Biological Assessment
For
Threatened, Endangered, and Proposed Fish Species
That May be Affected by the
Westside Fire Recovery Project

Happy Camp, Oak Knoll, Salmon River and Scott River Ranger Districts

Prepared and finalized by: _____ Date: 4/13/15
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Tables and Figures

PROJECT NAME: Westside Fire Recovery Project

ADMINISTRATIVE UNIT: Klamath National Forest; Happy Camp, Oak Knoll, Salmon River and Scott River Ranger Districts

FOURTH FIELD WATERSHEDS: Upper Klamath River, Scott River, Salmon River, and Lower Klamath River

FIFTH FIELD WATERSHEDS:

- 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
- Thompson Creek-Klamath River
- Ukonom Creek-Klamath River

SEVENTH FIELD WATERSHEDS: See list in Appendix B and D

WATERSHED ANALYSES: See list in References

NEPA DOCUMENTATION: Westside Fire Recovery Project EIS (in progress)

ESA LISTED SPECIES: Southern Oregon/Northern California Coasts Coho salmon (*Oncorhynchus kisutch)*

ESA CRITICAL HABITAT: Southern Oregon/Northern California Coasts Coho salmon CH

ESA DETERMINATIONS: May affect, but not likely to adversely affect Southern Oregon/Northern California Coasts Coho salmon ESU or their designated CH.

ESSENTIAL FISH HABITAT (EFH): The Westside Fire Recovery Project may adversely affect EFH for Coho and Chinook salmon, specifically EFH for Southern Oregon/Northern California Coasts Coho salmon and Upper Klamath-Trinity Rivers Chinook salmon.

I. Introduction

The purpose of this biological assessment (BA) is to determine effects of the Klamath National Forest's (KNF) Westside Fire Recovery (WSFR) Project (the Project) on Coho salmon, the only anadromous fish species listed under the Endangered Species Act (ESA) within the Project Analysis Area and on designated Critical Habitat (CH) for Coho salmon. Also considered are effects on Coho and Chinook salmon Essential Fish Habitat (EFH) designated under Magnuson-Stevens Fisheries Conservation and Management Act (MSFCMA). Species listed as "sensitive" by the Pacific Southwest Region of the USDA Forest Service are analyzed in the WSFR Project Aquatic Resources Report (WSFR Project EIS, in progress).

The WSFR Project EIS includes 4 action alternatives for salvage of burned trees within three areas burned by wildfires in 2014: Beaver Fire, Happy Camp Complex and Whites Fire. Alternative 2, the proposed action, was designed to meet the purpose and need for action and will treat a total of about 63,900 acres within the 218,000 acre project boundary. As a result of public input and streamlined consultation with USFWS and NMFS, the proposed action has been changed and reduced in scope and potential environmental impact. This modified Alternative 2 is the action analyzed in this BA and is referred to as the Consultation Action.

The Analysis Area is the following 5th-field watersheds (and 7th field subwatersheds) within the three major burn areas that were affected by the 2014 fires that have proposed activities:

- 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
- Thompson Creek-Klamath River
- Ukonom Creek-Klamath River

This BA is prepared in accordance with legal requirements set forth under Section 7 of the ESA of 1973, as amended, [16 U.S.C. 1531 et. seq. 50CFR 402], EFH consultation under 305 (b) (4) (A) of MSFCMA and is consistent with standards established in Forest Service Manual direction (FSM 2672.42; USFS 1991). The BA analyzes effects to the following Evolutionary Significant Units (ESUs) and EFH of anadromous fish and their habitat:

Endangered:	None
Threatened:	Southern Oregon / Northern California Coasts (SONCC) ESU Coho salmon (*Oncorhynchus kisutch*) (70 FR 37160, June 28, 2005), and it's designated CH (64 FR 24049, May 5, 1999)
Proposed:	None
Candidate:	None
EFH:	SONCC Coho salmon Upper Klamath-Trinity (UKT) Rivers Chinook salmon (*O. tshawytscha*)

APPENDICES: Supporting documents to this BA are located in the following appendices:

Appendix A. Project maps

Appendix B Detailed tables of proposed activities and CWE model outputs

Appendix C. KNF Table of Population and Habitat Indicators

Appendix D. Environmental Baseline and Effects Checklists, 5th and 7th field watersheds
Appendix E. Project Design Features, Best Management Practices and Wet Weather Operation Standards
Appendix F. Life history and biological requirements of Pacific Salmonids
Appendix G. Summary of Project Element Effects to Coho Salmon, and Critical Habitat, by 2014 Fire Area

II. Consultation to Date

A list of Threatened, Endangered, and Candidate species was obtained online from the Arcata FWS office website on January 21, 2014 (FWS 2014). This list was used as a basis for determining which species listed under the ESA would be included in this BA.

A NMFS representative (Don Flickinger) attended field reviews with US Forest Service personnel on: 10/27/14, 12/3/14, 1/8/15, 3/5/15, and 4/3/15. The WSFR Project was discussed with D. Flickinger in detail (including map and project design feature review) at Level 1 meeting on 1/7/15 and Project interdisciplinary team meetings on 1/9/15 and 3/20/15. Information sharing and incorporation of minimization measures to protect Coho salmon continued with D. Flickinger as the project developed (from October 2014 to present). A draft BA was submitted to D. Flickinger on 4/1/15. Comments from D. Flickinger were received on 4/9/15 and 4/11/15. Comments were reviewed and discussed together on 4/10/15 and 4/13/15. The BA was finalized on 4/13/15.

III. Proposed Action

The proposed action includes five Project Elements (PEs):

- Salvage and Reforestation
- Fuels Reduction
- Hazard Tree Removal
- Temporary Roads, Landings and Water Drafting
- Legacy Site Treatments

Maps showing the locations of all PEs and Coho salmon CH are provided in Appendix A; Appendix B has detailed tables of proposed actions and Cumulative Watershed Effects modelling by 7th field watershed. Watershed Project Design Features (PDFs) were developed by watershed specialists during project development to minimize potential impacts to soils and riparian/aquatic resources; these PDFs are included in Appendix E (and the full list of PDFs is in the project FEIS).

Project Summary

Type of Project: Post-fire Salvage Harvest

PE Information (all acres are approximate):

1) Salvage and Reforestation

The WSFR Project proposes salvage harvest on about 7,829 acres within the three areas burned by the 2014 fires (Beaver Fire, Happy Camp Complex and Whites Fire). See Table 1 and 2 for acres of salvage harvest proposed by 5th field watershed). The following criteria were used to establish the areas for salvage harvest treatments: No salvage harvest within Wilderness, Backcountry, Research Natural Areas, Designated or Recommended Wild Rivers, Inventoried Roadless Areas, or RRs associated with stream channels (hydrologic RRs); areas proposed for treatment include only 1) Areas of moderate to high severity vegetation mortality (i.e. greater than 50 percent of trees fire-killed on a unit level, based on Rapid Assessment of Vegetation Condition after Wildfire (RAVG)); 2) Areas determined to be feasible in terms of logging systems, accessibility, and economics; and 3) Areas with more than 10 contiguous acres of medium to high severity vegetation mortality. Land allocations are defined in the KNF's Land and Resource Management Plan (LRMP) (USFS 1995a). In

determining what individual trees will be harvested, standing dead trees 14 inches in diameter at breast height or greater will be considered for salvage using the guidelines in Report #RO-11-01 "*Marking Guidelines for Fire-Injured Trees in California*" (Smith & Cluck, 2011) to identify trees for removal. These guidelines were developed using peer reviewed scientific literature to evaluate tree species in Northern California for mortality. Treatment of slash/activity fuels associated with salvage logging may include jackpot burning, heli-torch burning, pile or windrow burning, and/or lop and scatter, as necessary. All skid trails and yarding corridors will be rehabilitated at Project conclusion, including installation of water bars, scattering slash, and other measures deemed necessary to control soil erosion and minimize potential impacts to water quality (as per BMPs and Watershed PDFs).

Salvage harvest would be accomplished using ground-based [tractor/end line], skylining, and helicopter methods. All salvage units will be reforested with the need for site-preparation evaluated per criteria outlined in site-preparation section below.

Reforestation includes site-preparation, planting, and release over approximately 7,873 acres to increase the likelihood and speed by which burned areas are reforested and will include: manual site preparation, skyline yarding, mastication, mechanical yarding and slash piling of dead trees. Treatments within RRs are proposed within the plantation site-preparation and planting units in the Whites Fire and Happy Camp Complex to achieve ground cover and encourage natural recovery of vegetation and soils. Treatment will be focused in areas of high and moderate vegetation mortality and where the overhead hazards can be mitigated without equipment entry into RRs. Trees up to 16 inches diameter at breast height in RR may be cut and felled. Treatment will include hand-work only (no ground-based equipment) 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 burned.

Table 1. 2014 fire areas wtih acres of salvage harvest by method, acres of site preparation, and relevant minimization measures (PDFs).

	Beaver Fire	Happy Camp Complex	Whites Fire	Grand Total
Site Prep and Plant	1,782	5,437	654	7,873
Logging System				
Ground-based	243	595	41	879
Skyline	106	4,234	238	4,579
Helicopter	0	3,899	462	4,361
Total	**350**	**8,728**	**741**	**9,819**
Watershed PDFs	Wet weather operations PDF-1; Skid trail and erosion control: PDFs 2, 7, 8, 10, 27, 28, 29, 30 and 32; Tractor harvest limitations: PDFs 3,4,7,9,12,14 and 26; Cable harvest limitations PDFs 3, 6 and 31.			
Total Acres of RRs within Harvest Units	**1,990**			

Table 2. Acres of salvage harvest by 5th field watershed.

Watershed	Acres
Beaver Creek	129
Elk Creek	651
Horse Creek-Klamath River	221

Humbug Creek-Klamath River	0
Lower Scott River	1619
Indian Creek	0
North Fork Salmon River	741
Lower Scott River	0
North Fork Salmon River	0
Seiad Creek-Klamath River	6107
South Fork Salmon River	0
Thompson Creek-Klamath River	350
Ukonom Creek-Klamath River	0

2) Fuels Reduction

Fuels treatments will occur on approximately 22,307 acres (Table 3) across the three burn areas and will include hand work, mechanical thinning, mastication, lop and scattering, chipping, broadcast burning, jackpot burning, and pile burning. Table 4 shows fuels treatments proposed, by 5th field watershed.

Table 3. Summary of fuels treatment and acres.

	WSFR Project
Acres of Fuels Treatment	22,307
Acres of RRs in Units	6,206
Watershed PDFs	Prescribed fire limitations: 33, 35 and 36 Handpiling and burning limitations: 34

Table 4. Acres of fuels treatment by type within 5th field watersheds.

Watershed	Fuels Management Zone (acres)	Roadside (acres)	Understory Prescribed Fire (acres)	WUI (acres)	Total Acres of Fuels Treatment (acres)
Beaver Creek	325	204	0	196	725
Elk Creek	800	1,426	888	224	3,336
French Creek-Scott River	0	0	0	0	0
Horse Creek-Klamath River	487	340	0	276	1,104
Humbug Creek-Klamath River	141	65	0	141	348
Indian Creek	0	0	0	0	0
Lower Scott River	637	0	59	400	1,096
North Fork Salmon River	625	807	8,979	413	10,824
Seiad Creek-Klamath River	1,186	847	278	220	2,530
South Fork Salmon River	293	0	230	0	523
Thompson Creek-Klamath River	388	736	296	246	1,666
Ukonom Creek-Klamath River	13	0	35	108	156
Total Acres	**4,895**	**4,424**	**10,765**	**2,223**	**22,307**

3) Hazard Tree Removal

Hazard tree removal will occur along an estimated 678 miles of roads (or within ~21,000 acres), including Forest Service system roads, County Roads, and State Highways to provide for public and forest worker safety and future fire suppression efforts. Both the mileage and acres of treatment proposed are a maximum; the numbers are representative of the entire length and area being evaluated for hazard tree identification and removal. Hazard trees will be identified, felled, and removed in compliance with Region 5 Hazard Tree Guidelines (USFS 2012). All trees within 250 feet of road systems will be evaluated as to hazard, regardless of burn severity. Additional guidance will be used for burned trees to determine mortality potential and, thus, need for removal (USFS 2011a). To be considered a hazard, burned trees must have a 60% or greater chance of dying. Treatment of slash associated with hazard tree abatement may include jackpot burning, pile and windrow burning, chipping, and/or lop and scatter, as necessary. Project design features require retaining hazard trees greater than 26 inches DBH on site when they are within one site tree height distance from fish-bearing streams.

Table 5. Acres of hazard tree removal.

	WSFR Project
Acres of Hazard Tree Removal	21,000
Miles of Road Treated	678
Acres of RR within Units	5,600
Watershed PDFs	Equipment exclusion within RRs: PDFs 4 and 13 Maintain large wood, leave felled trees: PDF 14 Maintain soil stability near streams: PDF 15 and 16

Table 6. Acres of hazard tree removal by 5th field watershed.

Hazard Tree Removal Acres	**20499**
Beaver Creek	1319
Elk Creek	3772
Horse Creek-Klamath River	1388
Humbug Creek-Klamath River	410
Indian Creek	1
Lower Scott River	3811
North Fork Salmon River	2484
Seiad Creek-Klamath River	4570
South Fork Salmon River	232
Thompson Creek-Klamath River	2448
Ukonom Creek-Klamath River	65

4) Temporary Roads, Stream Crossings, Landings and Water Drafting

About 16.4 miles of temporary road actions are proposed; which involves nine stream crossings. About 3.4 miles of new temporary road would be constructed. Seven of the nine crossings are over intermittent channels: none of the stream crossings are within anadromous salmonid habitat (or resident trout habitat).

Table 7. Summary of miles of temporary roads and number of stream crossings.

	WSFR Project Road Elements
Miles New Temp. Road	3.4
Miles Temp. Road Existing Alignment	7.3
Miles Reopened Decomm. Roads	5.6
Total Miles of Temporary Road Construction	**16.4**

# of Temp Road Stream Crossings	9
# of Temp Road Stream Crossings in anadromous salmonid habitat	0
Watershed PDFs	New temporary roads: PDFs 5, 23, 24 Watering roads: PDFS 18 Culvert replacements 20 Water drafting 37, 38.

Table 8. Summary of temporary road miles by 5th field watershed.

5TH-FIELD	Reopen Decomm. Road	Temp. Roads Existing Roadbed	Temp. Roads New	Total Miles
Beaver Creek	0	0.8	0	0.8
Elk Creek	0.7	1.5	0.2	2.4
Horse Creek-Klamath River	0	0.4	0	0.4
Humbug Creek-Klamath River	0	0	0	0
Indian Creek	0	0	0	0
Lower Scott River	0	1.1	0.2	1.4
North Fork Salmon River	0	0.6	0.1	0.7
Seiad Creek-Klamath River	4.0	2.0	2.9	8.9
South Fork Salmon River	0	0.1	0.0	0.1
Thompson Creek-Klamath River	0.9	0.8	0	1.8
Ukonom Creek-Klamath River	0	0	0	0
Total Miles	**5.6**	**7.3**	**3.4**	**16.4**

A maximum of 75 existing landings will be used and 135 new landings will be constructed. Maps in Appendix A show locations of landings. Landing size will be commensurate with operational safety. Helicopter landings will be up to two acres in size. Skyline landings will use roads where ever possible. New skyline landings off the road system and ground-based landings will average one acre in size but will not be larger than 1.5 acres in size. Both new and existing landings will be hydrologically stabilized after use.

Table 9. Number and type of landings within 5th field watersheds.

