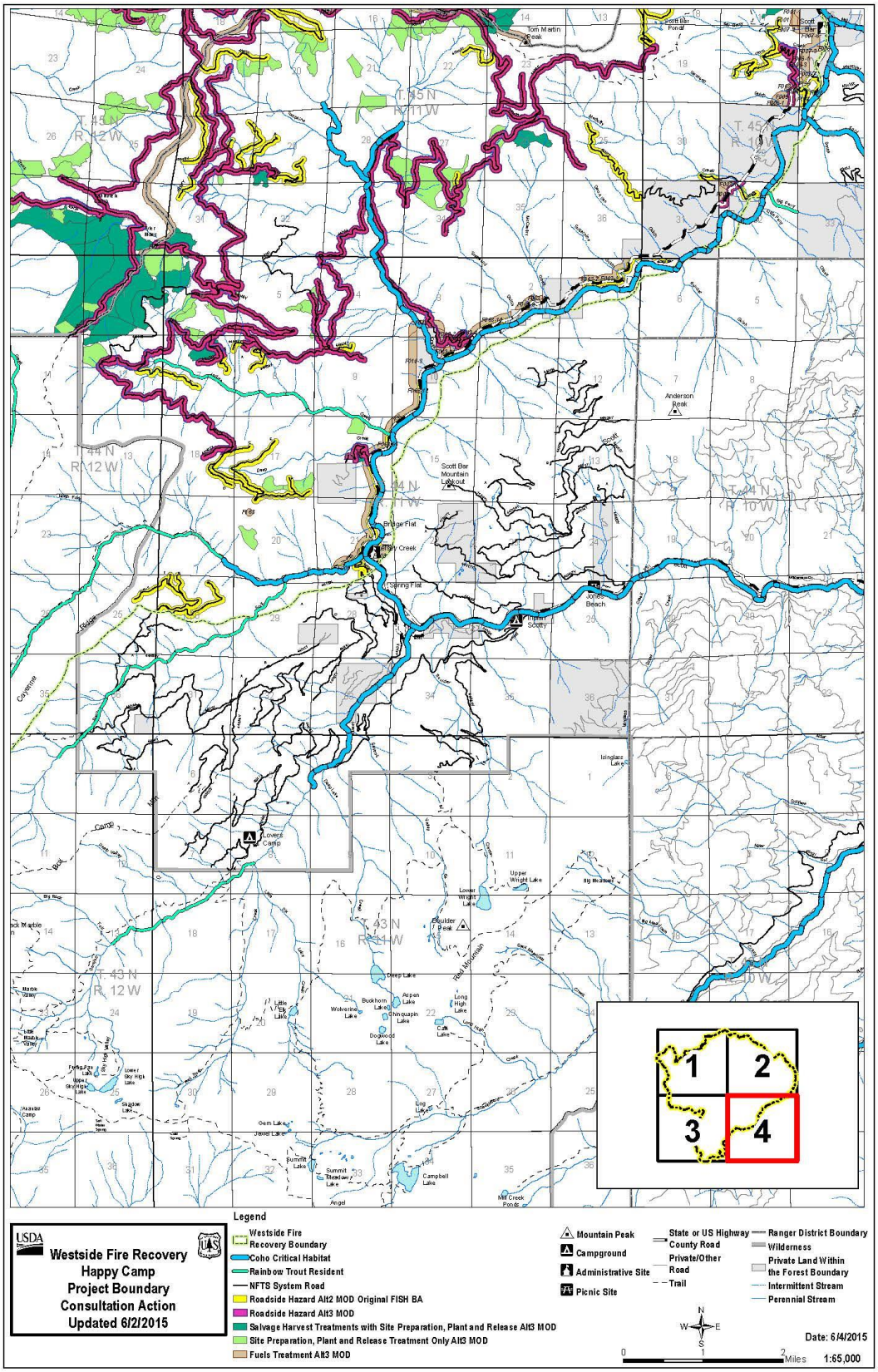

Figure 1e. Westside Fire Recovery Project Map, Whites Fire

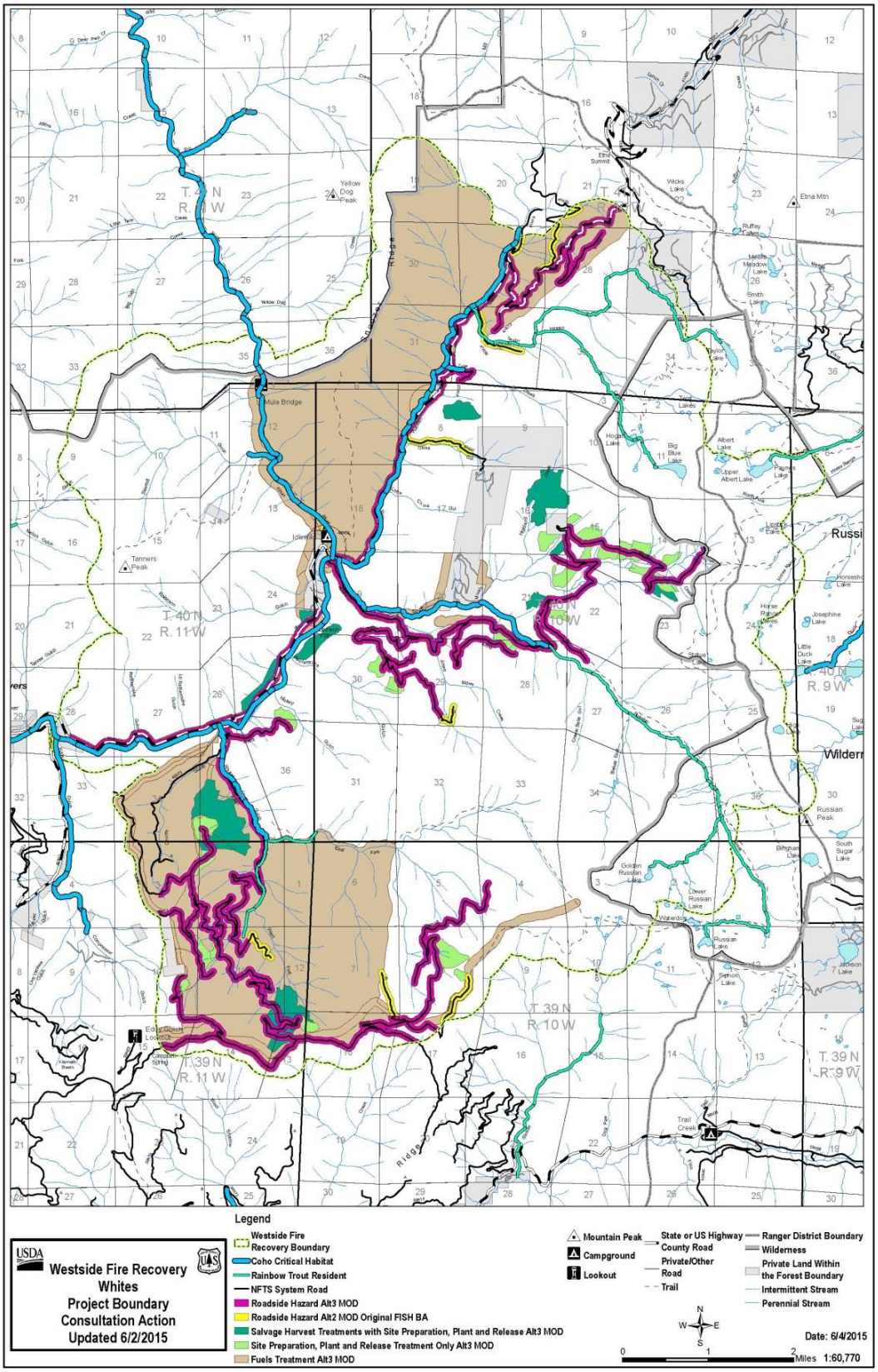

Figure 1f. Westside Fire Recovery Project Map, Beaver Fire

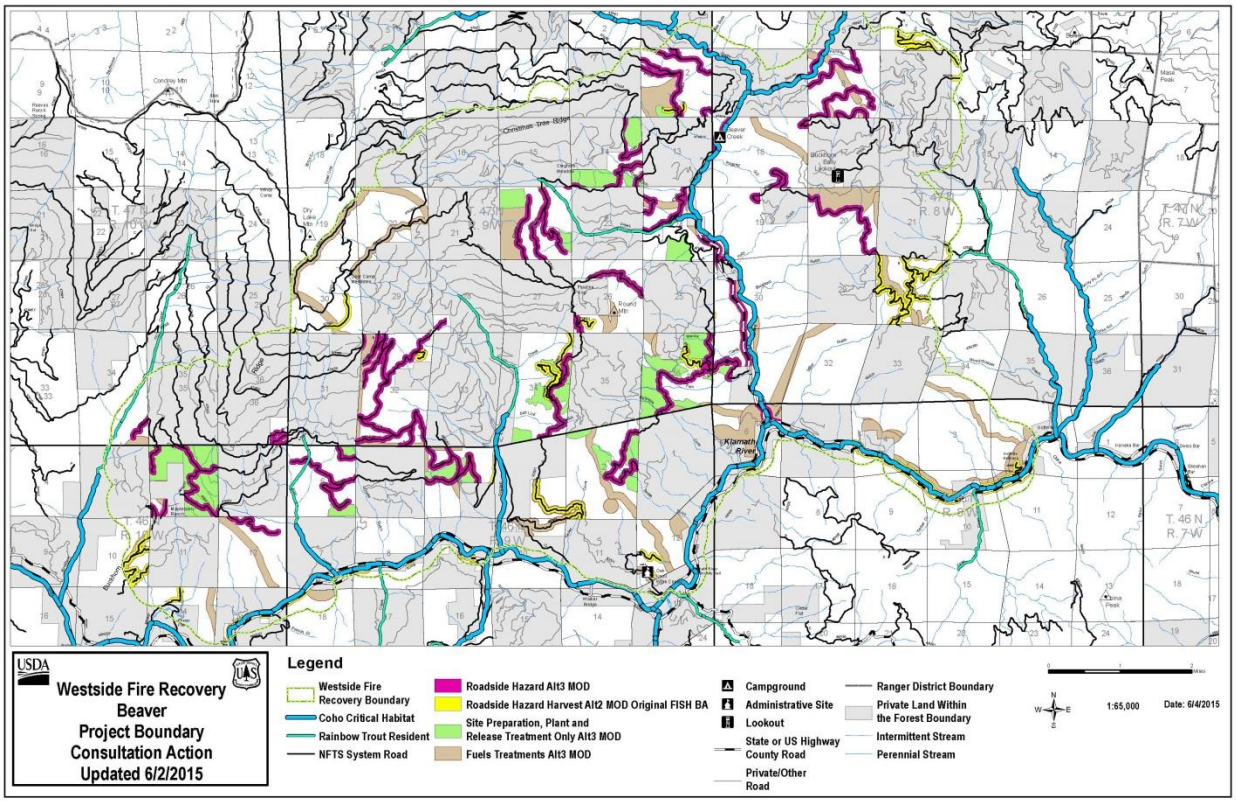

Figure 2a. Westside Fire Recovery Project Map, NW portion of Happy Camp Complex

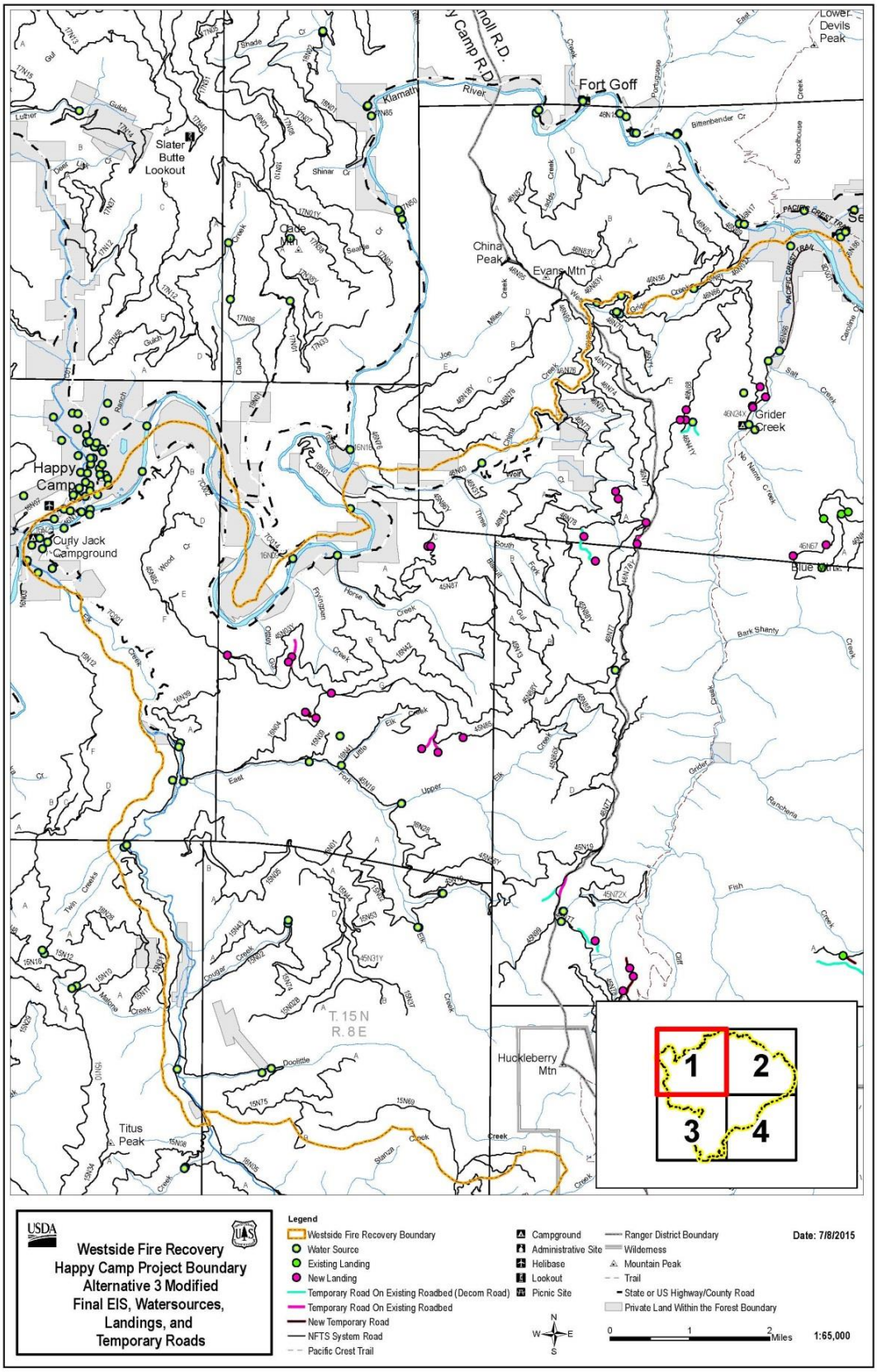