5th-field Watershed	Existing Landings	New Landings	Total
Ground Based Landing			
Beaver Creek	11	7	18
Horse Creek-Klamath River	14	12	26
Lower Scott River	4	3	7
North Fork Salmon River	0	0	0
Seiad-Creek-Klamath River	12	6	18
Thompson Creek-Klamath River	0	12	12
Total	**41**	**40**	**81**
Helicopter Landing			
Elk Creek		6	6
Lower Scott River	15	10	25
North Fork Salmon River	5	1	6
Seiad-Creek-Klamath River	14	29	43
Thompson Creek-Klamath River		6	6
Total	**34**	**52**	**86**

Skyline Landings			
Elk Creek		12	12
Lower Scott River		8	8
North Fork Salmon River		7	7
Seiad-Creek-Klamath River		11	11
South Fork Salmon River		1	1
Thompson Creek-Klamath River		4	4
Total		**43**	**43**
Total number of landings	**75**	**135**	**210**
New Landings in RRs	Landings # DZ03, DZ10, DZ23, L043, L044, and L090.		
Watershed PDFs	Use of existing landings: PDF 26 Expansion of landings: PDF 26 Erosion control on landings: PDF 26 Restoration of soil cover: PDF 26		

During project planning watershed specialists worked with logging systems specialists to minimize any proposed new landings in RR. Several were proposed, and not approved for use by watershed specialists who are directed to shape projects to meet direction to *maintain and restore* aquatic ecosystems. Several new landings within RR were approved for use (PDF Watershed-5). Variables that provided for field-surveyed landings to be approved for use by watershed specialists included if they were on stable landforms and slope positions, were in the outer zone of the Riparian Reserve, and/or were separated from perennial streams by existing, stable road segments. Landings in RR were not approved for use if they would require removal of mature green vegetation or significant earthwork or fill (several initially proposed landings near Walker Creek, Grider Creek, and Whites Gulch were dropped for these reasons). The following new landings in RR were approved as exceptions to PDF Watershed-5 (shown on project maps in Appendix A):

- Proposed landings **L043, L044, and DZ23** occur in RR above the 46N66 road as it heads up the hill near Grider Creek Campground. These three landings would be used to facilitate helicopter logging systems in the Grider Creek watershed.
- Proposed landing **DZ03** is within RR of the Klamath River on a barren mine tailing area about 300 feet north of the river. It would be used to facilitate helicopter logging systems in the Gard and Caroline Creek area between Walker and Grider creek confluences with the Klamath River.
- Proposed landing **L090** is within RR of upper Cliff Valley Creek. It would be used to facilitate skyline logging systems.
- Proposed landing **DZ10** is within RR of lower Scott River. It would be used to facilitate helicopter logging systems.

Water drafting will occur at existing water drafting sites (locations are shown on maps in Appendix A). The number of sites needed and locations of use are not known at this time, therefore Table 10 lists all existing sites in each 5th-field watershed that could potentially be used. Watershed PDFs (37 and 38) will be implemented to minimize effects of water drafting on sediment and aquatic species including the following: draft water only at designated water drafting sites; coordinate with KNF fisheries biologists so effects to thermal refugia are avoided; when drafting from waters designated as Coho salmon CH, implement NOAA Fisheries Water Drafting Specifications (2001) and implement Forest Service BMPs outside of CH.

Table 10. Number of existing water drafting sites in 5th field watersheds.

5th-field Watershed	Number of Water Drafting Sites
Beaver Creek	64
Elk Creek	39
Horse Creek-Klamath River	108
Humbug Creek-Klamath River	27
Indian Creek	71
Lower Scott River	29
North Fork Salmon River	32
Seiad Creek-Klamath River	87
South Fork Salmon River	34
Thompson Creek-Klamath River	42
Ukonom Creek-Klamath River	41

5) Legacy Sediment Site Treatments

Legacy sediment site treatments are considered connected actions. Restoration actions would occur at existing legacy sediment sites, scheduled for treatment in compliance with the Clean Water Act as a condition of the North Coast Regional Water Quality Control Board waiver of waste discharge requirements (Order No. R1-2010-0029). Most legacy site treatments are proposed within the Elk Creek watershed, per agreements made during Clean Water Act consultation. However, project use of temporary roads would also require treatment of existing legacy sites at several sites in lower Grider Creek, Kuntz Creek, and O'Neil Creek drainages.

The portion of Elk Creek within the project area contains about 148 legacy sites and most sites are located on or adjacent to the Forest transportation system. Other legacy sites are located on historical landings or roadbeds (historic roads, abandoned temporary roads, or decommissioned roads). In lower Grider Creek drainage, an existing legacy sediment site at a perennial stream crossing on 46N41YA would be properly hydrologically stabilized after use by the project. In lower Kuntz and O'Neil creeks, project use of existing non-system roadbeds would require proper hydrologic stabilization of these areas; fixing road drainage problems would address potential risks to water quality from these roads.

Table 11. Legacy sediment site treatments in Elk Creek Watershed.

Legacy Site Type	# of Sites
Culvert Upgrades to accommodate 100 year event	45
Diversion Prevention	51
Replace Culvert with Bottomless Arched Culvert	3
Retaining Wall	7
Fill Reduction	16
Fill Removal from stream channels, swales, shoulders on Closed Roads	27
Repair Culvert: clean and repair; place rip	16

rap to reduced erosion	
Road Storm Proofing	33 miles: Forest system roads (15N02, 15N75, 16N05, 16N39 and 45N19)
# of Legacy Sites within CH	0

Project Timing: Project implementation is planned to begin in the summer/fall of 2015. The Project duration for salvage harvest and hazard tree abatement is anticipated to be two years, in 2015 and 2016. Fuels treatments would occur within 10 years after the WSFR Project Decision. Because burning activities are dependent upon weather conditions and staff availability, it may continue for several years following completion of the rest of the project. The schedule for legacy repair actions in Elk Creek watershed is projected to start in 2017, and will be determined through consultation with the North Coast Water Quality Control Board and funding availability.

Resource Protection Measures: The proposed action includes project design features (PDFs) designed to avoid and/or minimize potential environmental effects. Fisheries biologists and other watershed specialists developed PDFs specifically for watershed protection, and implementation of these measures is critical in avoiding adverse effects to aquatic habitat and Coho salmon in both the short and long term. Watershed PDFs are in Appendix E (see also Project EIS, Chapter 2 for the comprehensive list of PDFs).

Best Management Practices (BMPs): These practices were developed in coordination with the State of California Water Quality Control Board to protect water quality (see Appendix E).

Wet Weather Operation Standards (USFS 2002) are included within BMPs and PDFs will be used to guide operations during periods of wet weather (see Appendix E).

IV. Description of the Action Area

The WSFR Project Analysis Area includes the ~214,000 acres burned in 2014 by the Beaver Fire, Happy Camp Complex and Whites Fire. The Beaver Fire area is located north of the Klamath River near Oak Knoll, the Happy Camp Complex is south of the Klamath River between Scott Bar and Happy Camp, and the Whites Fire is upstream of Sawyers Bar, in the North Fork Salmon River basin.

The ESA Action Area is the 5th-field watersheds (and their 7th field subwatersheds or drainages) that provide habitat for Coho or Chinook salmon within the three major burn areas that have proposed activities:

- Beaver Creek
- Elk Creek
- Horse Creek-Klamath River
- Humbug Creek-Klamath River
- Lower Scott River
- North Fork Salmon River
- South Fork Salmon River
- Seiad Creek-Klamath River
- Thompson Creek-Klamath River
- Ukonom Creek-Klamath River

The Project Action Area extends downstream to the confluence of the Klamath and Salmon Rivers. The Action Area provides habitat for Southern Oregon/Northern California Coasts Coho salmon (*Oncorhynchus kisutch;* Coho salmon), listed as Threatened under the ESA, and their designated CH. EFH for Coho and Chinook salmon occurs within the Action Area, and is identical to the distribution of Coho salmon CH as shown on maps

in Appendix A.

The distribution of anadromous fish and their habitat within the Action Area is based on existing stream survey information collected by or verified by KNF fisheries biologists. The status and general life history of Coho salmon and Chinook salmon is provided in Appendix F.

V. Analysis Methods

Special Status Species. A list of Threatened, Endangered, and Candidate species was obtained online from the NMFS website at http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#fish

Habitat information came from the KNF LRMP, watershed analyses conducted by the KNF, existing stream survey data and reports and other environmental analyses completed for projects within the Analysis Area.

The Analytical Process. This analysis uses habitat indicators from the *Analytical Process for Developing Biological Assessments for Federal Actions Affecting Fish Within the Northwest Forest Plan Area* (USDA-USDOC-USDI 2004). The Analytical Process (AP) utilizes key indicators of habitat quality (habitat indicators) and was formulated to standardize evaluations of actions and effects for conferencing/consultations under Section (§) 7(a)(2) of the ESA, focusing on salmonid fishes within the Northwest Forest Plan (NFP) area. The information developed through the AP generally also satisfies the information requirements for EFH consultation for Pacific salmon under the MSFCMA and its implementing regulations (50 CFR Part 600).

The AP involves several steps including assembling and presenting the best available scientific and commercial information (from a variety of sources, including watershed analysis, NEPA analysis, and other analyses used to implement land and resource management plans) and, developing a BA using analytical procedures that are based upon requirements specified in 50 CFR § 402.12(f) and described in the ESA consultation handbook (USDI and USDC 1998).

The AP includes use of the "USFWS/NOAA Fisheries Table of Population and Habitat Indicators" (the Table), which is a tool to characterize baseline habitat and populations for salmonids in the NFP Area. Habitat indicators are evaluated in the Table, and the AP allows for criteria values to be adjusted for local watershed conditions given supportive documentation. Consistent with the Matrix of Pathways and Indicators (NMFS 1996) the Table provides values and ranges of conditions to determine whether baseline conditions are *Properly Functioning*, *At Risk*, or *Not Properly Functioning*. The KNF has developed criteria for the mid-Klamath region using values from streams that are considered pristine and as supported by the data contained in the environmental impact statement for the Klamath LRMP. The Klamath tributaries matrix (Appendix D) serves as the basis to identify relative baseline conditions, including existing conditions for the WSFR Project. This information, as well as watershed assessments, reports, and field reviews were used to rate and describe existing conditions, and to evaluate effects.

The environmental baseline for the full suite of habitat indicators provided in the AP, by 5th and 7th field watershed, are included as part of this analysis via summary in "Checklists for Documenting Environmental Baseline and Effects of Proposed Actions on Relevant Indicators" (see Appendix D). Each indicator is analyzed at the watershed and drainage scale, including the pre-project, post-fire environmental baseline and effects of the proposed action. Table 12 lists the suite of habitat indicators from the AP.

Table 12. Analytical Process habitat indicators by category.

Indicator	Habitat: (non-watershed condition indicators)	Habitat: (watershed condition indicators)
Temperature	■	
Suspended sediment-intergravel dissolved oxygen/turbidity	■	
Chemical contaminants/nutrients	■	

Physical barriers	■	
Substrate character and embeddedness	■	
Large woody debris	■	
Pool frequency and quality	■	
Large pools	■	
Off-channel habitat	■	
Refugia	■	
Average wetted width/maximum depth ratio in scour pools in a reach	■	
Streambank condition	■	
Floodplain connectivity	■	
Change in peak/base flows	■	
Increase in drainage network	■	
Road density and location		■
Disturbance history		■
RRs		■
Disturbance regime		■
Summary/integration of all species and habitat indicators		

The BA effects analysis uses the following steps provided in the AP: Step 1-Identify all PEs; Step 2-Evaluate all of the PEs for each habitat indicator by eight factors in relation to the Environmental Baseline; Step 3-Provide a summary statement for each PE; Step 4-Combine the element summaries for each indicator into a single indicator summary; Step 5-Evaluate Watershed Condition Indicators for potential effects; and Step 6-Answer the questions in the Project Effects Determination Key for all indicator summaries.

Non-WCI Analysis Indicators. This BA groups the non-WCI habitat indicators into three major headings or divisions as follows, based on the pathways for potential effects and, in turn, the potential for impacts on anadromous salmonids and their habitat:

1) **Sediment**
   - Suspended sediment-intergravel dissolved oxygen/turbidity
   - Physical barriers
   - Substrate character and embeddedness
   - Pools - frequency and quality, large pools, average wetted width/maximum depth ratio in scour pools in a reach
   - Off-channel habitat
   - Change in peak/base flows
   - Increase in drainage network -roads.

2) **Water Quality**
   - Water Temperature
   - Turbidity
   - Chemical contaminants/nutrients
   - Physical barriers
   - Pool quality
   - Refugia
   - Change in peak/base flows

3) **Riparian Function**
   - Water Temperature - Stream Shade
   - Large woody debris and pool quality
   - Off-channel habitat
   - Streambank condition
   - Floodplain connectivity'

Habitat indicators will be addressed under each of the above three divisions. Effects of each PE will first be discussed, then summarized using the AP factors of Proximity, Probability and Magnitude. Consistent with the AP, PEs with insignificant, discountable, or no effects will not receive further factor analysis (Distribution, Frequency, Duration, Timing, and Nature**)**.

Intensity of Effects. "Intensity" refers to the severity of effects or the degree to which an action may adversely or beneficially affect a species or its habitat. The intensity definitions used throughout this analysis are described below.

Habitat Indicators. Effects to habitat Indicators and anadromous salmonid habitat are described using the following terms:

- Neutral Effect. The action has no effect.
- Beneficial Effect. Effect is contemporaneous positive effects without any adverse effect to the species.
- Discountable Effect. Effect is extremely unlikely to occur and based on best judgment, a person would not be able to meaningfully measure, detect, or evaluate insignificant effects.
- Insignificant Effect. Effect may occur but is not to a level that can be meaningfully measured or detected.
- Significant Effect. Effect is detectable, and may be meaningfully measured.

Species. Effects to Coho salmon are described using the following terms:

- Neutral Effect. The action has no effect.
- Beneficial Effect. Effects are contemporaneous positive effects without any adverse effects to the species.
- Insignificant Effect. Effect may occur but is not to a level that can be meaningfully measured or detected.
- Minor Effect. Effects would result in detectable effects to an individual/s of a listed species or its CH, but they would not be expected to result in substantial population fluctuations and would not be expected to have any measurable long-term effects on species, habitats, or natural processes sustaining them; minor effects equate with a "*May Affect/Not Likely to Adversely Affect*" determination.
- Moderate Effect. Effects would result in detectable impacts on individuals or population of a listed species, its CH, or the natural processes sustaining them and key ecosystem processes may experience disruptions that may result in population or habitat condition fluctuations that would be outside the range of natural variation, but would return to natural conditions; moderate level adverse effects would equate with a "*May Affect/Likely to Adversely Affect"* determination.
- Major Effect. Individuals or population of a listed species, its CH, or the natural processes sustaining them would be measurably affected and key ecosystem processes might be permanently altered resulting in long-term changes in population numbers and permanently modifying CH; major effects may result in jeopardy to the continued existence of a population unit, ESU, or species.

Spatial and Temporal Bounding. The Action Area is the 5th-field subwatersheds of the Middle Klamath River and their 7th field drainages that provide habitat for Coho or Chinook salmon that were affected by the 2014 fires and have proposed activities. Upstream extent of the Action Area is defined as Beaver Creek in the Klamath River, Kelsey Creek in Scott River, and North Russian Creek in Salmon River. Downstream the Action Area extends to the confluence of Salmon and Klamath Rivers.

The temporal bounding of the analysis includes short-term effects (during implementation or within one year of implementation) and long-term effect (chronic effect that persists longer than one year after implementation).

VI. Environmental Baseline and Biological Requirements

The Action Area provides habitat for Southern Oregon/Northern California Coasts Coho salmon (*Oncorhynchus kisutch*), listed as Threatened under the ESA, and their designated CH. Forest Service Sensitive fish species that may occur within the Analysis Area include Upper Klamath-Trinity Rivers Chinook (*Oncorhynchus tshawytscha*), Klamath Mountains Province Steelhead (*Oncorhynchus mykiss*), Klamath River lamprey (*Entosphenus similis*), and Pacific lamprey (*Entosphenus tridentatus*). Both steelhead and resident rainbow trout (*Oncorhynchus mykiss*) are management indicator species under the KNF Forest Plan. EFH for Coho and Chinook salmon occur within the Action Area, and is considered identical to the distribution of Coho salmon CH in this document.

The biological requirements of Coho and Chinook salmon are given in Appendix F. The environmental baseline is given as a narrative below for each fire area and is focused on 5th-field watersheds. The Environmental baseline for HUC 7 watersheds in the Action Area is summarized in tables in Appendix D.

Overall, the water quality in the Klamath River is impaired and is on the 303(d) Clean Water Act list due to temperature and other constituents (Table 13). Use of mainstem habitat by salmonids is most limited by water quality during the summer months (June through September) when water temperatures are high throughout the day. Juveniles must utilize tributaries and other off-channel thermal refugial areas where cooler water can be found.

Table 13. Clean Water Act 303(d) listed reaches of the Middle Klamath River (NCRWQCB 2008).