Figure 2b. Westside Fire Recovery Project Map, NE portion of Happy Camp Complex

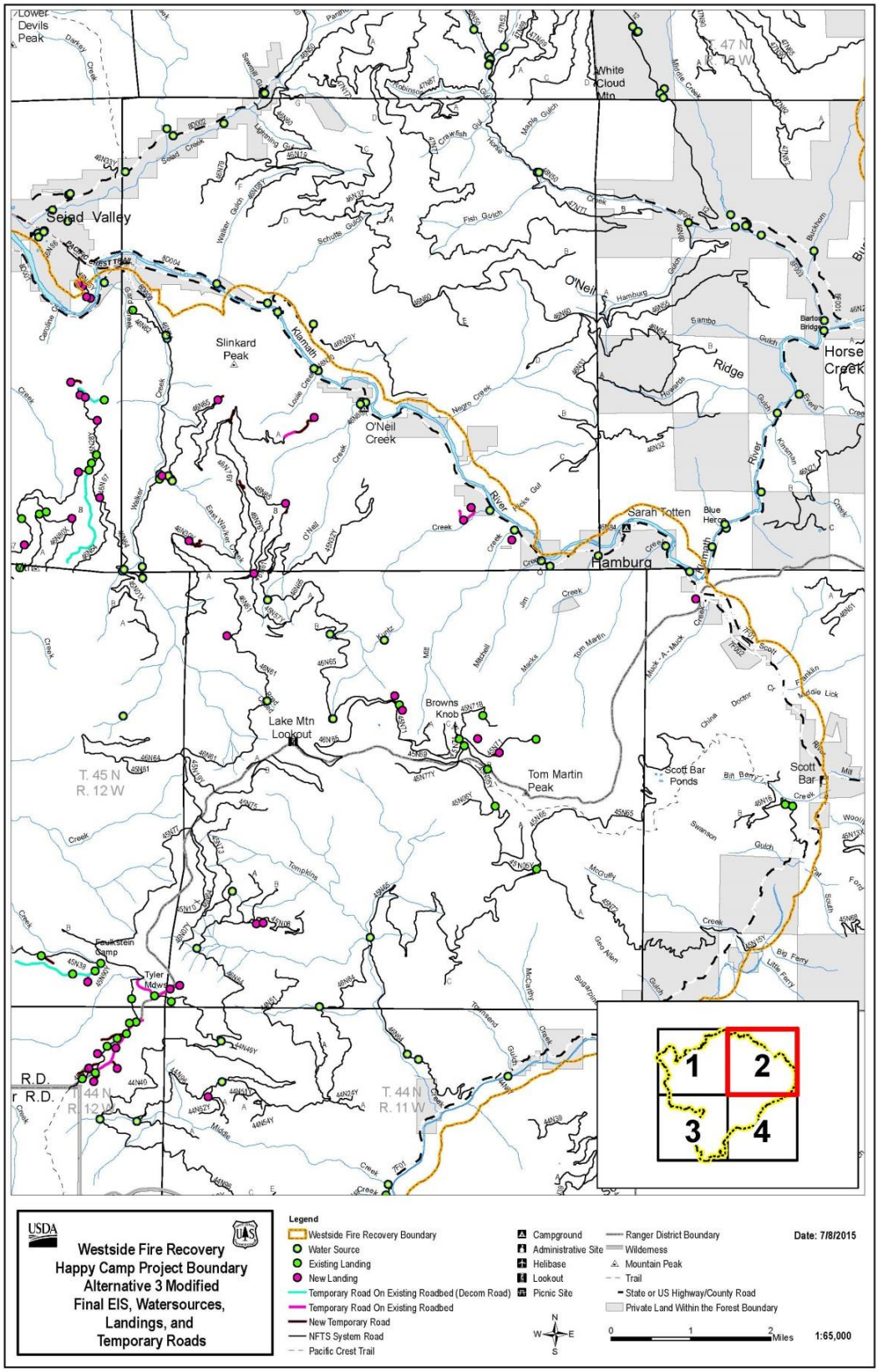

Figure 2c. Westside Fire Recovery Project Map, SW portion of Happy Camp Complex

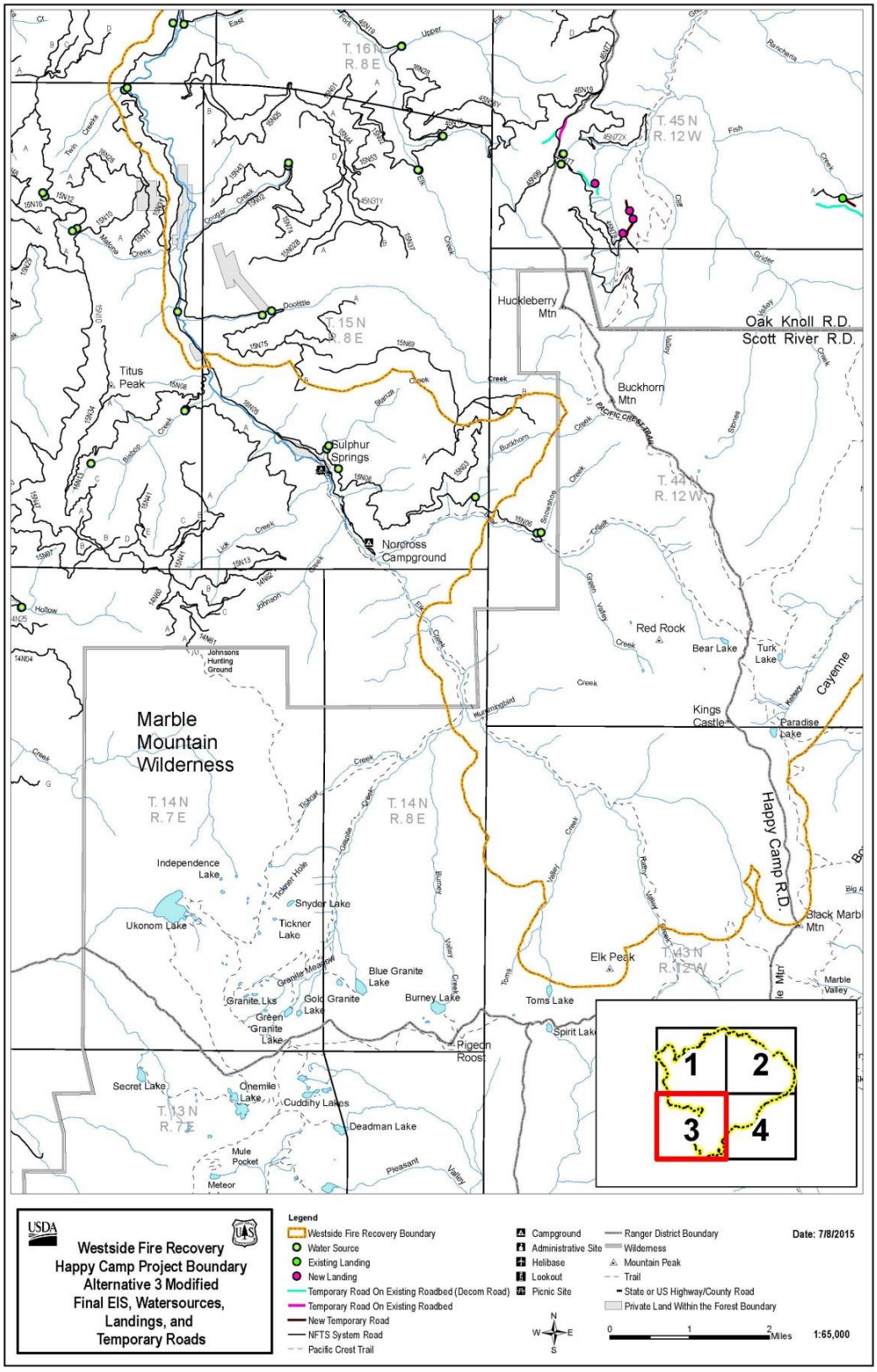

Figure 2d. Westside Fire Recovery Project Map, SE portion of Happy Camp Complex

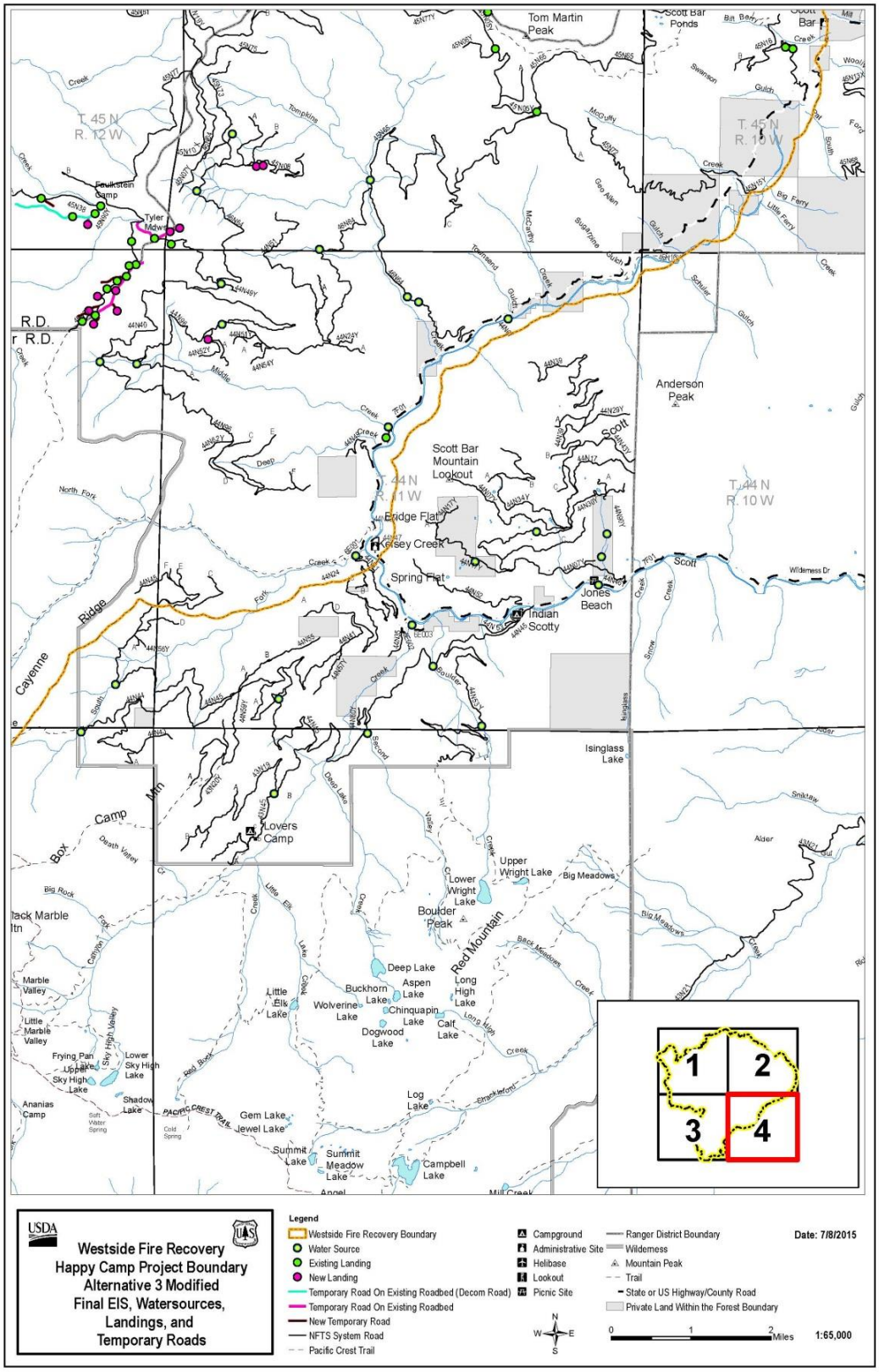

Figure 2e. Westside Fire Recovery Project Map, Whites Fire

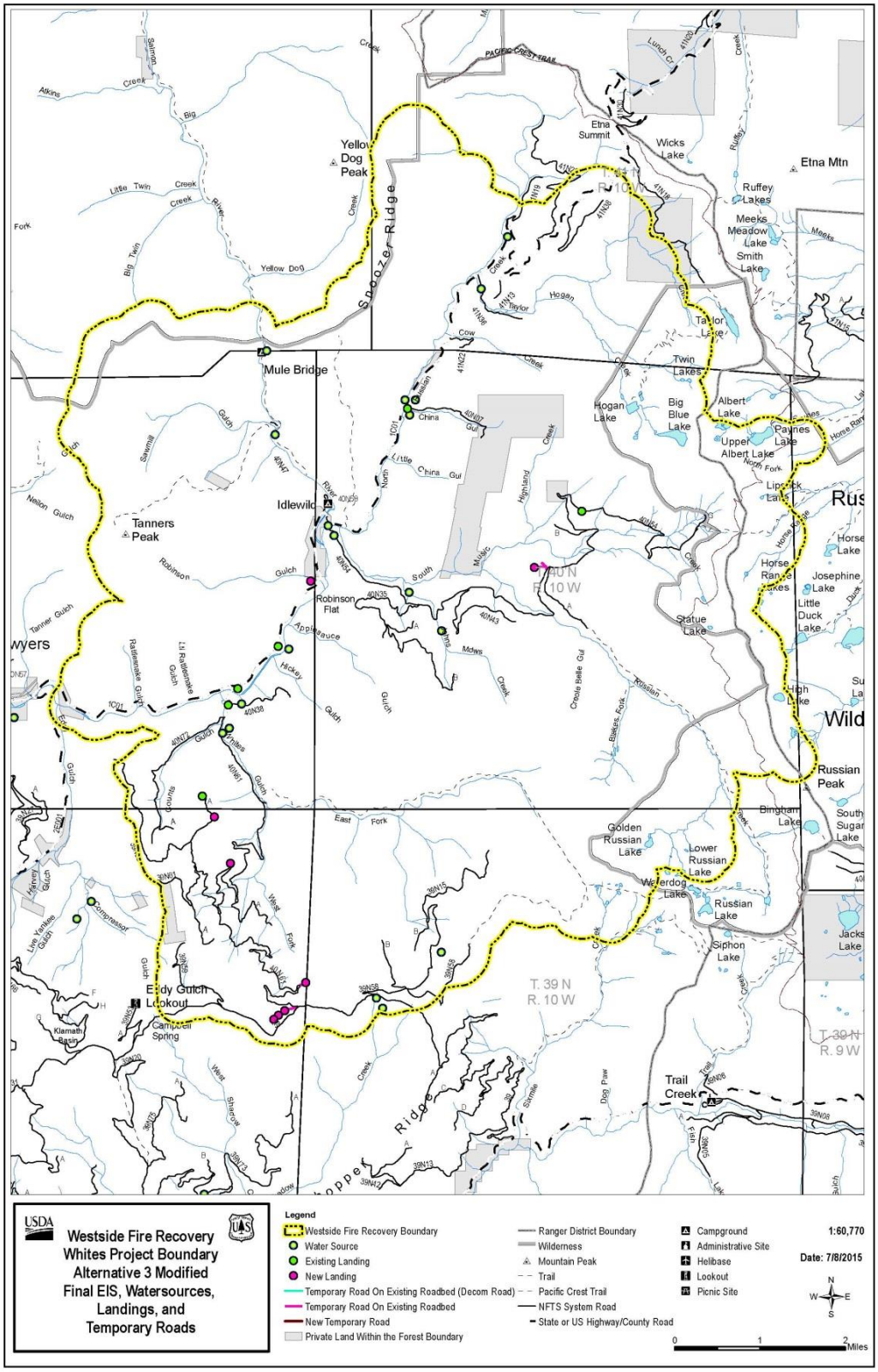

Figure 2f. Westside Fire Recovery Project Map, Beaver Fire

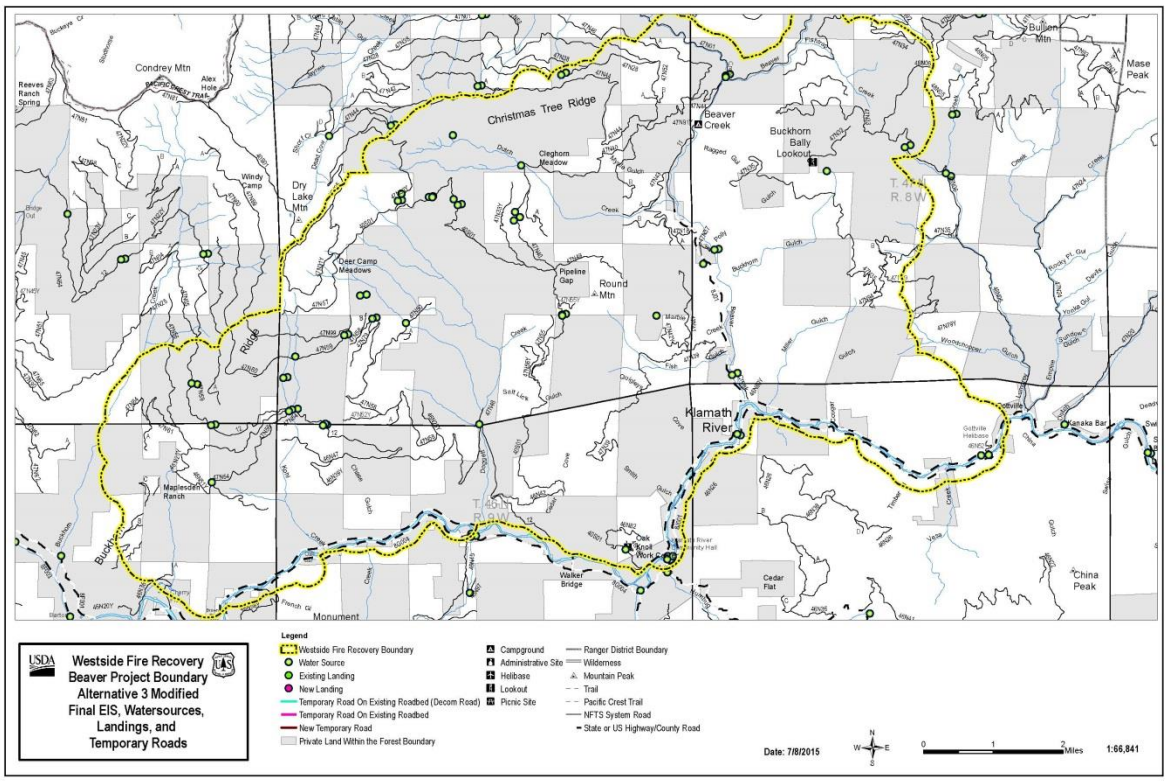

Figure 3a. The geographic boundaries of the Upper Klamath River coho salmon population. Figure shows modeled Intrinsic Potential of habitat (Williams *et al.