Waterbody	Pollutant
Middle Klamath River HA, Iron Gate Dam to Scott River Reach	Nutrients, Organic Enrichment/Low Dissolved Oxygen, Temperature
Middle Klamath River HA, Iron Gate Dam to Scott River Reach, mainstem Klamath	Microcystin
Middle Klamath River HA, Beaver Creek, Cow Creek, Deer Creek, Humgry Creek, West Fork Beaver Creek	Sediment
Middle & Lower Klamath River HAs, Scott River to Trinity River Reach	Nutrients, Organic Enrichment/Low Dissolved Oxygen, Temperature
Middle & Lower Klamath River HAs, Scott River to Trinity River Reach, mainstem Klamath River	Microcystin
Middle & Lower Klamath River HAs, China Creek, Fort Goff Creek, Grider Creek, Portuguese Creek, Thompson Creek, Walker Creek	Sediment
Salmon River HA	Temperature
Scott River HA	Sedimentation/Siltation, Temperature

Beaver Fire

The 2014 Beaver Fire burned approximately 43,327 acres in the following 5th-field watersheds:

- Beaver Creek (16,303 acres burned)

- Horse Creek-Klamath River (21,244 acres burned)
- Humbug Creek-Klamath River (5,780 acres burned)

Aquatic Resources

Beaver Creek is tributary to the Klamath River and the watershed provides approximately 31 miles of CH for SONCC Coho salmon, habitat for winter and summer-run KMP steelhead, and EFH for spring and fall-run UKT Chinook salmon. Tables in Appendix B list the HUC 7 drainages and miles of anadromous salmonid habitat in each. Beaver Creek also provides habitat for Pacific lamprey and other native aquatic species. The Beaver Creek Ecosystem Analysis (USFS 1996) contains more detailed watershed information. Natural barriers exist in tributaries to Beaver Creek: anadromous salmonids cannot access many tributaries including Smokey Creek, Deer Creek and Upper West Fork Beaver Creeks. KNF Chinook spawning surveys indicate that approximately 77% of fall Chinook salmon utilize the lower five miles of Beaver Creek between the mouth and Beaver Creek campground, 22% utilize a four mile reach upstream of the campground, and 1% utilize a reach 9-15 miles upstream of the mouth (USFS 1996). Most of the stream channels in this watershed drain forested mountainous areas. At the present time, there are no known runs of spring Chinook or summer steelhead in Beaver Creek. SONCC Coho salmon CH overlaps with fall Chinook salmon distribution in the Beaver Creek watershed, while also including the lower four miles of Grouse Creek. SONCC coho salmon CH is also found in the Klamath River adjacent to the the watersheds affected by the Beaver Fire, including the lower reaches and confluence zones of Doggett and Kohl Creeks with the Klamath River, and in the lower two miles and seven miles of Buckhorn and Horse Creeks, respectively.

Table 14. Beaver Fire 7th field watersheds, burn acres and miles of Coho CH.

Beaver Fire HUC 7 Watersheds	Beaver Fire Burned Acres	Total Miles of Anadromous Salmonid Habitat/Miles Within Analysis 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 Canyon	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**

Bear Creek, Collins Creek, Little Humbug, Lumgrey Creek, McKinney Creek, Vesa Creek have no proposed activities and will not be discussed further.

Sediment

The Beaver Creek watershed is on the 303(d) Clean Water Act list as impaired for Sediment (Table 13). Approximately 36% of the watershed is privately owned and managed. Intensive management on private lands and high road density contributes to the high risk ratios in the Beaver Creek 5th-field watershed. In addition, Long John, Grouse Creek and Hungry Creek subwatersheds all have large proportions of granitic soils.

The 2014 fires burned at high severity over 6% of this watershed and 28% burned at moderate severity (Table 15) resulting in significant watershed disturbance in the Beaver Creek 5th-field subwatersheds.

Table 16 provides summary CWE modeling results from Mondry's (2015) WSFR Hydrology Report. This report also includes CWE modeling results for Beaver Fire 7th field subwatersheds, some of which exceed TOC, both before and after 2104 fire effects were modeled. See Appendix B for CWE modeling of effects of this project by 5th and 7th field watershed.

Table 15. Summary of watershed burn severity for the 2014 Beaver Fire.

Fire Area	Amount of Very Low Severity Acres (%)	Amount of Low Severity Acres (%)	Amount of Moderate Severity Acres (%)	Amount of High Severity Acres (%)	Total Burned (Acres)
Beaver Fire	5,131 (16%)	16,138 (50%)	9,208 (28%)	1,989 (6%)	32,466

Table 16. Beaver Creek CWE model results at the 5th field watershed scale comparing pre- and post-fire conditions.

5th-field Watershed	Watershed Area (Acres)	Pre-Fire (2012)	Post-Fire, No Action	2014 Fire Area
Beaver Creek				
ERA	69,610	0.7	1.0	
USLE		1.1	1.2	
GEO		0.8	1.1	
Horse Creek-Klamath River				
ERA	98,625	0.7	0.7	Beaver Fire
USLE		0.7	0.8	
GEO		0.7	0.9	
Humbug Creek-Klamath River				
ERA	68,023	0.6	0.3	
USLE		0.6	0.5	
GEO		0.8	0.8	

Lower Beaver Creek is lower gradient and less confined than upper reaches. Pulses of sediment have overloaded the system during extreme storm events (e.g. 1997 flood) and originate from road failures and washouts. Road density in general is high in this watershed and chronic sediment delivery is a result. Road density within RRs is also high: 4.1 miles per square mile. Grouse Creek and Hungary Creek are recognized as heavy sediment contributors to Beaver Creek and the quality of spawning gravels has been reduced due to sedimentation from roads.

Wildfires result in increased runoff and sediment yield commensurate with burn severity. KNF BAER teams reported that, post-fire, about two thirds of the fire area had low or very low levels of soil burn severity and that the rate of water infiltration into the soil in these areas was not greatly affected. Dutch Creek was the most severely affected tributary: approximately 93% of this subwatershed was burned and had a large area of moderate to high soil burn intensity. BAER teams reported the following information: the highest changes in peak runoff potential are in the Dutch Creek, and Kohl Creek. The Kohl Creek watershed had almost half of its acreages in the fire and is at risk for flooding and sedimentation; many of the intermittent and ephemeral channels in the affected watersheds in the Beaver fire area are full of sediment; and, a significant storm event will mobilize this sediment sending it downhill onto forest roads and downstream to perennial streams such as Beaver, Doggett and Kohl Creeks affecting water quality. Much of the moderate and high soil burn severity areas of the fire was on steep terrain in a checkerboard area of ownership with alternating sections of private land with federal land. These conditions have and will continue to make it very difficult to implement effective hillslope treatments. The most effective action taken post-fire to reduce increased runoff and sedimentation was stormproofing the road system. However, BAER teams observed sediment stored in intermittent and ephemeral channels post-fire. These fine sediments will flush downstream during winter storm events.

The Beaver Creek 5th-field watershed is at or exceeds the threshold of concern (TOC; risk ratios greater than 1.0). KNF CWE assessments model disturbances and land sensitivity and results fall on a continuum. As disturbances increase (and recover) over time and space, at some point, the risk of initiating or contributing to existing adverse cumulative watershed impacts becomes a cause for concern. These model-specific levels are called “inference points” (or “thresholds of concern” - TOC) and are used to inform land management decisions. Ecologically, a transition exists from lower to higher risk of adverse effects to beneficial uses – from insignificant to potentially significant. From a management perspective, inference points are intended to represent the center of that transition zone. Inference points do not represent the exact point at which cumulative watershed effects will occur. Rather, they serve as “yellow flag” indicators of increasing susceptibility for significant adverse effects occurring within a watershed. The USLE model assumes 10% of mobilized hillslope sediment is delivered to stream channels during the first winter season post-disturbance, and the GEO model requires a storm event with a 10-year recurrence interval (10% chance of annual occurrence) to produce mass wasting.

In addition to CWE modelling, the KNF is actively monitoring stream channel sediment as part of a program to meet North Coast Water Quality Control Board waiver requirements. A primary goal of this monitoring program is to determine *reference conditions* for stream sediment (Laurie and Elder, 2012). KNF watersheds were stratified in to *managed* and *reference* types (primarily at the 6th-field HUC scale), with the reference watersheds used to define desired conditions in the managed basins. A total of 20 reference streams were established, and sampling of reference stream fine sediment (filled pool volume, surface fines, subsurface fines) was used to define thresholds (75th percentile of reference + survey error) for evaluation of conditions in managed streams (Laurie and Elder, 2012). Prior to the 2014 fires, Beaver Creek mainstem met the sediment reference conditions for all measures of fine sediment (V* and surface and subsurface sediment). The West Fork of Beaver Creek exceeded reference conditions for V* (the fraction of pool volume that is filled with fine sediment).

Decreased interception of rainfall as a result of wildfire as well as increased sediment and runoff delivered to streams, can lead to an increased debris flow probability in the affected watersheds compared to pre-fire conditions. Post-fire debris flow events can degrade or aggrade stream channels and remove riparian vegetation. BAER teams reported that the probability of aquatic habitat being damaged by debris flow is likely and there is a moderate risk of damage to the quality of habitat (for about the next 10-years).

Fire intensity and extent of area burned within RRs is also an indicator of the potential for sedimentation to streams and adverse effects to riparian function. Areas that burned at moderate to high intensity experienced an almost complete loss of soil cover. Where this occurred, the magnitude of impacts would be strongly influenced

by the amount of area impacted and the severity of winter storms immediately following the fire and prior to re-establishment of grasses, forbes and shrubs. The duration of impacts would likely be intermediate between short- and long-duration as regrowth of vegetation covers soils and high gradient channels flush stored sediments, dependent on the magnitude of winter runoff.

Table 17. Burn severity along intermittent and perennial streams in the three project fire areas (data from 2014 BAER assessment reports and derived from BARC data).

Stream Channel Burn Severity						
		Very Low miles (%)	**Low miles (%)**	**Moderate miles (%)**	**High miles (%)**	**Total (miles)**
Happy Camp Complex	Intermittent	23 (9%)	196 (72%)	50 (18%)	2 (0.8%)	271
	Perennial	31 (13%)	188 (76%)	27 (11%)	0.4 (0.2%)	246
Beaver Fire	Intermittent	20 (15%)	66 (50%)	37 (28%)	10 (8%)	133
	Perennial	12 (34%)	18 (51%)	5 (14%)	<1 (<3%)	35
Whites Fire	Intermittent	18 (21%)	43 (50%)	21 (24%)	4 (5%)	86
	Perennial	16 (25%)	36 (57%)	9 (14%)	2 (3%)	63

Post-fire, the Sediment habitat indicator in the Beaver Creek watershed is considered as "at risk" or "not properly functioning" based on modeled risk ratios and expected impacts from the 2014 fires.

Water Quality

Tributaries and upper reaches of Beaver Creek have low summer water temperatures. Although lower reaches of the mainstem Beaver Creek are warmer and diversions exist, temperatures are far cooler than in the Middle Klamath River and are considered "Properly Functioning." Thus, Beaver Creek provides thermal refugia for anadromous salmonids. However, pool habitat is lacking in Lower Beaver Creek, which limits available space for salmonid rearing.

Table 18. 2013 water temperature data for Beaver Creek (USFS 2014h).

Location	**Date of Maximum MWMT**	**MWMT (◦C)**
Beaver Creek upstream from West Fork Beaver	7/23/13	18.4
Beaver Creek 1/4 mile upstream of Klamath River	7/27/13	21.2

Riparian Function

RRs in Beaver Creek have a high density of medium to small conifers and other vegetation. The continuity of RRs along Beaver Creek is impacted by the main road and other disturbed sites including recovering mine sites and flood deposits. The Beaver Creek watershed has a large proportion of private industrial timberlands that are managed under the California Forest Practice Rules, which has included harvest within RRs.

The percent of stream channel burned is used herein as indication of the impacts from the 2014 fires to riparian function. Streamside areas that burned at high severity will provide little to no function with respect to sediment retention, stream shade, microclimate moderation and future large wood recruitment immediately post-fire. Moderate severity burn areas will provide reduced function as an estimated 50% of the streamside vegetation was burned.

Pre-fire wood loading in Beaver Creek was determined to be "properly functioning." The 2014 fires had no effect on instream wood levels in the mainstem but will increase short-term wood loading in some areas and reduce large wood available for recruitment in the long-term, especially in areas burned at moderate or high severity.

The Happy Camp Complex Fire Project Area

The Happy Camp Complex Fire burned approximately 131,313 acres within the following 5th-field watersheds (and their HUC 7 subwatersheds):

- Lower Scott River (30,600 acres)
- Elk Creek (34,633 acres)
- Seiad Creek-Klamath River (50,897 acres)
- Thompson Creek-Klamath River (11,243 acres)

Approximately 1% of the area burned at high severity, and 22% at moderate severity.

Table 19. Summary of watershed burn severity for the 2014 Happy Camp Complex.

Fire Area	Amount of Very Low Acres (%)	Amount of Low Acres (%)	Amount of Moderate Acres (%)	Amount of High Acres (%)	Total (Acres)
Happy Camp Complex	12,472 (10%)	86,814 (67%)	28,182 (22%)	1,439 (1%)	128,907

The WSFR Hydrology Report (Mondry 2015) contains a complete CWE analysis, and model results by 7th field watershed are in Appendix B of this BA. Table 20 summarizes the results of the CWE modeling. ERA post-fire values are relatively low for 5th-field watersheds in the Happy Camp Complex. Numerous 7th field watersheds in the project area exceed the TOC when 2014 fire effects were modeled (see Appendix B tables for post-fire existing condition and effects of the Project CWE values by 5th and 7th field watershed).

Table 20. Modeled pre- and post-fire CWE, USLE and Mass Wasting (GEO) risk ratios for 5th field watersheds within the 2014 Happy Camp Complex.

5th-field Watershed Name	Pre-Fire (2012)	Post-Fire, No Action
Elk Creek		
ERA	0.5	0.5
USLE	0.1	0.3
GEO	1.0	1.0
Lower Scott River		
ERA	0.1	0.5
USLE	0.1	0.5
GEO	0.3	0.6
Seiad Creek-Klamath River	0.6	0.6
	0.3	0.7
ERA	0.5	0.8
USLE		
GEO		
Thompson Creek-Klamath River	0.1	0.4
ERA	0.4	0.3
USLE	0.4	0.5
GEO		

Numerous 7th field watersheds were affected by the Happy Camp Complex and have proposed activities under the WSFR Project.

Table 21. Happy Camp Complex 7th field watersheds, burned acres and miles of Coho CH.

Happy Camp Complex HUC 7 Watersheds	Happy Camp Complex Burned Acres	Total Miles of Anadromous Salmonid Habitat/Miles Within Project 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 &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
Tompkins Creek	9,327.2	5.2/5.2
Toms Valley Creek-Elk Creek	3,598.4	2.1/2.1
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	991.0	4.5/1.1
Grand Total	131,313	119/76.8

Both the Whites Fire and Happy Camp Complex burned within the Lower Scott River. The Happy Camp Complex affected tributaries to the Scott River including 34,239 acres within the Canyon Creek watershed and 9,327 acres in the Tompkins Creek watershed. The Whites Fire burned 1,542 acres within the French Creek watershed. These streams provide important habitat for anadromous salmonids and other native species. The Lower Scott River Ecosystem Analysis (USFS 2000) and the Callahan Ecosystem Analysis (USFS 1997a) contain more detailed information on watershed conditions. For the Scott River, this discussion is focused on areas affected by the fires and that will have proposed activities: the mainstem Scott River from Kelsey Creek downstream, and Tompkins Creek.

Aquatic Resources

The Scott River provides habitat for fall-run Chinook, steelhead, Coho salmon, Pacific lamprey and other native species. Fall Chinook are usually not able to access historical spawning habitat in the upper mainstem Scott River or in the East Fork of South Fork Scott River due to low late summer/early fall flows. Juvenile Coho salmon have been observed in the South Fork Scott River, Boulder Creek, French Creek and Sugar Creeks.

In recent times, and especially since 2001, spawning and/or redds of Coho salmon have been observed in the mainstem Scott River and its tributaries, including: East Fork Scott River, South Fork Scott River, Sugar Creek, French Creek, Miners Creek, Etna Creek, Kidder Creek, Patterson Creek, Shackleford Creek, Mill Creek, Canyon Creek, Kelsey Creek, Tompkins Creek, and Scott Bar Mill Creek (Soil Conservation Service 1972, CDFG 1974, Maurer 2005, Yokel 2007-2011, Calfish 2013 *In* NMFS 2014).