* 2006), land ownership, coho salmon distribution (CDFG 2012a), and location within the Southern-Oregon/Northern California Coast Coho Salmon ESU and the Interior Klamath River diversity stratum (Williams *et al.* 2006). Grey areas indicate private ownership.

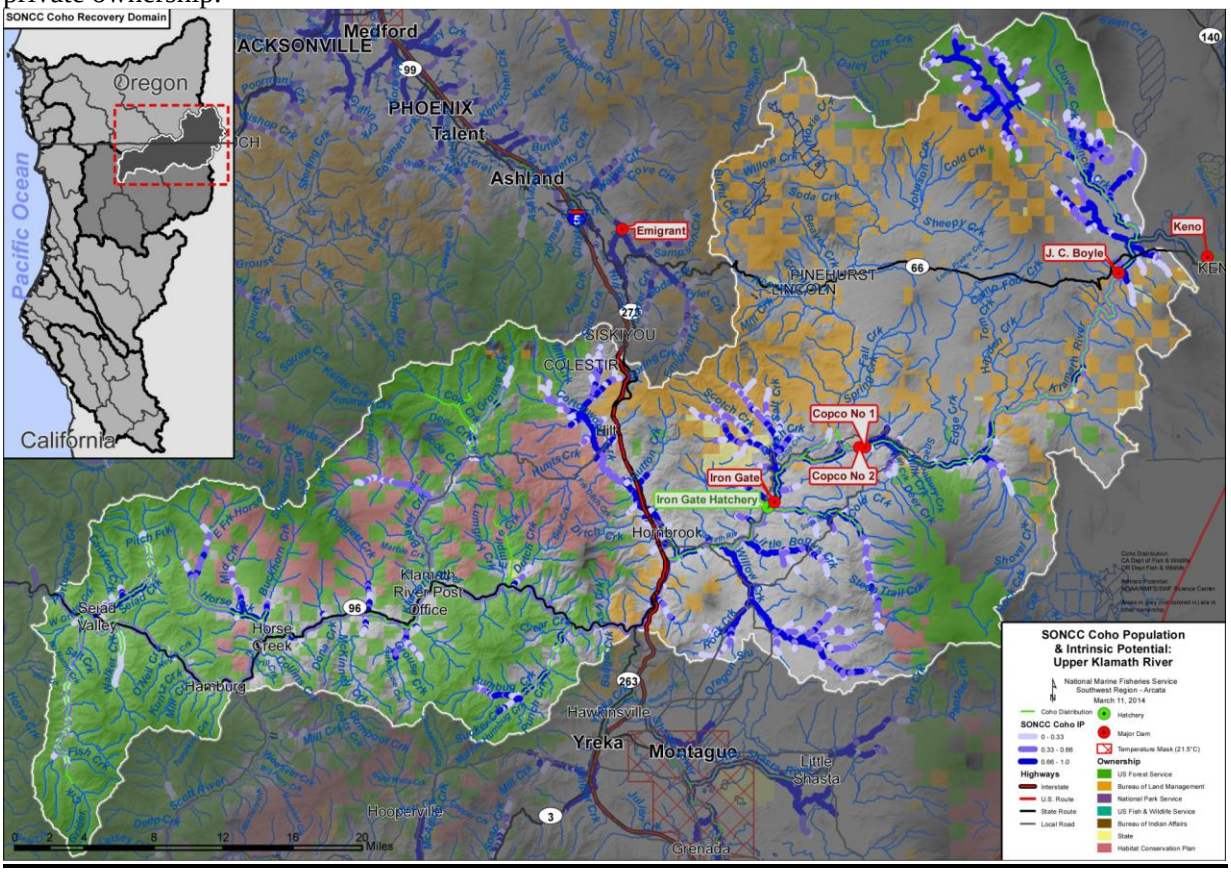

Figure 3b. The geographic boundaries of the Middle Klamath River coho salmon population. Figure shows modeled Intrinsic Potential of habitat (Williams *et al.* 2006), land ownership, coho salmon distribution (CDFG 2012a), and location within the Southern-Oregon/Northern California Coast Coho Salmon ESU and the Interior Klamath River diversity stratum (Williams *et al.* 2006). Grey areas indicate private ownership.

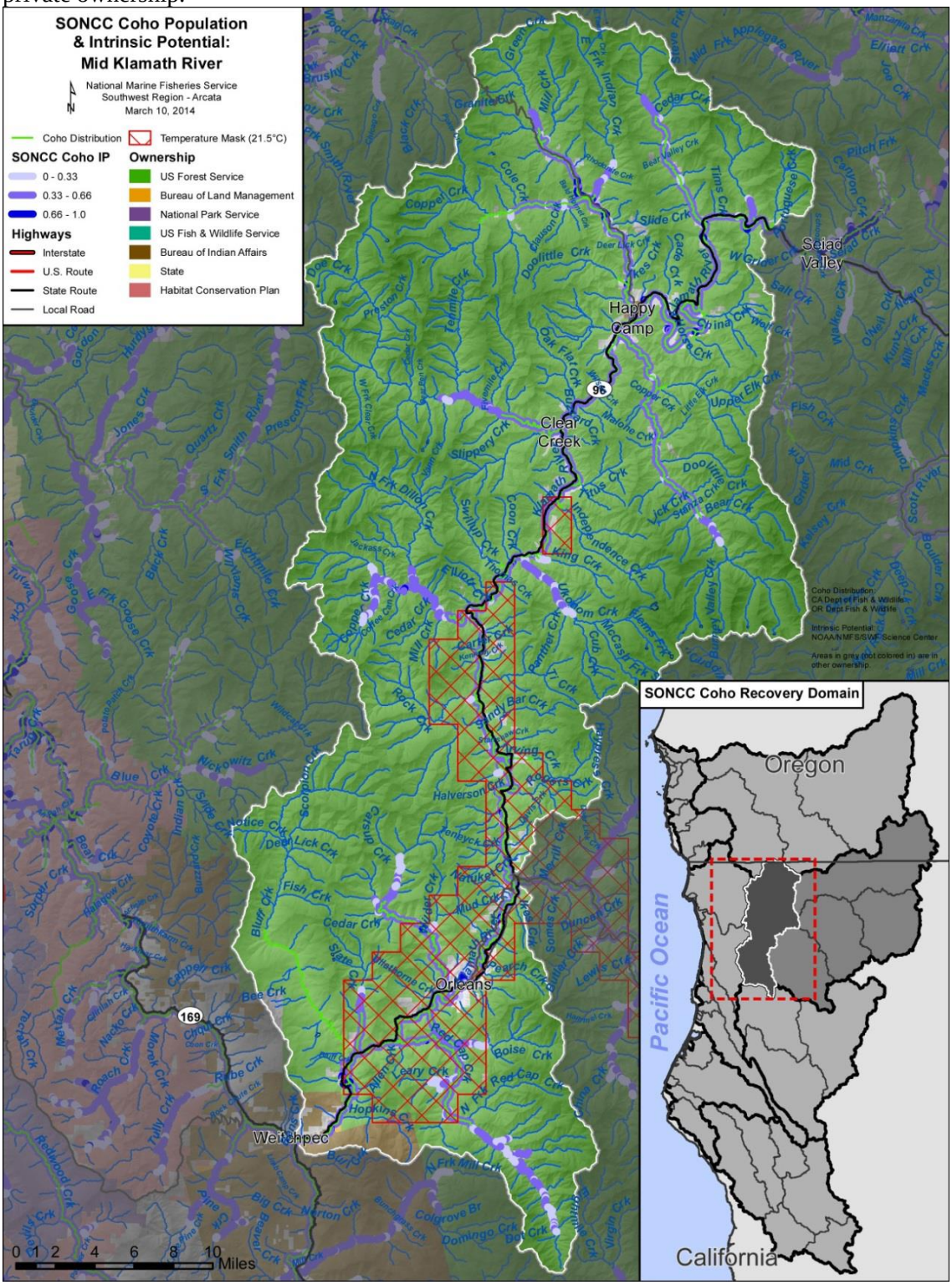

Figure 3c. The geographic boundaries of the Scott River coho salmon population. Figure shows modeled Intrinsic Potential of habitat (Williams *et al.* 2006), land ownership, coho salmon distribution (CDFG 2012a), and location within the Southern-Oregon/Northern California Coast Coho Salmon ESU and the Interior Klamath River diversity stratum (Williams *et al.* 2006). Grey areas indicate private ownership.

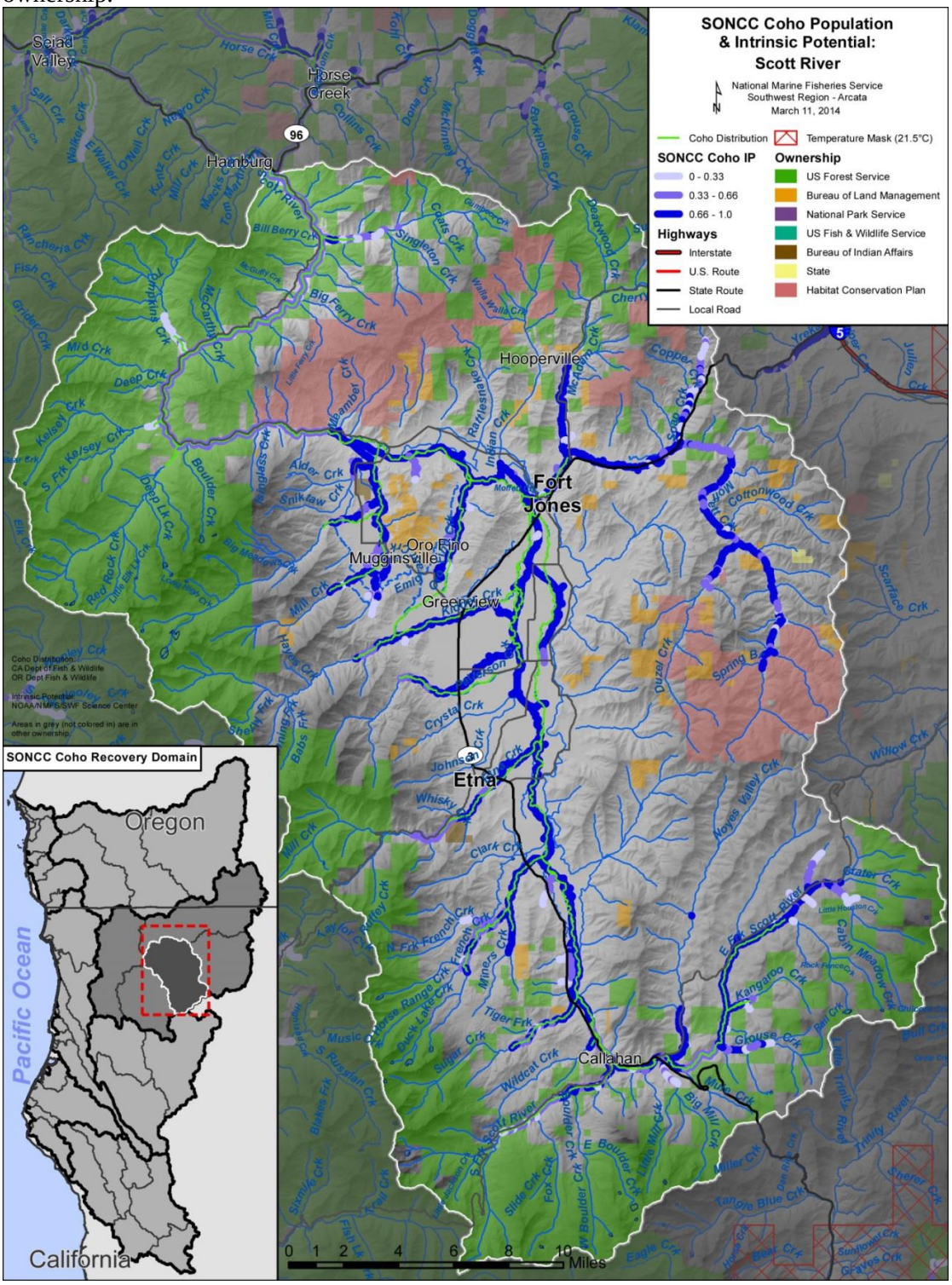

Figure 3d. The geographic boundaries of the Salmon River coho salmon population. Figure shows modeled Intrinsic Potential of habitat (Williams *et al.* 2006), land ownership, coho salmon distribution (CDFG 2012a), and location within the Southern-Oregon/Northern California Coast Coho Salmon ESU and the Interior Klamath River diversity stratum (Williams *et al.* 2006). Grey areas indicate private ownership.