The South Fork Scott River provides approximately 4.7 miles of habitat for anadromous salmonids. KNF stream surveys document that the upper extent of Coho spawning in the South Fork Scott River appears to be limited by a natural barrier in the gorge at mile 4.7.

Tompkins Creek is a third-order perennial of the Scott River. Flowing south, it drains the western flanks of Tom Martin Peak, the south side of Lake Mountain Peak, and much of the east side of the ridge south of Lake Mountain Peak to the Tyler Meadows area. Past and present influences within the drainage include timber harvests, roads, grazing, mining, water diversion, wildfire, and flood. Coho, steelhead, and rainbow trout are present in the creek, with the upstream limits of each species (e.g., approx. three miles upstream from the mouth of Tompkins Creek for SONCC Coho salmon) restricted by gradient, discharge, stream size, and/or barriers.

O'Neil Creek is a second-order perennial tributary to the Middle Klamath and drains the ridgeline between Tom Martin Peak and Lake Mountain Peak. O'Neil Creek provides habitat for rainbow trout, and Coho and Chinook salmon in the lower reaches near or downstream of Highway 96. Due to restoration at Highway 96, SONCC Coho salmon can now ascend O'Neil Creek above the bridge crossing, but suitable habitat is limited above here by progressively steepening gradients.

Elk Creek provides about 51.6 miles of fish-bearing streams and provides habitat for SONCC Coho salmon, Chinook salmon, steelhead, Pacific lamprey, Klamath smallscale sucker and other native fishes. Steelhead are found in the mainstem as well as Bear, Cougar and the East Fork of Elk Creek. Fall-run Chinook salmon are found in the lower 14 miles of Elk Creek. Coho salmon utilize habitat in mainstem Elk Creek and the lower section of East Fork Elk Creek up to Little Elk Creek.

Thompson, Walker and Grider creek watersheds provide spawning, rearing and holding habitat for fall and spring-run Chinook salmon, winter and summer run steelhead and Coho salmon. In addition, these streams provide habitat for Pacific lamprey and other native species. Based on stream survey data anadromous salmonids can access the lower reaches of Grider and West Grider creeks, and Walker Creek. The other smaller,

steep, bedrock-dominated, stream systems found within these subwatersheds are generally more suited to resident trout populations than to anadromous species. However, these streams are critical as thermal refugia to anadromous populations because of the high quality, cool water they provide downstream to the Middle Klamath River system.

Grider Creek is a Key watershed and a domestic water source for private landowners. There are approximately 18.4 miles of fish-bearing streams in the Grider Creek watershed. Coho salmon are found in the lower 8.0 miles of the mainstem of Grider Creek. CH for Coho salmon is considered to be the same as steelhead, that is, the lower 12 miles of the mainstem of Grider Creek. There are no Coho salmon or CH in any of the tributaries to the mainstem of Grider Creek. Steelhead are found within approximately lower 12 miles of the mainstem. Fall-run Chinook salmon are found within the lower 7.5 miles of the mainstem of Grider Creek. Spring-run Chinook salmon are not known to be present in Grider Creek. There is no EFH for Coho salmon or Chinook salmon in any of the tributaries to the mainstem of Grider Creek. Resident trout occupy Rancheria, Fish, and Cliff Valley creeks.

Rancheria Creek is a third order stream that flows west draining the ridgeline south of Lake Mountain Peak to the Marble Mountain Wilderness boundary. This stream supports resident rainbow trout and steelhead in the lower reach, as there is a barrier to upstream salmonid migration about 0.5 miles upstream from the mouth.

Sediment

The Scott River is a 303(d) Clean Water Act listed reach (Sediment; Table 13). Excessive sediment loads and elevated water temperatures in the Scott River and its tributaries have resulted in degraded water quality conditions that impair anadromous fish production. Sediment yield from some Lower Scott River tributaries increased as a result of the 1997 flood and many reaches of the East Fork Scott, Moffett Creek and Shackleford Creek also suffered flood damage.

Sommerstrom (2001) measured fine sediment at many different locations on the mainstem Scott River and also on some tributaries. McNeil samples of fine sediment in the mainstem Scott showed sand size particles (<6.3 mm) to comprise more than 90% of the bed at some locations. Optimal levels of fine sediment of this size would be less than 20%. Sommerstrom (2001 noted that the principle source of fines was watersheds with granitic terrain and more specifically from road surfaces, road cuts and road fills. Following the sediment study, a French Creek Watershed Advisory Group was formed to help coordinate activities in this highly erodible Scott River sub-basin. The U.S. Forest Service, private timber landowners, ranchers, the County of Siskiyou and the Scott Valley CRMP (later to become the Scott Valley Watershed Coucil) all contributed to erosion control projects in French Creek. Studies to determine fine sediment in pools (V*) were conducted by the U.S. Forest Service in French Creek to determine the progress of restoration. The volume of fine sediment in pools decreased from approximately 30% in 1992 to nearer 10% in the following three years. The 1997 high water seemed to shift a great deal of fine sediment to reaches of the Scott River just above its convergence with the Klamath. These reaches are often the most important for spawning, particularly in drought years. However, the flows in fall of 1997 allowed fish access to reaches further upstream that had lower levels of fine sediment. Sediment yield increased in Lower Scott River tributaries on USFS lands as a result of the January 1997 storm event. The U.S. Forest Service repaired some of the flood damage to roads and other infrastructure from the 1997 storms. The most intensive area of activity for road repair after the 1997 flood was in the Canyon Creek, Kelsey Creek, and Tompkins Creek watersheds. The Klamath National Forest improved drainage structures and stream crossings in these watersheds so that future flood damage is much less likely. Even during moderate flows, Moffett Creek has such high turbidity levels that it discolors the Scott River down to its convergence with the Klamath.

Altered sediment supply occurring in the Scott River imposes a medium stress to juvenile and smolt, high stress to adults, and a very high stress to the egg and fry Coho salmon life history stages (NMFS 2014). The movement of fine sediment into streams can cause substrate embeddedness, preventing spawning and smothering eggs in redds.

Additionally, excessive levels of fine sediment in pools and low gradient reaches of the Scott River and its tributaries also reduce the amount of rearing habitat available for juvenile Coho salmon (USFS 2000, NCRWQCB 2006, CDFG 2009, Cramer Fish Sciences et al. 2010 *In* NMFS 2014). While unaltered background levels of sediment were around 10 percent volumetrically, monitoring in the French Creek watershed has shown large fluctuations in the percentages of fine sediment occurring in this watershed (Sommarstrom et al. 2001). Data from the early 1990s indicate a high of approximately 32 percent fine sediment occurring in French Creek in 1992, decreasing to approximately 7.5 percent by 1994 (Power and Hilton 2003), and then reaching a dynamic level of approximately 14 percent in 2012 (Farber and Nicolls 2012). More recent monitoring indicates that there is still a large percentage of fine sediment in the channel substrate in the upper portions of French Creek, which is one of the two most productive spawning and rearing tributaries in the Scott River basin.

Tompkins Creek is considered to be "At Risk" for sediment. A 2011 survey documented elevated fines in pools and substrates relative to reference conditions (USFS 2013). Erosion of streambanks was identified as a primary source of sediment and is a result of past flooding.

The Lower Scott River 5th-field watershed post-fire ERA risk ratios are at 0.48, well below 1.0, and indicating that disturbance resulting from roads, vegetation management, and wildfire is sufficiently below the watershed TOC. This is interpreted to mean that effects on increased peak flow will not be significant at this scale. However, channel change would be expected along reaches that convey debris flows. The Lower Scott post-fire Mass Wasting (GEO) risk ratio is at 0.6, below the TOC and indicates increased hillslope sediment production is not expected to be significant at this scale.

Elk Creek is characterized by having good water quality and serves as a domestic water supply for Happy Camp. Except for broad, coarse alluvial deposits in Elk Creek upstream from its confluence with East Fork Elk, little sediment is stored in stream channels. Most of the coarse sediment in stream channels is delivered by landsliding. Streams in the Elk Creek basin are high gradient, coarse bedded and erosion dominated. Channels run through steep, narrow gorges. This watershed was extensively burned in 1987 and subsequently salvage logged. The January 1, 1997 storm initiated debris torrents at the headwaters of Elk Creek and major channel changes occurred to over 80% of the channel of Elk Creek (De La Fuente 1998). Significant quantities of big wood were entrained by floodwaters and major bed aggradation also occurred.

In 2014, the Happy Camp Complex Fire burned 34,633 acres in the Elk Creek watershed. KNF BAER teams reported that many of the intermittent and ephemeral channels in the affected watersheds are full of sediment and that a significant storm event will mobilize this sediment and send it downstream to perennial streams. BAER teams predicted that the primary watershed responses are expected to include: 1) an initial flush of ash, 2) rill and gully erosion in drainages and on steep slopes within the burned area, and 3) flash floods with increase peak flows and sediment deposition. The BAER teams expected that these responses would be greatest within initial storm events. Field observations after the first larger rain event in November 2014 confirmed that there was an initial flush of sediment and ash. The disturbances will become less evident as vegetation is reestablished, providing ground cover and increasing surface roughness. Soils will also become stabilized and the infiltration capacity of the soils will improve.

The Elk Creek 5th-field watershed ERA risk ratios are at 0.5, well below 1.0 indicating that disturbance resulting from road, vegetation management, and wildfire is sufficiently below the watershed threshold of concern (TOC), and interpreted to mean that effects on increased peak flow will not be significant at this scale. However, channel change would be expected along reaches that conveyed debris flows. At the HUC 7 scale, Middle Elk Creek watershed exceeds the TOC based on post-fire ERA modelling. Middle Elk Creek HUC 7 also exceeds the Mass Wasting (GEO) threshold of concern indicating a risk for increased hillslope sediment production.

Fire intensity and extent burned within RRs are also an indicator for potential sedimentation to streams and adverse effects to riparian function. Sediment impacts are likely to be minor to moderate because of the

relatively low amounts (0.2-0.8%) of intermittent and perennial RRs burned at high severity. These high burn severity areas experienced a nearly complete loss of soil cover. Where this occurred, the magnitude of impacts would be strongly influenced by the severity of winter storms immediately following the fire and prior to re-establishment of grasses, forbes and shrubs. The duration of impacts would be likely to be intermediate between short- and long-duration as regrowth of vegetation reduces sediment source areas and high gradient channels flush stored sediments, dependent on the magnitude of winter runoff.

Thompson, Walker and Grider creeks are high-gradient, coarse-bedded and, due to uplift of the region, erosion dominated. Channels typically run in steep, narrow gorges. Although influenced by large landslides and bedrock structure and composition, channel patterns are dendritic. Except for broad, coarse alluvial deposits in the vicinity of the mouth of Seiad and Grider Creeks, relatively little sediment is stored in stream channels. Channels are typically cut in bedrock. Most of the coarse sediment generated to stream channels is delivered by landsliding. Fine sediment is generated by surface erosion of disturbed areas, as well as landsliding. Conditions within these watersheds are influenced by various watershed disturbances in combination with a large percentage of unstable or easily eroded land types. Large portions of these watershed were impacted by wildfires in 1987 and the January, 1997 flood event, which contributed large amounts of sediment to streams, especially to Walker Creek. Large amounts of coarse sediment were deposited at the mouth of Thompson, Seiad and Walker Creeks as a result of the 1997 flood event. These deposits occur as a result of channel widening where the streams enter the broad Klamath River channel. Such deposits cause wandering of the stream channels and channel-bank erosion. Some areas have received extensive timber harvest and have high road densities. The land types of the watershed include easily eroded granitic soils and both dormant and active landslides.

In the Thompson Creek, China Creek, and upper Walker Creek basins, extensive deposits of the Dormant Landslide and Residual Soil Terrane exist, and many large, active earthflow landslides are found in this terrane. Movement of some of the landslides that produced large quantities of sediment to these streams in the Flood of 1997 is associated with roads. Extensive Granitic Terrane is found in Grider and Walker Creek basins. Some of the sandy, low cohesion soils that form on granitic rocks make road fill that is difficult to stabilize. Refer to the KNF (1999b) Thompson/Seiad/Grider Ecosystem Analysis for more detailed information on watershed disturbance. Watershed impacts include high road densities, wildfires and past timber harvest. From 1922-1997, this area has had a total of 1,026 fires, 67% started by lightning. Extensive areas in these watersheds have been burned in past fires including as recent as 1987, which increased susceptibility to erosion. In the twelve years since these fires, ground fuels have increased. Road erosion in these watersheds is triggered by intense seasonal thunderstorms, however severe erosion problems associated with roads may be chronic, and generally can be traced to one or more causes (e.g. geometric design of the road, road grades, surface type, soil type, road location, steepness of terrain, inadequate drainage structures, road location, lack of maintenance, or vehicle use during wet weather conditions). In addition, numerous road failures occurred in the Rancheria Creek sub-basin which had been logged. The rain-on-snow event in January 1997 triggered over 63 landslides and 15 road failures. The lowest reaches of Grider Creek widened substantially and water temperatures increased.

Water quality monitoring conducted by the Forest Service documented that Walker Creek V* values (pre-2014 fires) exceed reference conditions. A cause of impairment has been attributed to legacy sediment sites from past management.

KNF BAER teams documented conditions in these watersheds after the 2014 fires. Fire intensities in Grider Creek were as follows: 60% low; 30% moderate and 1.2% high (9% unburned). Fire intensities in Walker Creek were as follows: 58% low; 27% moderate and 3% high (11% unburned). The Happy Camp Complex BAER Hydrologic Response Report (USDA-KNF 2014) contains more detailed information on these and other watersheds in the burn area. Post-fire, hydrologists noted that many of the intermittent and ephemeral channels in the affected watersheds in the Happy Camp Complex fire area were full of sediment. A significant storm

event was expected to mobilize this sediment and send it downstream including to Tompkins, Walker, Grider, and East Fork Elk Creek.

Thompson Creek-Klamath River post-fire 5th -field watershed risk ratios are at 0.3, well below 1.0 indicating that disturbance resulting from road, vegetation management, and wildfire is sufficiently below the watershed TOC, and interpreted to mean that effects on increased peak flow will not be significant at this scale. However, channel change would be expected along reaches that conveyed debris flows. The Walker Creek HUC 7 watershed exceeds the TOC based on post-fire ERA modelling. Risk ratios are at 1.03 indicating increased susceptibility for significant adverse effects. The Walker Creek 7th field watershed post-fire Mass Wasting (GEO) risk ratio is at 1.89, exceeding the Mass Wasting (GEO) threshold of concern and indicating a risk for increased hillslope sediment production. The Lower Grider Creek 7th field watershed risk ratio does not exceed TOC. The Lower Grider Creek 7th field watershed post-fire Mass Wasting (GEO) risk ratio is at 1.09, exceeding the Mass Wasting (GEO) threshold of concern and indicating a risk for increased hillslope sediment production.

KNF fisheries biologists conducted Chinook salmon spawning surveys post-fire and observed large quantities of post-fire sediment in the mainstem Grider Creek (Figure 1).

Figure 1. Post-fire sediment slug in Grider Creek.

Water Quality

Anthropogenic processes that influence water temperature include changes to: stream shade, stream flow via changes in groundwater accretion/reduction, stream flow via surface water use, microclimate, and channel geometry. The primary factor affecting stream temperatures in the Scott River watershed is increased solar radiation resulting from reductions of shade provided by near-stream vegetation. Changes in groundwater accretion also impact water temperatures in Scott Valley. Diversions of surface water lead to relatively small temperature impacts in the mainstem Scott River, but have the potential to affect temperatures in smaller tributaries where the volume of water diverted is relatively large compared to the total stream flow. Microclimate alterations resulting from near-stream vegetation removal increase temperatures, where microclimates exist. Changes in channel geometry from natural conditions may also negatively affect water temperatures.