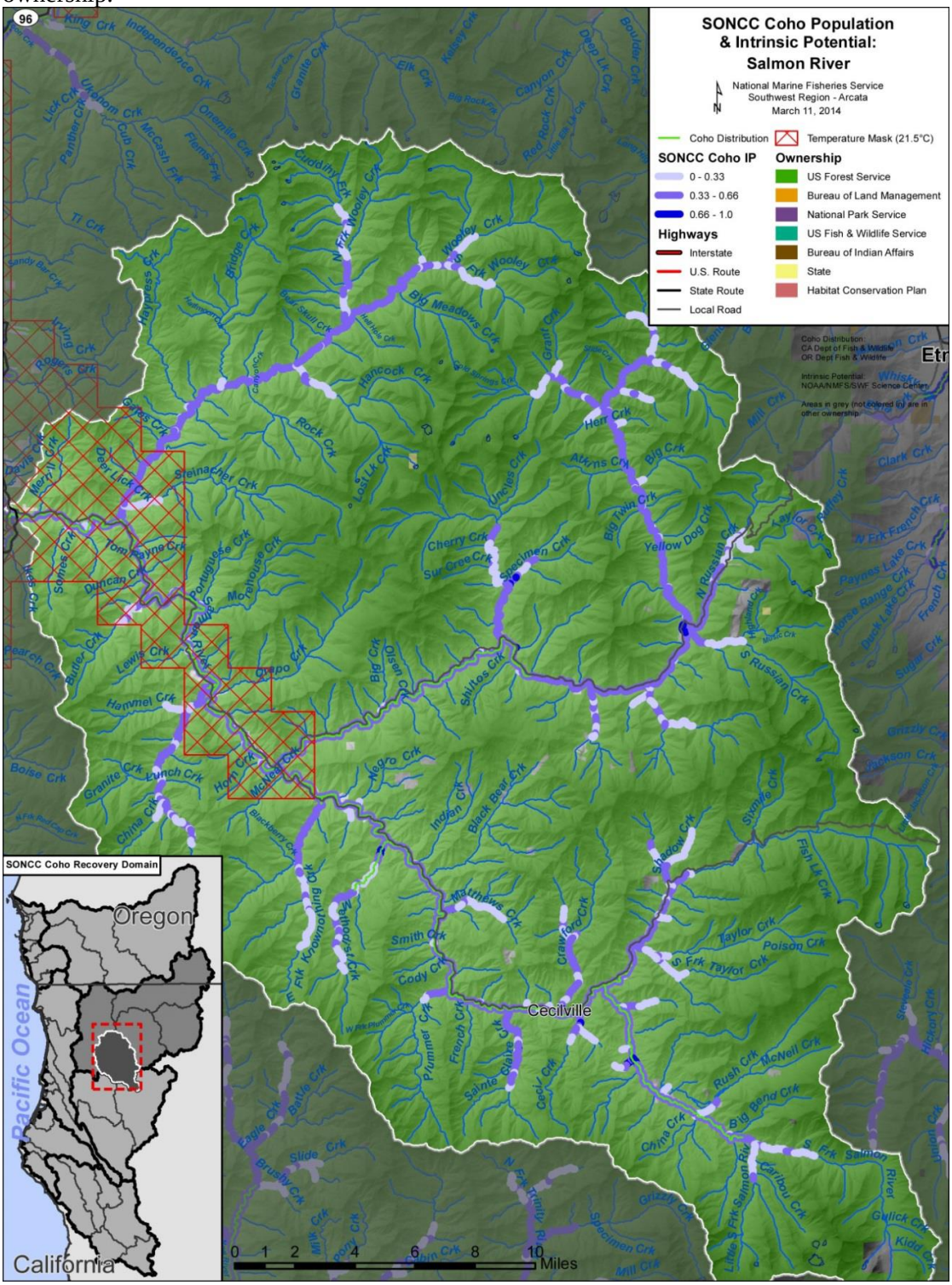

Figure 4a. July 2015 storm debris flow, lower Walker Creek at twin culverts

Figure 4b. July 2015 storm debris flow, lower Walker Creek, downstream from twin culverts

Figure 4c . Photos from February (left) and July (right) 2015, looking upstream from the Pacific Crest Trail Bridge at Grider Creek Campground (Courtesy of AC 7000 at icasaweb.google.com). Note deposition along the upper left of the right photo, by the alders.

Figure 5. Detail of Project commercial salvage harvest units and road activities, including the No Name Creek watershed, lower Grider Creek. Project salvage harvest will occur exclusively within the dark brown, dark green, and sky blue polygons.

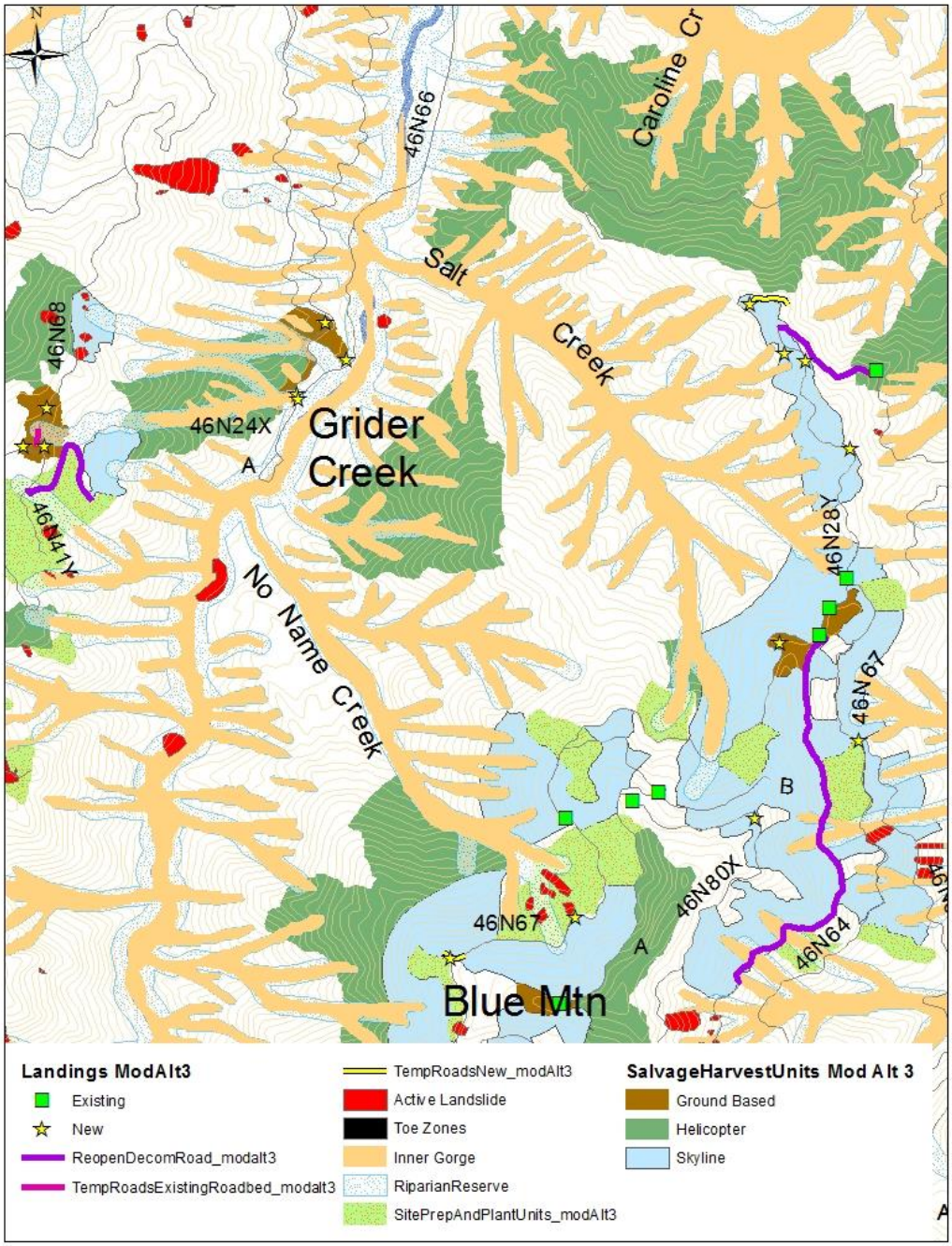

Figure 6. SONCC coho salmon exhibiting normal swimming behavior adjacent to fish exclusion screen during water drafting operations, Canyon Creek, Scott River Canyon, September 2009.

Table 1. Landslide risk assessment based on the probability and consequence of landsliding in the action area watersheds (KNF Amendment to the Geology Report 2015).