Water temperatures in the Scott River can be limiting for salmonids, particularly in dry years. Flow depletion tends to contribute to temperature problems. Comprehensive temperature monitoring on the Scott and its tributaries has provided a greater understanding of how varying water years can affect temperature. The Scott River can exceed stressful conditions for salmonids in low gradient valley reaches in dry years, but remains below stressful on average in wet years. The warmest reaches of the Scott mainstem in the valley are at Highway 3 and Jones Beach. The Lower Scott River flows in a gorge which is completely open to the full arc of

the summer sun and very subject to warming. Cold water tributaries flowing from USFS lands in the Marble Mountains moderate mainstem Scott River temperatures in this reach and provide substantialthermal refugia at their mouths. Channel scour in other Lower Scott River tributaries may also contribute to temperature increases. Loss of cold water contributions from these lower tributaries may have profound impact on ecosystem function in the Lower Scott River. Long-term trends show that periods of critically low flow have tended to increase since 1942, when flow records began to be monitored consistently on the Scott River.

Where passage is possible, juvenile fish can reach thermal refugia pools along both the mainstem Scott River and west-side tributaries, where the water temperature can be several degrees cooler than in adjacent channels. NMFS (2014) lists the following areas as thermal refugia: French Creek, Patterson Creek, Kidder Creek, Shakleford/Mill Creek, Scott River from Boulder Creek to Tompkins Creek, Canyon Creek, Kelsey Creek and Tompkins Creek.

The WSFR Project is within the Lower Scott River 5th-field watershed, which includes the mainstem from the mouth to about one mile east of Jones Beach or Isinglass Creek area, and all the subwatersheds and other land areas that drain to this section of mainstem. While the mainstem Scott River stream temperatures are "not properly functioning", French, Tomkins and Canyon creeks are all considered "Properly Functioning" relative to stream temperatures (see Table 13) and provide important thermal input and refugia to aquatic species in this watershed.

Table 22. 2013 water temperature data for Lower Scott River (USFS 2014h).

Location	Date of Maximum MWMT	Maximum Weekly Maximum Temperature ºC (MWMT)
Scott River at Sugarpine Gulch	7/26/13	26.6
Scott River downstream of Bridge Flat CG	7/27/13	23.7
Scott R downstream from Townsends GL	7/27/13	24.6
Scott River near 7F01Bridge	7/26/13	27.9
French Creek upstream of NF French Creek	7/26/13	19.7
Tompkins Creek at USFS property line Sec. 3	7/27/13	17.4
Canyon Creek (Scott) just upstream from mouth	7/27/13	16.3

The percent of streamside areas that burned in the 2014 fires is an indication of impacts to riparian function, including stream shade along perennial streams. Approximately 0.2% of perennial streamside areas burned at high severity and will provide little to no shade post-fire and until trees re-establish. Approximately 11% of perennial streamside areas burned at moderate severity and, based on field observations, experienced an estimated 50% loss of vegetation. The percent of impact from 2014 Happy Camp Complex fires to streamside areas is relatively

Figure 2. Burned RR in Grider Creek, fall 2014.

low, and is not expected to result in measurable changes to stream temperatures.

Table 23. Summary of stream channel burn severity data from BAER reports (USFS 2014a-2014f) for the 2014 Happy Camp Complex.

Fire Area	Stream Type	Very Low miles (%)	Low Miles (%)	Moderate miles (%)	High miles (%)	Total (miles)
Happy Camp Complex	Intermittent	23 (9%)	196 (72%)	50 (18%)	2 (0.8%)	271
	Perennial	31 (13%)	188 (76%)	27 (11%)	0.4 (0.2%)	246

Peak summer temperatures have been higher than optimal for fish in the lower mainstem reaches of Elk Creek. However, habitat in Elk Creek provides some of the highest quality spawning and rearing habitat for Coho salmon in the Middle Klamath River (Mid Klamath Restoration Partnership 2010) and Elk Creek is considered thermal refugia (MKWC 2006, NCRWQCB 2010). Recent temperature monitoring data collected by the KNF indicates that Elk Creek stream temperatures range from "Properly Functioning" to "At Risk."

Table 24. 2013 water temperature data for Elk Creek (USFS 2014h).

Location	Date of Maximum MWMT	Maximum Weekly Maximum Temperature ºC (MWMT)
Elk Creek at 7C001 Bridge	7/27/13	23.0
Elk Creek upstream of mouth ~0.5 mile	7/27/13	23.2
Elk Creek upstream of Bear Creek	7/27/13	20.5
East Fork Elk Creek upstream from mouth	7/27/13	20.0

Thompson, Walker and Grider creeks are rainfall dominated. Streamflows and the maintenance of cool water during the hot dry season are sustained primarily by groundwater inputs. Large areas of dormant landslide terrain, typically composed of deep red soils, function as a sponge in storing and slowly releasing large quantities of water. Most of the subwatersheds generally have streams that flow dependably all year long, with relatively high baseflows and good water quality. Most named creeks support fish in their lower reaches before the channel gradient gets too high and upstream passage becomes restricted by waterfalls or debris jams in constricted channels.

The mouth of Grider Creek formerly produced one of the most important large, cold water refuge areas on the mainstem Klamath (Belchik and Turo, 2002), but the flood effects of the 1997 storm raised temperatures and reduced the benefit of this area as a refugia. However, Grider Creek provides CH for Coho salmon and stream temperatures are rated as "Properly Functioning" relative to salmonid criteria.

Walker Creek suffered the worst flood damage in 1997 of any stream on the KNF and its stream channel and floodplains were scoured from headwaters to the mouth. One reach of Walker Creek went from approximately 50 feet wide to over 200 feet wide. It will be decades before this tributary recovers. It had provided a medium sized refuge area of cold water at its convergence with the Klamath according (Belchik and Turo, 2002). Walker, Grider and Thompson creeks provide important water quality to the Middle Klamath River and these tributaries may provide thermal refugia for anadromous salmonids during warm periods.

Table 25. 2013 water temperature data for Walker, Grider, and Thompson creeks (USFS 2014h).

Location	Date of Maximum MWMT	Maximum Weekly Maximum Temperature ºC (MWMT)
Grider Creek near 46N66 Bridge	7/27/13	19.1
Walker Creek at ~RM 1.1	7/27/13	18.9
Thompson Creek near 18N02 Bridge	7/27/13	17.3
Thompson Creek upstream from Cedar Creek	7/30/13	15.4

Riparian Function

The Lower Scott River flows through a canyon with intermediate gradient and faster current, when there is sufficient flows. A majority of the Lower Scott River basin is USFS lands and the mid- and upper valley portions are mostly privately owned.

The 2014 fires had no effect on instream wood levels in the mainstem Scott River but will affect short-term wood loading, and large wood available for recruitment in the long-term. Fire intensity and extent of area burned within RRs is used herein as to update available large wood information collected prior to the 2014 fires. High burn severity areas along perennial streams will experience an increase in wood loading in the short-term and a reduction in large wood available for recruitment to streams in the long-term. The percent of perennial stream channels that burned at high severity during the 2014 fires is limited (<0.2 percent), indicating that fire effects to the large wood loading and recruitment baseline were insignificant. Approximately 11% of perennial stream RRs were burned at moderate severity in the Happy Camp Complex, and an estimated 50 percent of the vegetation was burned in these areas. Thus, in the moderate severity areas, an increase in large wood loading is expected in the near term, and a reduction in large wood available for recruitment is expected in the long-term. Collectively, these high and moderate burn severity areas will increase large wood loading in the near term and reduce the available sources of large wood recruitment in the long-term.

The Happy Camp Complex burned approximately 34,633 acres within the Elk Creek watershed. Elk Creek is a tributary of the Klamath River and a “Key” watershed. Its’ confluence with the Klamath River is just downstream of the town of Happy Camp. Over 99% of the lands in the Elk Creek watershed are federal lands. The Elk Creek Ecosystem Analysis contains more detailed watershed information (USFS 1995d).

The Happy Camp Complex burned 11,243 acres in the Thompson Creek-Klamath River 5th-field watershed, 7,593 acres in the Walker Creek watershed, and 20,223 acres in the Grider Creek watershed. Walker and Grider creeks are included here because they are important 6th-field Klamath River tributaries that provide habitat, including non-natal rearing habitat, for anadromous salmonids and other native species, and have proposed Project activities. For more detailed information on these watersheds see the Thompson/Seiad/Grider Ecosystem Analysis (USFS 1999).

RRs in the Elk Creek basin are predominately forested and comprised of conifers and hardwoods. Current levels of large woody debris are considered “at risk”. Large wood was removed from Elk Creek in the 1960s and 1970s to prevent damage to downstream infrastructure and floods have since removed shallow-rooted vegetation, such as alders, in patches immediately adjacent to the mainstem. Large wood is delivered to stream channels via debris flows in Elk Creek. The Elk Creek Mass Wasting Risk Ration is at 0.98, bumping up against the Mass Wasting (GEO) threshold of concern, indicating an increasing risk for debris flows, which would increase large wood loading to streams as well as sedimentation. Debris slides and floodwaters from the 1997 storms contributed large wood, which subsequently added to habitat complexity in Lower Elk Creek.

The 2014 fires had no effect on instream wood levels in the mainstem Elk Creek but will increase wood loading in the near-term, and reduce large wood available for recruitment in burned areas in the long-term. Fire intensity and extent of area burned within RRs is used here to update available large wood information collected prior to the 2014 fires. High burn severity areas along perennial streams will experience an increase in wood loading in the short-term and a reduction in large wood available for recruitment to streams in the long-term. The percent of perennial stream channels that burned during the 2014 firees at high severity is limited (<0.2 percent) indicating that effects to large wood loading and recruitment will be minor. Approximately 11% of perennial stream RRs were burned at moderate severity in the Happy Camp Complex, and an estimated 50 percent of the vegetation was burned in these areas. Thus, in the moderate severity areas, an increase in large wood loading is expected in the near term, and a reduction in large wood available for recruitment is expected in the long-term.

The Whites Fire Project Area

The Whites Fire burned a total of 38,916 acres in the North Fork Salmon River. Amount of burned area, and total miles of CH, within the 7th field watersheds of the Whites Fire are shown in Table 26. USFS ecosystem analyses (USFS 1995b; USFS1995c; USFS 1997b and c) contain more detailed watershed information. Current environmental baseline information for habitat indicators in fish-bearing 7th field watersheds is provided in Appendix D.

Table 26. Whites Fire 7th field watersheds, burned acres and miles of Coho CH.

Whites Fire HUC 7 Watersheds	Whites Fire Burned Acres	Total Miles of Anadromous Salmonid Habitat/Miles Within the Analysis Area	Total Miles of Fish-Bearing Streams/Miles of Habitat Within the Analysis Area
Big Creek	104.2	1.1/0	1.1/0
Eddy Gulch	178.3	2.7/0.2	2.7/0.2
Jackass Gulch	384.3	2.5/0	2.8/0
Jessups Gulch-North Fork Salmon River	328.2	2.6/0.2	2.6/0.2
Lower North Russian Creek	4,501.2	4.6/4.6	4.7/4.7
Lower South Russian Creek	2,137.9	2.1/2.1	2.2/2.2
Music Creek	3,285.8	0	0
Robinson Gulch-North Fork Salmon River	5,038.0	4.6/4.6	4.6/4.6
Shadow Creek	693.7	1.9/0	1.9/0
Sixmile Creek	885.9		2.5/0
Specimen Creek	164.1	2.2/0	3.2/0
Sugar Creek	234.6	4.0/0	9.2/0
Taylor Creek	2,973.2	0/0	0/0
Upper French Creek	1,307.8	8.5/0	15./0.5
Upper North Russian Creek	1,346.8	1.2/1.1	1.2/1.1
Upper South Russian Creek	5,142.4	1.0/1.0	8.0/5.9
Whites Gulch	8,308.2	1.6/1.6	3.6/3.6
Yellow Dog Creek-North Fork Salmon River	5,023.1	6.0/3.5	6.1/3.5
Grand Total	**42,037.9**	**46.6/18.9**	**71.4/26.5**

Aquatic Resources

The Salmon River is a Key Watershed. This basin provides approximately 175 miles of anadromous fish habitat (Elder et al. 2002), distributed within the main stem, Wooley Creek, and North Fork and South Fork Salmon River, including for spring and fall run UKT Chinook salmon, summer and winter run KMP steelhead, and SONCC Coho salmon.

The Salmon River spring-run Chinook salmon are one of the last and largest populations in the Klamath River system (Elder et al. 2002). Spring Chinook use the mainstem Salmon River, Nordheimer Creek, and Wooley Creek (Brucker 2004 *In* NCRWQCB 2005; Barnhart 1994, USFS 1995c, West 1991) and apparently use the mainstem North Fork up to the confluence with Right Hand Fork, as well as the Little North Fork and South Russian Creek (Brucker 2004, USFS 1995c). Spring Chinook use the South Fork mainstem at least to the Little South Fork and to Shadow Creek in the East Fork of the South Fork, as well as several tributaries, particularly Knownothing Creek and Methodist Creek (Brucker 2004, Elder et al. 2002, USFS 1997c).

Fall Chinook use much of the same habitat (except for holding) as the spring Chinook, though generally do not go as far up the streams. Barnhart (1994) stated that fall Chinook use in the mainstem, North Fork, and South Fork, and Moyle (2002) indicated Wooley Creek as a spawning stream as well. Use in the North Fork occurs at least up to Russian Creek USFS (1995c), and in the South Fork up to French Creek (Barnhart 1994). Spawning occurs in Nordheimer Creek, a mainstem tributary, as well as in a number of tributaries to the South and North forks. Brucker (2004) reports observations of late fall/winter run Chinook in the Lower Salmon River watershed below Knownothing Creek.

Steelhead are the most widely distributed of anadromous salmonids in the Salmon River system (Elder, et al 2002). Summer steelhead adults use summer holding areas with spring Chinook. Snorkel counts of summer steelhead indicate about 50% hold in the South Fork, the remainder split equally between Wooley Creek, the North Fork and the mainstem (USFS 1997b).

The North Fork Salmon River (5^{th}-field watershed) is one of two major forks of the Salmon River and is part of the National Wild and Scenic River System. The North Fork Salmon River provides habitat for the Klamath River's largest wild run of spring Chinook, as well as KMP summer-run steelhead. These wild Salmon River runs are unaffected by hatchery-produced salmonids because there are no fish hatcheries in the Salmon River basin. Coho and Chinook are present in the North Fork Salmon River. Spawning and dive surveys document spring- and fall-run Chinook and summer steelhead.

A comprehensive review of datasets originating from multiple agencies/entities was conducted by CDFW, with the conclusion that Coho presence in the North Fork Salmon River has been substantiated (Garwood 2012). Coho spawning surveys in the North Fork Salmon River are not conducted due to dangerous discharge conditions and poor water visibility, therefore observations of rearing juveniles during summer and fall is used to indicate Coho presence. A 2005 survey of thermal refugia in the North Fork Salmon River found Coho juveniles at the mouth of the following tributaries: Big Creek, Olsen Gulch, Jones Gulch, Little North Fork Salmon River, Shiltos Creek, and Jackass Gulch (SRRC 2005). Coho, Chinook and steelhead presence in Big Creek is expected to be limited to the mouth area only due to the small size of this drainage, low discharge, steep gradient, and lack of adequate spawning substrate. The culvert, just above the mouth of Big Creek, is considered to be a barrier to anadromous fish. Coho or Chinook surveys have not been conducted in Jackass Gulch; suitability of the system for these species is unknown. Spawning surveys were performed in 1991 and 1999, but no live fish, carcasses, or redds were found. The upstream limit of anadromy is considered to be a waterfall located ~0.2 miles above the mouth. This barrier was noted by KNF biologists in 1975, 1983, and 1988. The falls were modified in 1990 by the installation of two log and rock weirs to allow steelhead access to upstream habitat, however, the structures are no longer functioning as designed. No surveys specifically targeting Coho or Chinook salmon have been completed in the Specimen Creek drainage. This situation is largely due to difficulty of road access and/or unsafe discharge conditions when Coho would be expected to be spawning. Habitat surveys which included snorkeling to identify fish occurred in 1991, but did not observe Coho. Resident rainbow trout and presumed steelhead juveniles have been observed in the mainstem Specimen

Creek to 1.5 miles up from the mouth, with resident trout present for an additional mile upstream; and both are found on Left Hand Fork to a distance of 0.75 miles up from the mouth. Fish (fry) have also been recorded as present in the King Creek tributary to a distance of ~1000 feet. Additionally, spawning surveys conducted in 1981, 1988, 1990-1996, and 1999 were positive all years, except 1993, for live steelhead and redds. Although Garwood (2012) stated Coho occupancy in Specimen Creek to be unsubstantiated, this conclusion was based from limited records. The 1995 Klamath National Forest North Fork watershed analysis did identify Specimen Creek as potentially supporting Coho salmon (USFS 1995).

Sediment

In addition to fire effects, landsliding is a significant watershed process of concern in the North Fork Salmon River. Roads and harvest in granitic soils, road density, and fire are concerns relative to increasing landslide potential in this watershed. During the Twentieth Century, 75 percent of the landslide-derived sediment, which entered the stream, was associated with flood and storm events that occurred from 1964 to 1975. Roads produced landslides at a rate much higher than undisturbed lands. Harvested or burned areas produced landslides at a rate much lower than roads but higher than undisturbed lands.

The 2014 wildfires affected tributaries to the North Fork Salmon River that provide habitat for anadromous salmonids (Cow Creek, North Russian, South Russian and Whites Gulch) as well as tributaries that provide habitat for resident steelhead trout (Highland Creek, Hogan Creek, Johns Meadows Creek, Music Creek, Sawmill Gulch and Taylor Creek). Several other small, unnamed drainages that drain the east side of Tanners Peak towards the North Fork Salmon River between Idlewild Campground and Mule Bridge were also burned but do not have connectivity to the North Fork Salmon. Redd mapping (2011 through 2013) has documented Chinook redds scattered throughout anadromous streams in the 2014 fire-affected area. Although fire and its effects are a part of the natural disturbance regime in a watershed, a primary concern is the potential for excessive fine sediment, which can result in pool filling, impacts to spawning substrate, food production and thermal refugia. Several accessible tributaries to the North Fork Salmon River within the wildfire area function as thermal refugia when the mainstem North Fork Salmon River temperatures increase. The extent of damage to RRs and the potential for impacts to stream shade is also a concern.

Post-fire BAER field reviews were focused on identifying the necessary treatments to minimize both road failure and general mobilization of post-fire road-related sediment, such as installation of critical dips and cleaning of culverts and cross-drains. Treatments were identified for Whites Gulch as multiple culverts were found to be partially blocked with debris, with a few completely buried such that the inlet could not be found. Post-fire mapping indicated that burn intensity along fish-bearing streams was predominantly low, or unburned. The primary exception was East Fork Whites Gulch, as well as a small segment of the North Fork Salmon River in the Hickey/Applesauce Gulch area. Additionally, the riparian area of many of the larger fishless perennial streams within the fire boundary exhibit relatively low burn severity. Field observation confirmed mapping results.

Table 27. Summary of watershed burn severity for 2014 Whites Fire.

Fire Area	Amount of Very Low Acres (%)	Amount of Low Acres (%)	Amount of Moderate Acres (%)	Amount of High Acres (%)	Total (Acres)
Whites Fire	5,612 (17%)	16,497 (49%)	10,007 (30%)	1,637 (5%)	33,753

The North Fork Salmon River post-fire 5th-field watershed risk ratio is at 0.33, well below 1 indicating that disturbance resulting from road, vegetation management, and wildfire is sufficiently below the watershed TOC, and interpreted to mean that effects on increased peak flow will not be significant at this scale. However,

channel change would be expected along streams/reaches that conveyed debris flows. The North Fork Salmon River 5th-field watershed post-fire Mass Wasting (GEO) risk ratio is at 0.73 and does not exceed the Mass Wasting (GEO) threshold of concern.

Table 28. Modeled post-fire CWE, USLE, and Mass Wasting (GEO) risk ratios for Whites Fire 5th field watersheds.

5th-field Watershed	Area (Acres)	Pre-Fire (2012)	Post-Fire, No Action	2014 Fire Area
ERA Risk Ratios				
North Fork Salmon River	130,545	0.17	0.34	Whites Fire
USLE Risk Ratios				
North Fork Salmon River	130,545	0.05	0.33	Whites Fire
GEO Risk Ratios				
North Fork Salmon River	130,545	0.53	0.73	Whites Fire

Water Quality

The Salmon River is impaired and is listed under the 303(d) Clean Water Act for temperature (Table 13). Water temperatures stressful to salmonids occur in the Lower Salmon River annually, but the extent and duration changes in different flow years. Cool, deep pools in the Lower Salmon River are critical for summer holding and rearing salmonids. Spawning occurs in the mainstem Salmon River in gravels located in pool tail-outs.

Shade is lacking along the entire North Fork of the Salmon, with the exception of the upper-most reaches. Tributary temperatures are typically below lethal levels and provide thermal refugia. The Little North Fork has the largest cooling effect on the North Fork of the Salmon River due to its significant flow contribution. High water temperatures have resulted in fish kills of spring-run Chinook salmon and summer steelhead during warm low-flow drought conditions of some summer seasons, such as in 1994 and 2014.

The KNF collected water temperature data in 2013 (Table 29). Temperatures ranged from “properly functioning” to “at risk” to “not properly functioning.”

Table 29. 2013 water temperature data for NF Salmon River (USFS 2014h).

Location	Date of Maximum MWMT	Maximum Weekly Maximum Temperature ºC (MWMT)
NF Salmon River upstream of Mule Bridge	7/27/13	21.9
NF Salmon River upstream of Right Hand Fork	7/27/13	19.5
NF Salmon River just upstream of Forks	7/27/13	26.2
NF Salmon R upstream of Little NF	7/30/13	25.6

The percent of stream channel burned in 2014 is an indication of the impacts to riparian function, including stream shade along perennial streams. Approximately 3% of streamside areas were burned at high severity and these areas will provide little to no shade to stream channels post-fire until trees re-establish. Approximately 14% of streamside areas burned at moderate severity, and these areas experienced an estimated 50% reduction in streamside vegetation. The relative percentages of reduction in vegetation along streams is low, and are not expected to measurably increase stream temperatures.

Table 30. Summary of stream channel burn severity data from BAER reports (USFS 2014a-2014f) for the 2014 Whites Fire.

Fire Area	Stream Type	Very Low Severity Miles (%)	Low Severity Miles (%)	Moderate Severity Miles (%)	High Severity Miles (%)	Total (miles)
Whites Fire	Intermittent	18 (21%)	43 (50%)	21 (24%)	4 (5%)	86
	Perennial	16 (25%)	36 (57%)	9 (14%)	2 (3%)	63

Riparian Function

Approximately 29 percent of the watershed is designated as RRs, which includes unstable or potentially unstable lands and stream buffers. Current conditions in RRs have been impacted by historic grazing, roads, stream crossings, and mining. Analysis of the 1944 air photos showed that at that time, most stream channels were fully vegetated with a mixture of conifer and hardwood species. The 1964 flood resulted in major changes to the stream channel in that the channel widened and long segments were scoured out. The entire length of the North Fork of the Salmon River was modified and stripped of riparian vegetation. For context, there were 8 miles of freshly scoured channels visible on the 1944 air photos, 40 miles of freshly scoured channels on the 1965 photos, and 12 miles of freshly scoured channels on the 1975 photos. Recovery from debris and other scour events occur in stages and along variable timelines. Full recovery of large conifers may take 100 years or more, although initial recovery of short-lived riparian species that also provide bank stability and integrity can occur in a decade or two. In 1995 the Klamath National Forest estimated that the mainstem North Fork of the Salmon River showed 20 percent initial recovery since the 1964 flood. This may be because, in general, larger streams recover more slowly than smaller streams (the KNF also studied recovery of smaller streams) due to larger surface areas affected by scour and larger streamflows acting on this surface. Unstable areas and disturbed streams that have poorly defined primary channels may recover slowly due to frequent re-disturbance by subsequent high flow events.

Significant portions of RRs were burned in the past with moderate to high severity by the Hog, Yellow, and Specimen fires. Riparian vegetation recovery to a mature state within granitic terrains takes approximately 80 years (to re-establish large conifers). As described above, post-2014 fire mapping indicated that burn intensity along fish-bearing streams was predominantly low, or unburned. The primary exception was East Fork Whites Gulch, as well as a small segment of the North Fork Salmon River in the Hickey/Applesauce Gulch area. Additionally, the riparian area of many of the larger fishless perennial streams within the fire boundary exhibit relatively low burn severity. Field observation confirmed mapping results.

The 2014 fires had no effect on instream wood levels in the mainstem but will affect tributaries that burned relative to short-term wood loading and large wood available for recruitment in the long-term. Fire intensity and extent of area burned within RRs is used herein to update the large wood information collected prior to the 2014 fires. High burn severity areas along perennial streams will experience an increase in wood loading in the short-term and a reduction in large wood available for recruitment to streams in the long-term. The percent of perennial stream channels that burned in the Whites Fire at high severity is limited (3%) indicating that effects to large wood loading and recruitment will be minor. Approximately 14% of perennial stream RRs were burned at moderate severity in the Whites Fire, and an estimated 50 percent of the vegetation was burned in these areas. Collectively, these high and moderate burn severity areas will increase large wood loading in the near term and reduce the available sources of large wood available for recruitment in the long-term.

VII. Effects of the Action

The following effects analysis is based upon project data as of 03/31/15. Since that date, field review has continued to provide information that leads to minor modifications in project design such as trimming or dropping of treatment units based on feasibility or economic (cost/benefit) considerations; or changes to logging systems and temporary roads and landings. During this consultation process, potential changes to the following

roads were discussed: roads 46N78, 46N41YA, 15N75A, 40N61A and 46N30Y. The potential changes to project design for these roads would reduce potential impacts to riparian/aquatic resources including SONCC Coho salmon and CH (roads may be dropped prior to decision and not used in the Project). The analysis presented in this biological assessment, however, includes actions on these roads as described herein and displayed on maps in Appendix A.

Direct Effects

The potential for direct effects to Coho salmon and anadromous salmonid habitat is associated with actions that occur within active stream channels. The only PEs proposed within active stream channels are water drafting and road stream crossing work, the latter related to both temporary road use and Legacy sediment site restoration.

Water Drafting. Direct effects to Coho salmon and anadromous salmonid habitat can result from water drafting activities. Numerous water drafting sites may be used for the WSFR Project, and some are within Coho salmon CH (see locations in Appendix A).

Drafting operations can disturb holding or spawning adult fish, as well as impinge or entrain juveniles (Sicking 2003). Additionally, water drafting operations can mobilize suspended sediment to nearby downstream aquatic habitat. Suspended sediment increases turbidity, exposing juvenile fish to gill damage and reduced oxygen uptake, and/or reduced vision and compromised feeding effectiveness. If water drafting were to occur with eggs present in adjacent redds, it is possible that deposition of suspended sediment could fill interstices of stream bottom substrate, depriving incubating eggs of dissolved oxygen and resulting in their mortality.

While screening intakes can reduce effects to fingerlings and fry, minimization of impingement requires the use of specific mesh sizes, pumping rates, and sufficiently large screen areas, as outlined in the *NOAA Fisheries Water Drafting Specifications* (NOAA 2001). NOAA drafting specifications will be implemented during water drafting at all sites within Coho salmon CH. There is a very low probability of impingement given that fish have been routinely observed to temporarily move away from a drafting pump site when a truck or hose is detected. An important minimization measure is Watershed PDF-5, which requires that decisions regarding which drafting sites to use in a given area be coordinated with KNF fisheries biologists. Based on observations, it is anticipated that fish temporarily avoiding water drafting activities are not likely to experience reduced feeding success, nor be exposed to a significantly higher probability of exposure to prey.

Proximity. Numerous water drafting sites are within anadromous salmonid habitat (CH). Numerous drafting sites have been identified for use to provide greater flexibility in choosing the best source during Project implementation, and to minimize exposure of fish and particularly SONCC Coho salmon to water drafting. Not all sites mapped for potential use during the Project will be used. The timing of water drafting limits the potential for direct impacts to Coho salmo;: adults or eggs are not typically present, but juveniles may be present. Chinook and Coho egg incubation period is generally October through March, during the winter period. Therefore likelihood of water drafting having any effect on the reproduction of Chinook or Coho salmon is low. However, the potential for effects to rearing juvenile Coho salmon ranges from low to high, dependent upon the drafting site location and other localized conditions such as drought and/or other nearby water withdrawals related to wildfire suppression or private land activities.

Probability. Rearing juvenile Coho salmon would be expected to move away from drafting sites when a truck approaches or a hose is dropped. If an individual fish did not flee, there is a probability of impacts. Therefore the magnitude of potential effects is discussed below. Project design feature Watershed-5 further reduces the probability that Coho salmon would be present or affected by project water drafting, by requiring that KNF fisheries biologists help determine where drafting will occur. Sites that are not likely to have rearing Coho salmon present will be prioritized for use, such as mainstem sites on the Klamath, Scott, and Salmon rivers. Priority will also be given to sites that involve drafting relatively warmer waters in mainstem rivers; 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 dependent upon thermal refugia). Water storage facilities such as foldable tanks are encouraged and will be assessed for sites with moderate flows that simultaneously support rearing SONCC coho salmon, and may be subject to high drafting use (e. g., Walker Creek). Project-related water drafting will be monitored, and shifted away from streams if their baseflows will no longer sustain drafting-related water withdrawal consistent with PDFs. 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 Cr, O'Neil Cr, Little Horse Cr, and China Cr.

PDFs eliminate any drafting site alterations within CH, such as deepening pools or removing , vegetation. Due to implementation of Forest Service BMPs and PDFs specific to water drafting, effects on anadromous salmonid habitat will be insignificant.

Magnitude. While screening intakes can reduce effects to fingerlings and fry, minimization of impingement requires the use of specific mesh sizes, pumping rates, and screen areas, as outlined in the *NOAA Fisheries Water Drafting Specifications* (NOAA 2001). NOAA drafting specifications will be implemented during project water drafting within Coho salmon CH (see maps in Appendix A for locations). Forest Service BMPs which require screening for aquatic species present, will be implemented at water drafting sites outside of CH. As described above, there is a very low probability of impacts, especially impingement on screens, given that fish routinely move away when a truck or hose is detected. It is anticipated that fish temporarily fleeing or avoiding water drafting activities are not likely to experience measurable reductions in feeding success, nor result in a high probability of exposure to prey, due to the limited extent of drafting sites relative to other available and suitable habitat located adjacent to where drafting will occur.

The frequency of effects from water drafting is limited to dry months, during operations, and when those operations overlap with juvenile rearing (summer months). Drafting will be done in accordance to the NOAA *Fisheries Water Drafting Specifications* (NOAA 2001) and appropriate Project PDFs (Appendix E) and BMPs. By following these specifications and considering the mobility and likely behavioral response of Coho salmon to move out of the area when a truck approaches or hose is dropped, the effects of water drafting will have minor and insignificant direct effects on Coho salmon.

The direct effects of water drafting will be limited to periods of project implementation (short-term) and are likely to result in only minor effects on Coho salmon, and insignificant effects to anadromous salmonid habitat (including CH/EFH). Direct effects will be neutral in the long-term.

Stream Crossings. Installation of temporary stream crossings on proposed temporary roads will mostly occur in dry intermittent and ephemeral stream channels. Proposed temporary road actions that include stream crossings are: 46N41YA in Lower Grider Creek drainage, 46N78 in China Creek drainage, and 46N77 in Cliff Valley Creek drainage. None of the stream crossings are within fish-bearing habitat and stream crossings will not directly affect anadromous salmonids. Indirect effects are discussed below. Methods and minimization measures for stream crossings, including for culvert installation and dewatering/rewatering, were analyzed in the Facilities Maintenance and Watershed Restoration BA (USFS 2004) and these methods and measures will be implemented as part of this project to minimize direct and indirect effects. Due to the location of temporary stream crossing work upslope and at least 0.5 mile away from SONCC Coho salmon CH, and the localized nature of impacts from project stream crossing work, direct effects on Coho salmon are expected to be discountable, while effects on anadromous salmonid habitat at least 0.5 mile downstream are expected to be insignificantly small.

Legacy sediment site repair will include work at stream crossings to address sediment sources or to provide improved passage for aquatic species (see Appendix A for map of legacy sediment site repair in Elk Creek watershed). The proposed legacy sites are in the Elk Creek watershed (and one site in Lower Grider Cr drainage, if 46N41YA is used in the Project) but are not within anadromous salmonid habitat. PDFs and BMPs

will be implemented to minimize short term effects. Because legacy sites are not within accessible habitat (at least 300 feet upstream), direct effects from legacy site repairs to Coho salmon are expected to be discountable, and effects to anadromous salmonid habitat will be insignificant. Indirect effects are discussed below.