Watershed Code	Watershed Name	Fire Area	Consequence of Landslide Event	Percent Watershed Unstable	Current Risk Ratio	Percent Disturbance last decade	Current Landslide Likelihood	Current Landslide Risk
18010206080302	Lumgrey Creek	Beaver	Moderate	9.5%	1.04	2.1%	Highly Likely	High
18010206080304	Miller Gulch-Klamath River	Beaver	Minor	10.3%	0.75	8.6%	Likely	Low
18010206090203	Soda Creek-Beaver Creek	Beaver	Moderate	17.0%	1.46	12.7%	Highly Likely	High
18010206090301	Jaynes Canyon	Beaver	Moderate	14.3%	0.85	14.8%	Likely	Moderate
18010206090304	Lower West Fork Beaver Creek	Beaver	Moderate	13.5%	1.05	12.0%	Highly Likely	High
18010206090401	Dutch Creek	Beaver	Minor	13.0%	0.93	45.2%	Highly Likely	Moderate
18010206090402	Buckhorn Gulch-Beaver Creek	Beaver	Moderate	18.1%	1.16	55.1%	Highly Likely	High
18010206100202	Quigleys Cove-Klamath River	Beaver	Moderate	5.9%	0.72	21.7%	Likely	Moderate
18010206100301	Doggett Creek	Beaver	Moderate	9.7%	1.11	49.3%	Highly Likely	High
18010206100303	Dona Creek-Klamath River	Beaver	Minor	12.8%	1.16	25.6%	Highly Likely	Moderate
18010206100406	Buckhorn Creek	Beaver	Moderate	11.2%	0.68	10.5%	Likely	Moderate
18010206100501	Kohl Creek	Beaver	Moderate	8.1%	1.18	66.9%	Highly Likely	High
18010206100502	Collins Creek-Klamath River	Beaver	Moderate	8.8%	0.78	13.7%	Likely	Moderate
18010206110101	Upper Grider Creek	Happy Camp	Catastrophic	11.5%	0.31	24.0%	Likely	High
18010206110102	Cliff Valley Creek	Happy Camp	Catastrophic	12.3%	0.33	12.8%	Likely	High
18010206110103	Rancheria Creek	Happy Camp	Catastrophic	21.6%	0.68	46.4%	Highly Likely	Very High
18010206110104	Lower Grider Creek	Happy Camp	Catastrophic	58.5%	1.09	36.5%	Almost Certain	Very High
18010206110301	Tom Martin Creek-Klamath River	Happy Camp	Minor	16.3%	0.44	26.2%	Highly Likely	Moderate
18010206110303	O'Neil Creek	Happy Camp	Moderate	56.1%	1.5	28.6%	Almost Certain	High
18010206110304	Schutts Gulch-Klamath River	Happy Camp	Nuisance	31.3%	1.15	6.8%	Highly Likely	Low
18010206110305	Walker Creek	Happy Camp	Catastrophic	69.8%	1.89	29.6%	Almost Certain	Very High
18010206110306	Caroline Creek-Klamath River	Happy Camp	Moderate	68.4%	1.64	11.4%	Almost Certain	High
18010206110307	West Grider Creek-Klamath River	Happy Camp	Minor	16.0%	0.59	2.3%	Likely	Low
18010208020301	Upper French Creek	Whites	Moderate	5.8%	0.78	4.8%	Likely	Moderate
18010208020402	Sugar Creek	Whites	Minor	5.4%	0.45	0.1%	Unlikely	Very Low
18010208060101	Upper Canyon Creek	Happy Camp	Minor	5.3%	0.07	2.8%	Unlikely	Very Low
18010208060301	North Fork Kelsey Creek	Happy Camp	Moderate	12.0%	0.46	17.7%	Likely	Moderate
18010208060302	South Fork Kelsey Creek	Happy Camp	Moderate	16.1%	0.35	2.6%	Likely	Moderate
18010208060401	Middle Creek	Happy Camp	Minor	15.0%	1.09	19.6%	Highly Likely	Moderate
18010208060402	Deep Creek-Scott River	Happy Camp	Minor	16.7%	1.39	10.1%	Highly Likely	Moderate
18010208060403	Tompkins Creek	Happy Camp	Moderate	15.5%	0.85	18.6%	Likely	Moderate
18010208060601	McCarthy Creek-Scott River	Happy Camp	Moderate	13.3%	0.43	18.1%	Likely	Moderate
18010208060602	Big Ferry-Swanson	Happy Camp	Moderate	10.9%	0.61	31.5%	Highly Likely	High
18010208060603	Franklin Gulch-Scott River	Happy Camp	Minor	17.4%	0.39	11.3%	Likely	Low
18010209020302	China Creek	Happy Camp	Moderate	12.6%	0.75	5.2%	Likely	Moderate
18010209020303	Horse Creek	Happy Camp	Moderate	14.9%	0.76	12.5%	Likely	Moderate

Watershed Code	Watershed Name	Fire Area	Consequence of Landslide Event	Percent Watershed Unstable	Current Risk Ratio	Percent Disturbance last decade	Current Landslide Likelihood	Current Landslide Risk
18010209020305	Fryingpan Creek-Klamath River	Happy Camp	Moderate	14.4%	0.75	5.1%	Likely	Moderate
18010209030101	Headwaters Elk Creek	Happy Camp	Moderate	11.4%	0.15	21.7%	Likely	Moderate
18010209030102	Rainy Valley Creek	Happy Camp	Moderate	12.2%	0.02	5.2%	Likely	Moderate
18010209030103	Toms Valley Creek-Elk Creek	Happy Camp	Moderate	11.2%	0.6	14.9%	Likely	Moderate
18010209030104	Granite Creek	Happy Camp	Moderate	9.3%	1.52	32.8%	Almost Certain	High
18010209030105	Middle Elk Creek	Happy Camp	Moderate	18.9%	2.85	56.0%	Almost Certain	High
18010209030201	Upper East Fork Elk Creek	Happy Camp	Moderate	13.0%	0.54	22.9%	Likely	Moderate
18010209030202	Upper Elk Creek	Happy Camp	Moderate	13.8%	0.43	17.7%	Likely	Moderate
18010209030203	Lower East Fork Elk Creek	Happy Camp	Moderate	15.4%	0.48	21.1%	Likely	Moderate
18010209030301	Bear Creek	Happy Camp	Moderate	12.9%	1.01	26.4%	Highly Likely	High
18010209030302	Bishop Creek-Elk Creek	Happy Camp	Moderate	17.6%	1.76	18.0%	Highly Likely	High
18010209030303	Doolittle Creek	Happy Camp	Moderate	15.3%	0.46	25.7%	Highly Likely	High
18010209030304	Cougar Creek-Elk Creek	Happy Camp	Moderate	16.4%	0.64	6.3%	Likely	Moderate
18010209030305	Hoop&Devil-Elk Creek	Happy Camp	Moderate	15.2%	0.6	2.1%	Likely	Moderate
18010209060103	Benjamin Creek-Klamath River	Happy Camp	Minor	15.6%	0.63	5.1%	Likely	Low
18010210010304	Sixmile Creek	Whites	Minor	13.6%	0.38	2.2%	Likely	Low
18010210010306	Shadow Creek	Whites	Minor	17.3%	0.45	3.7%	Likely	Low
18010210020301	Upper South Russian Creek	Whites	Minor	4.4%	0.78	19.6%	Likely	Low
18010210020302	Music Creek	Whites	Minor	13.5%	1.21	43.5%	Highly Likely	Moderate
18010210020303	Lower South Russian Creek	Whites	Moderate	12.6%	0.66	20.7%	Likely	Moderate
18010210020401	Upper North Russian Creek	Whites	Minor	14.5%	0.98	4.3%	Highly Likely	Moderate
18010210020402	Taylor Creek	Whites	Minor	10.7%	0.53	13.3%	Likely	Low
18010210020403	Lower North Russian Creek	Whites	Moderate	18.8%	0.83	34.1%	Highly Likely	High
18010210020502	Big Creek	Whites	Minor	14.9%	0	0.0%	Likely	Low
18010210020503	Yellow Dog Creek-North Fork Salmon River	Whites	Major	16.1%	0.28	13.7%	Likely	High
18010210020603	Specimen Creek	Whites	Minor	18.0%	0.65	0.2%	Likely	Low
18010210020701	Whites Gulch	Whites	Moderate	13.4%	0.64	31.7%	Highly Likely	High
18010210020702	Robinson Gulch-North Fork Salmon River	Whites	Minor	17.0%	0.8	41.3%	Highly Likely	Moderate
18010210020703	Eddy Gulch	Whites	Moderate	16.4%	0.76	0.0%	Likely	Moderate
18010210020704	Jessups Gulch-North Fork Salmon River	Whites	Major	15.6%	0.59	0.1%	Likely	High
18010210020705	Jackass Gulch	Whites	Minor	18.7%	0.19	16.0%	Likely	Low