Proximity. None of the legacy sediment site treatments or temporary stream crossing work will occur in habitat accessible to Coho salmon or other anadromous salmonids. None of the three temporary road actions that involve stream crossings are within CH. Proximity of these crossings to CH are as follows: 46N41YA, face drainage just over ½ mile upstream of CH in Grider Cr; 46N77 Cliff Valley Cr about 3 miles upstream of CH in Grider Cr; 46N78 South Fork Three Biscuit Cr about 2.5 miles upstream of CH in China Cr.

Six of the proposed culvert upgrade sites in Elk Creek Watershed are approximately 300 feet upstream of CH. Stream crossing work will occur in a dry channel wherever possible; and BMPs and PDFs will be implemented to minimize effects to aquatic species and habitat present. Because work will occur on existing roads and at existing crossings that have been previously disturbed, direct effects to anadromous salmonid habitat downstream (CH) are expected to be insignificant.

In summary, Project water drafting which would occur during 2015 and 2016, have the potential to affect Coho salmon juveniles from the 2014 and 2015 brood years that are rearing in the Project Action Area. Along with legacy sediment site restoration treatments on roads and crossings, which may occur over serveral years, these activites are: located outside of SONCC coho salmon CH; or, in the case of water drafting, will occur in a manner that complies with NOAA's Water Drafting Specifications, and will result in only localized, low impact, short-duration, and insignificant effects to salmonids, including SONCC Coho salmon. Other PEs will not result in direct impacts to Coho salmon as work will not occur within CH or within active stream channels.

Indirect Effects

Sediment

The following discussion is organized by PE, and includes an analysis of effects to the Sediment habitat Indicator group listed below, based on the potential for indirect effects associated with each PE:

- **Suspended sediment-intergravel DO/turbidity**: the risk of increased soil disturbance then sediment supply and delivery associated with all of the PEs.
- **Physical barriers**: the risk of increased soil disturbance then sediment supply and delivery associated with all of the PEs.
- **Substrate character and embeddedness**: the risk of increased soil disturbance then sediment supply and delivery associated with all of the PEs
- **Pools - frequency and quality, large pools, average wetted width/maximum depth ratio in scour pools in a reach**: the risk of increased soil disturbance then sediment supply and delivery associated with all of the PEs.
- **Off-channel habitat**: the risk of disturbance and increased peak flows and resulting channel changes associated with all of the PEs.
- **Change in peak flows**: the risk of disturbance and then increased peak flows associated with all PEs.
- **Increase in drainage network –roads**: increased disturbance and changes to the road drainage network associated with temporary roads and landings.

The Sediment habitat Indicator group is discussed collectively below under PE headings, including at the site- and watershed scale. The watershed scale effects analysis relies on the WSFR Hydrology Report (Mondry 2015) analysis and the interpretation of CWE modeling and results that compare pre-fire disturbance with post-fire and post-Project disturbance, at both the 5th-field and 7th field watershed scales. The mass-wasting (GEO) model was used to assess potential risk of channel changes from landslides and debris flows, which have a high likelihood of causing: channel morphological changes including channel bed aggradation (affecting fish

passage, especially at lower flows within response reaches); reduced pool frequency and quality; and changes to channel width/depth ratios. The ERA model was used to assess the potential for increased peak flows, including for temporary roads and landings.

The assessment of potential effects to the Sediment habitat Indicator group at the site-scale relies on field review of the proposed treatment units/areas, predictions of action effects based on past projects, literature reviews, and discussions with relevant interdisciplinary team members (geologist, hydrologist, silviculturist, wildlife biologist, and fire behavior specialist). The potential for Project-related sediment mobilization to affect aquatic resources downstream is based on site conditions (including unit-specific slope stability, soil types, disturbance potential, and effects minimization measures that are to be implemented).

1) Salvage Harvest and Reforestation

Salvage harvest will occur on about 7,829 acres. Areas proposed for treatment include 1) Areas of moderate to high severity vegetation mortality; 2) Areas determined to be feasible in terms of logging systems, accessibility, and economic viability; and 3) Areas with more than 10 contiguous acres of medium to high severity vegetation mortality. Only standing dead trees 14 inches in diameter at breast height or greater will be considered for commercial salvage harvest. Salvage logging will be accomplished by ground-based, skyline, and/or helicopter logging systems. All salvage units will be reforested with the need for site-preparation (site prep) evaluated prior to planting. Stream course Riparian Reserves, as well as inner gorges and active landslides, are excluded from salvage harvest units. Tractors and mechanical harvesters are excluded from all RRs associated with stream channels, active landslides, inner gorges, and toe zones of dormant landslide deposits (Watershed-4 PDF, Appendix E).

Figure 3 below displays an example of how these features overlap treatment units, and the first cut at what specific areas will be excluded from, salvage harvest units in the lower Grider Creek drainage. Precise lay out of RR and inner gorge features are determined in the field during unit layout when the site specific slopes and distances are determined. These features are identified on the ground using flagging and GPS points, and the excluded areas are identified on timber sale area maps. Proper implementation of these design features is critical to ensuring that the environmental effects forecast in Project documentation, including this BA, are representative of conditions on the ground. The Forest Service is responsible for laying out salvage units consistent with this Project description, as well as closely monitoring implementation throughout the Project.

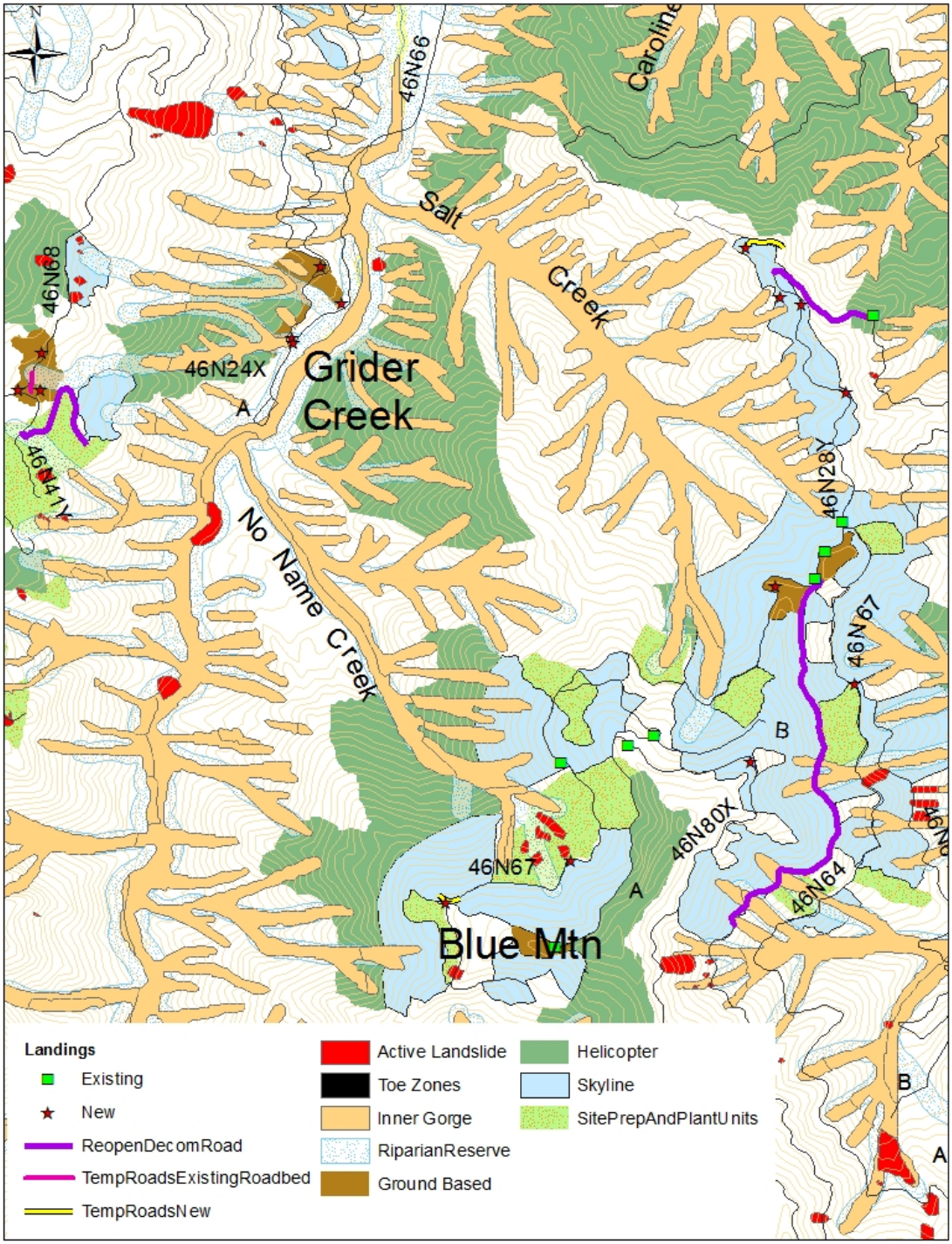

Figure 3. Proposed activities in lower Grider Creek displaying how RR, inner gorge, and active landslides will be excluded from units across the Action Area.

Reforestation includes site-preparation, planting, and release on approximately 7,873 acres, in addition to salvage harvest units, to increase the likelihood and speed at which burned areas are reforested. Like salvage harvest, all site prep and plant activities were planned to exclude Riparian Reserves. Methods for treatment may include: manual site preparation, skyline yarding, mastication, mechanical yarding, and slash piling of dead trees.

Due to concerns from watershed specialists about the currently impaired function of heavily burned RRs, lop and scatter treatments, done by hand, are proposed within RRs where they overlap site prep and plant units. These activities would occur where safety of forest workers can be ensured. This treatment is proposed for RRs within plantations within the Happy Camp Complex and Whites Fire that burned with moderate to high severity: approximately 1,100 acres in the Happy Camp Complex and 127 acres in Whites Fire may be treated. These RRs hand treatment areas are scattered across the landscape and will be costly to implement. For those reasons, it is not clear at this time where these treatments will actually occur on the ground. Where they occur, these RRs hand treatments will increase near term soil cover and sediment filtering capacity in burned RRs. They are designed to reduce erosion and sedimentation at the site, and to encourage natural recovery of soils and vegetation. Detailed tables showing acres of RRs hand treatment proposed by 7th field watershed are in Appendix B.

Timber harvesting, including skid trails, landing and road construction, can increase soil disturbance, erosion, and sediment delivery to streams. Soil disturbance and loss of cover exposes soil to raindrop impact and subsequent erosion. Eroded soil moves from hillslope to stream channel via surface runoff, and occasionally via landslides. In sufficient quantities, fine sediment can reduce the abundance and quality of aquatic habitat. This is an indirect effect in that sediment movement is driven by winter storms or snowmelt events that occur following disturbance and effects can occur far downstream from sites of disturbance.

Altered sediment supply poses a stress to salmonids and other aquatic species. The AP Sediment habitat Indicator group includes key elements of anadromous salmonid habitat that can be adversely affected by an increase in sediment supply and delivery to streams, as well as mechanisms that can increase sedimentation including the following: suspended sediment/intergravel dissolved oxygen/turbidity, physical barriers, substrate character and embeddedness, pools frequency and quality, average wetted width/maximum depth ratio in scour pools in a reach, change in peak flows and increase in drainage network. Effects to sediment supply and delivery to streams are also analyzed at the site-scale and any aggregated effect is then inferred to affect the sediment-related indicators listed above.

Stream temperature (discussed below under the Water Quality Indicator) may also be indirectly affected through changes in sediment supply and delivery to streams via changes in channel morphology (pool depths or increases in width-to-depth ratio), which can facilitate heat exchange (Poole and Berman, 1999). In addition, fine sediment may block exchange between surface waters and intragravel flows, also contributing to warming. This discussion focuses on effects to sediment, and where those effects are determined to have a measurable or significant impact on temperature through the pathways described above.

Measurable changes in watershed sediment supply and delivery are particularly important relative to the Physical Barrier habitat Indicator because this may mediate access to tributary rearing habitat and refugia within Actions Area streams. Access to some refugial areas from the mainstem Klamath River is currently blocked in some locations by alluvial barriers resulting from sediment loads flushing out of watersheds.

In addition, excessive fine sediment reduces habitat diversity, embeds spawning gravel, and reduces channel stability. Soils in the Action Area in some watersheds are highly erodible, and in combination with the steep terrain, recent fires, and a legacy of past timber harvest and road-building, fine sediment loading has contributed to impaired aquatic habitat conditions in some areas. This impairment is indicated by the pre- and post-fire CWE modeling data.. This discussion focuses on effects to sediment, and where those effects are determined to have a measurable or significant impact on barriers through the pathways described above.

The method of salvage harvest used affects the extent of watershed disturbance. Chase (2006) compared sediment production rates from sites burned at high severity and subjected to helicopter, cable or tractor logging and found that cable- and tractor-logged sites have significantly more ground disturbance than sites logged by helicopter (Chase 2006). The effect of different salvage logging methods on percent ground disturbance was studied by Klock (1975) who reported that the mean percent ground disturbance for tractor skidding over bare

ground was 36%, 32% for cable logging without full suspension, 2.8% for cable logging with full suspension and less than 1% for helicopter. Chou et al. (1994a; 1994b) also measured disturbance after salvage logging on the 1987 Stanislaus National Forest fire and reported the mean ground disturbance for tractor logging was 35% versus 18% for cable-logged sites. Some studies have argued that salvage logging may reduce post-fire sediment production by breaking up soil water repellency and increasing infiltration rates by disturbing sealed soil surfaces (Bautista et al. 1996). Slash from salvage logging can increase percent cover and surface roughness, thereby reducing overland flow velocities and surface erosion (Shakesby et al. 1996; Poff 2002).

Wagenbrenner et al. (2014) found that skidder and feller-buncher plots generally had greater compaction, less soil water repellency, and slower vegetation regrowth than untreated control plots. Adding slash to skid trails increased total ground cover and reduced sediment yields by 5-50 times compared to untreated plots. Vegetative regrowth and sediment production varied widely among the study areas due to differences in rainfall and soil properties, however, susceptibility to surface runoff and erosion after high severity fire suggests that areas disturbed by ground-based salvage logging need additional mitigation.

Table 31 shows modeled CWE results pre-fire, post-fire and post-Project. Disturbance from the 2014 fires was high in some watersheds, increasing risk ratios in Beaver Creek, Lower Scott River, Thompson Creek and North Fork Salmon. Disturbance associated with implementation of salvage harvest and all associated actions was modeled against the post-fire baseline. At the 5th-field watershed scale, the proposed action including salvage harvest and reforestation does not add any incremental increase in disturbance beyond the 2014 fires to runoff (ERA), mass wasting (GEO) or sedimentation (USLE). Similarly, the project will have insignificant effects to sediment and anadromous salmonid habitat, and by extension, insignificantly small effects to SONCC Coho salmon at the 5th field watershed scale.

Table 31. CWE model results at 5th field watershed scale comparing pre-fire conditions, no action, and effects of Consultation Action.

5th-field Watershed Name	Area (Acres)	Pre-Fire (2012)	Post-Fire, No Action	Consultation Action	2014 Fire Area
Beaver Creek					
ERA	69,610	0.7	1.0	1.0	
USLE		1.1	1.2	1.1	
GEO		0.8	1.1	1.0	
Horse Creek-Klamath River					
ERA	98,625	0.7	0.7	0.7	
USLE		0.7	0.8	0.8	Beaver Fire
GEO		0.7	0.9	0.9	
Humbug Creek-Klamath River					
ERA	68,023	0.6	0.3	0.3	
USLE		0.6	0.5	0.6	
GEO		0.8	0.8	0.9	
Elk Creek					
ERA	60,829	0.5	0.5	0.5	
USLE		0.1	0.3	0.5	
GEO		1.0	1.0	0.5	Happy Camp Complex
Lower Scott River					
ERA	98,016	0.1	0.5	0.6	
USLE		0.1	0.5	0.4	
GEO		0.3	0.6	0.6	

Seiad Creek-Klamath River					
ERA	81,706	0.6	0.6	0.6	
USLE		0.3	0.7	0.3	
GEO		0.5	0.8	0.7	
Thompson Creek-Klamath River	67,301				
ERA		0.1	0.4	0.4	
USLE		0.4	0.3	0.2	
GEO		0.4	0.5	0.6	
North Fork Salmon River					
ERA	130,545	0.2	0.3	0.3	Whites Fire
USLE		0.1	0.3	0.3	
GEO		0.5	0.7	0.7	

In addition to the assessment of watershed-scale effects to sediment at the 5th-field watershed scale, the hydrology assessment modelled and interpreted past and predicted disturbance at the 7th field watershed scale. The WSFR Hydrology Report (Mondry 2015) and Appendix B to this BA include more detailed CWE modelling results, summarized here.

For the ERA model, which is used to assess relative effects to watershed sediment regimes and peak flows, the following 7th field watersheds are at or above the 1.0 risk ratio threshold of concern pre- and post-Project: Buckhorn Gul-Beaver Creek, Doggett Creek, Dutch Creek, Jaynes Canyon, Kohl Creek, Lower West Fork Beaver Creek, Soda Creek-Beaver Creek, Big Ferry-Swanson, Middle Elk Creek, Walker Creek, and Music Creek. The incremental increase to ERA risk ratio added by this Project is small, with a maximum increase of 0.3. The 7th field watershed with the lowest overall impact of the Project, as reflected by ERA risk ratio, is Lower East Fork Elk Creek and Cougar Creek-Elk Creek drainages which both have zero change due to the Project. The lack of increase in post-Project ERA risk ratio is because the Project includes substantial legacy sediment site treatments (which are assigned negative ERA values), and a relatively small amount of ground disturbing and road-related actions in these drainages (see Appendix B tables for ERA accounting by 7th field watershed). The 7th field watersheds with the highest overall impact of the Project, as reflected by ERA risk ratio, are Whites Gulch and Upper North Russian Creek at 0.3 increase. This increase is expected to have only insignificant effects on sediment production and anadromous salmonid habitat, including SONCC Coho salmon CH, in the Salmon River Watershed. The Beaver Fire area drainages were the most disturbed pre-Project as reflected by CWE values. Project activities in the Beaver Fire area are limited to 350 acres of salvage, scattered in several units across Kohl, Doggett and Beaver Creek drainages, and 0.8 miles of temporary road on existing road bed. Approximately 1,700 acres may receive site prep and plant treatments, dependent on funding availability. These activities constitute a minor level of ground disturbance scattered across drainages and Project actions will help recover late seral forests more quickly in treated areas.

For the GEO model, which is used to assess landslide risk and potential resulting channel changes, the following 7th field watersheds are at or above the 1.0 risk ratio threshold of concern pre- and post-Project (driven largely by 2014 fire effects): Bishop Cr-Elk Cr, Lower West Fork Beaver Cr, Lumgrey Cr, McKinney Cr, Soda Cr-Beaver Cr, Bear Cr, Granite Cr, Middle Elk Cr, Schutts Gulch-Klamath River, Deep Cr-Scott River, Music Cr, O'Neil Cr, Doggett Cr, Caroline Cr-Klamath River, Dona Cr-Klamath River, Buckhorn Gul-Beaver Cr, Walker Cr, Lower Grider Cr, Kohl Cr, and Middle Cr. The incremental increase to GEO model risk ratio added by this Project is small, only up to 0.1. GEO model risk ratios are reduced post-Project in Elk Creek drainages due to proposed legacy sediment site fixes.

As described in the Project Geology Report, the proposed action would reduce the duration of elevated landslide risk for nine 7th field watersheds as compared to no action. The 7th field watersheds with a high landslide risk that will have a reduced duration of elevated risk are Upper Grider Creek, Cliff Valley, Lower Grider Creek, O'Neil Creek, Walker Creek, and Caroline Creek. These watersheds have a high percentage of steep, weathered granitic lands so the project will benefit this Riparian Reserve landform in the long-term by decreasing the duration of elevated risk of landslide events. The reduction in duration of elevated risk will benefit natural resources and infrastruction in the long-term. Middle Creek, Horse Creek, and Upper Elk Creek have a moderate landslide risk and will have a duration of elevated risk of 30 years with the proposed action. Lower Grider and Walker Creek have very high landslide risk due to the potential to impact private land – so the reduction of elevated risk from more than 80 years to 30 years is of great benefit for protecting human safety and private property as well as fish habitat in these drainages. Rancheria Creek drainage, which also has a very high landslide risk, will continue to have a greater than 80 year duration of elevated risk because there is less than 25% of the high and moderate vegetation burn severity areas being planted. See the Project Geology Report for detailed analysis of landslide risk and the project's expected influence on it.

CWE modelling estimates of watershed disturbance caused by the Project are relatively small when compared to projects that harvest live trees over the same acreage; the reason for this is that dead/dying trees do not provide the same essential functions on the landscape as live forests. As described in detail in the Project Geology Report (Bell 2015), after trees die, root support begins to decline immediately and provides almost no support/soil stability after about a decade. In addition, mature conifers affect site hydrology and soil moisture through interception and transpiration, and these functions are lost after trees die. As reflected in the CWE model coefficients and outputs, the disturbance related to salvage harvest that drives potential impacts to mass wasting and hillslope processes is ground based harvest and infrastructure development such as roads and landings. The Project is comprised largely of skyline and helicopter logging systems, and is designed to avoid unstable features such as active landslides, inner gorges, and stream course RRs (as depicted in Figure 3). Therefore, the project involves a relatively low level of watershed-scale disturbance in the context of existing conditions; however there remains potential for site level impacts, especially where infrastructure would be constructed or developed.

In addition to a review of the CWE modelling results at the 5th- and 7th field watershed scale, potential impacts to sediment at the site scale were assessed, to identify appropriate impact avoidance and minimization measures. At the site-scale, salvage harvest and reforestation effects will be minimized through project design (excluding RR, inner gorges and active geologic features) and implementation of Watershed PDFs and BMPs (listed in Appendix E and Project FEIS).

RRs have been established along all streams to protect riparian function (see PDF Watershed-3) including sediment retention capacity. Trees will not be cut or removed from RRs as part of salvage harvest under all methods of removal/harvest (tractor, skyline and helicopter). The sediment retention function of RRs will not be impacted by salvage harvest. There would be benefits to sediment retention function in RRs that receive lop and scatter hand treatments to achieve near term ground cover; approximately 1227 acres within site prep and plant units scattered across the Happy Camp Complex and Whites fire areas may receive this treatment. At the site level, this treatment would reduce sediment inputs to streams and speed the recovery of soils and vegetation within RR. Upper reaches of East Fork Elk, Middle, and Tompkins are the creeks that stand to benefit the most from hand lop and scatter treatment in RR.

Salvage harvest will remove dead trees and contribute to a timely restoration of burned stands. Without capturing the value of dead trees via timber salvage, site restoration would likely be unsafe and/or cost prohibitive. Planting without site preparation would likely result in the loss of conifer plantations to fire before they mature, given the median 5-25 year fire return interval predicted within the Analysis Area.

Summary of Indirect Effects. At the watershed scale (5th- and 7th field watersheds), the 2014 fires resulted in measurable impacts to sediment supply and delivery in some watersheds as described above, and observed

during 2014-2015 fall/winter storm events. However, the proposed action does not add any increase to modelled disturbance at the 5th-field watershed scale, and only a slight incremental increase to post-fire disturbance at the 7th field scale in some watersheds, as described above and displayed in Appendix B tables. The proposed action will remove burned trees and conduct reforestation which are likely to restore forested areas quicker than if no action were taken. Project designs, Watershed PDFs, and BMPs minimize effects through avoiding unstable areas, minimizing ground disturbance and requiring erosion control. Based on these factors, salvage harvest and site preparation will have insignificant effects on the Sediment habitat Indicator group and anadromous salmonid habitat, and minor effects on SONCC Coho salmon. Activities proposed within RR of site prep and plant units (lop and scatter hand treatments) may have insignificant beneficial effects on the Sediment habitat Indicator group at the site, with insignificant or neutral effects to Coho salmon and CH.

Proximity and Probability. Maps in Appendix A show that units are within proximity to anadromous salmonid habitat. Because salvage harvest will not occur within stream course RR, it will occur greater than 300 feet from any stream with SONCC Coho salmon CH. The probability of effects to the Sediment habitat Indicator group and Coho salmon is insignificant, as described above.

2. Fuels Reduction Treatments

The proposed action includes treatment of hazardous fuels on about 22,307 acres and will include the following: hand work, mechanical thinning, mastication, lop and scattering, chipping, broadcast burning (including use of helicopters for ignition), jackpot burning, and pile burning. Fuels reduction activities near streams can increase the potential for sediment-related impacts to aquatic habitat. The proposed action includes fuels reduction within RRs within fuels management zones, roadside hazard reduction units, WUI's and underburn units (locations are shown on maps in Appendix A). Small diameter trees would be removed using a masticator and hand work, and fuels would be piled and burned.

Mastication using low ground pressure tracked or wheeled machines with a masticator head would be used to grind slash produced from mechanical thinning and existing ground fuels where feasible. Masticated material would be left scattered in treatment areas. Secondary treatment is required to dispose of activity-generated ground fuels and existing ground fuels to significantly decrease the potential for future stand-replacing fire effects. Secondary treatments would include mastication and prescribed burning, which includes burning piles of slash and underburning. The track-mounted excavator with masticator arm is restricted to slopes of 45% or less and when soil moistures are less than 18%. Masticators will cover their tracks/traces with masticated slash upon exiting fuels treatment units/areas, thereby reducing the potential of surface erosion from masticator-treated units (Blessing 2015). Therefore, insignificant amounts of rutting will occur when using this machine. In addition, the 30" track produces ground pressures of up to six psi, therefore chances of any soil compaction occurring is also insignificant. RRs in treatment areas could be treated with a masticator where feasible. The 50-foot treatment buffer on small perennial and intermittent streams and 100 foot buffer on larger perennials (> 1' wetted width) reduces the possibility of sediment reaching these streams to an insignificant risk. Indirect effects to sediment and anadromous salmonid habitat from mechanical and hand fuels treatments will be insignificant, while they will have minor effects on SONCC Coho salmon.

Burning under prescription can result in localized loss of protective soil cover. This effect would occur as a result of unforeseen prescribed burn flare-ups in fuel accumulations. Indirect effects involve the movement of sediment from areas with significantly reduced soil cover to stream channels and then downstream, to be deposited in pools and riffles. Such events are expected to be few in number and limited in size by the fact that burn plans will be designed for retention of cover in burn areas in conformance with LRMP guidance, project-specific effects minimization measures (PDFs, RR Standards and Guidelines, Best Management Practices), and experience from decades of KNF prescribed burning. Should flare-ups occur, loss of soil cover would be localized and short-term as regrowth and adjacent unburned stands contribute to the rapid re-establishment of soil cover. Indirect effects from burning under prescription to sediment and anadromous habitat will be insignificant, while they will have minor effects on SONCC Coho salmon. Beneficial effects are expected in

terms of less severe future fire effects, particularly when/if fire occurs in this area greater than 5 years in the future.

Project design standards, BMPs and PDFs will be implemented to minimize potential effects at the site-scale including the following (PDFs 33, 34, 35, and 36): prescribed fire effects will mimic a low intensity backing fire, except for handpiles/windrows where localized higher intensity may occur in consuming pile material; ignition of underburns will generally not occur in RRs; handpile and windrows in RRs will be placed in a checkerboard pattern whenever possible (not piled directly above one another); handpiles will be less than 6 feet in diameter and will be more than 15 feet away from intermittent streams and 30 feet away from perennial streams; for underburning, handline construction in riparian vegetation shall be avoided where practical but will be farther than 25 feet from any channel, if necessary; handlines will be mitigated (waterbarred and covered with organic material) immediately following prescribed burning, when safe to do so; When underburning in RRs, at least 90% of the large woody debris will not be consumed, both standing and on the ground; tractors and mechanical harvesters will be excluded from all RRs associated with stream channels, active landslides, inner gorges, and toe zones of dormant landslide deposits; and refueling will not take place within any RR. A spill containment kit will be in place where refueling and servicing take place. Indirect effects from prescribed fire/burning treatments, including within RRs, to sediment will be insignificant, while they will have minor effects on SONCC Coho salmon.

The risk of impacts to the Sediment habitat Indicator group at the site-scale is associated with soil disturbance within RRs. Watershed PDFs (as listed above) will be implemented to minimize effects of all project fuels reduction work.

At the 5th-field watershed scale, the proposed action including fuels reduction does not add any incremental increase in disturbance beyond the 2014 fires [to runoff (ERA), mass wasting (GEO) or sedimentation (USLE)]. At the 7th field watershed scale, the proposed action including fuels reduction is expected to add only an insignificant increment to disturbance beyond the 2014 fires: an amount that is predicted to have insignificantly small effects on sediment and anadromous salmonid habitat, while they will have minor effects on SONCC Coho salmon.

Summary of Indirect Effects. Handpiling and pile burning, heli-torch burning and underburning, may occur in RRs, comprising approximately 8,000 acres across the project area. These activities will remove soil cover in some areas and therefore has the potential to increase sedimentation. Project design, Watershed PDFs and BMPs will be implemented to minimize and mitigate effects including PDF 34, 35, 36 and 37, which require that piles not be stacked near each other, and that piles be small (<6 ft.). These measures will limit disturbance and result in a low potential for erosion and sedimentation, and piles will be interspersed with undisturbed areas that will retain and.or intercept sediment. Treating hazardous fuels in RRs will mimic the effects of a low intensity fire and will likely reduce the effects of a future wildfire by reducing fuels, particularly when fire occurs greater than 5 years in the future. Given the minimization measures that will be implemented, indirect effects from handpiling and burning to Sediment and anadromous salmonid habitat will be insignificant, while they will have minor effects on SONCC Coho salmon, as defined on page 16 above.

Proximity and Probability. Maps in Appendix A show that treatment units are within proximity to anadromous salmonid habitat. However, the probability of effects to the Sediment habitat Indicator group and, by extenstion, to SONCC Coho salmon and their CH is insignificant, as described above.

3. Hazard Tree Abatement

The proposed action includes hazard tree removal along most Forest Service system roads, County Roads, and State Highways within the project boundary, and is estimated at 678 miles of roads (over a maximum of 20,499 acres). This is to be done to provide for public and Forest worker safety and future fire suppression efforts. Both the mileage and acres of treatment proposed are a maximum; the numbers are representative of the entire length and area being evaluated for hazard tree identification and removal. Trees determined to be a hazard to

the roadway will be felled, this includes within RRs where roads intersect and/or parallel stream channels. Project design features require retaining hazard trees greater than 26 inches DBH on site when they are within one site tree height distance from fish-bearing stream, unless they continue to pose a hazard to safety or accessibility.

At the 5th-field watershed scale, the proposed action including hazard tree removal does not add any incremental increase in disturbance beyond the 2014 fires [to runoff (ERA), mass wasting (GEO) or sedimentation (USLE)]. At the 7th field watershed scale, the proposed action including hazard tree felling/removal only adds a slight incremental increase to disturbance beyond the 2014 fires, a level that is predicted to have insignificant effects on sediment and anadromous salmonid habitat, while they will have minor effects on SONCC Coho salmon.

The risk of impacts to the Sediment habitat Indicator group at the site-scale is associated with soil disturbance within RRs. Watershed PDFs (Watershed 4 and 13) will be implemented to minimize the effects of soil disturbance associated with hazard tree felling/removal, including the following: equipment will be excluded from the inner 50 feet of the non-fish bearing RR and one site tree height/distance for fish bearing streams; all hazard trees cut within 25 feet of a stream channel will be left on site; in fish-bearing stream reaches, all hazard trees greater than 26 inches in diameter at breast height within the first site tree (150-170 feet) will be left on site unless they continue to pose a hazard to safety or accessibility; live trees directly rooted into the banks or otherwise integral to the stability of the channel bank will not be felled unless they pose an overhead hazard and, if felled, will be left on site unless this poses a hazard on the ground per OSHA requirements; directional felling will be used to protect streambanks where hazard trees need to be felled/removed for public or employee safety; refueling will not take place within RRs and a spill containment kit will be in place where refueling and servicing take place.

Summary of Indirect Effects. Based on implementation of the Watershed PDFs for hazard tree removal that require trees to be felled and left on site in near-stream zones, and field review of hazard tree removal areas, hazard tree removal along roadsides will have insignificant effects to the Sediment habitat Indicator group and anadromous salmonid habitat, and minor effects to SONCC Coho salmon.

Proximity and Probability. Maps in Appendix A and tables in Appendix C show that treatment units are within proximity to anadromous salmonid habitat. However, the probability of effects to the Sediment habitat Indicator group and Coho salmon is insignificant, as described above.

4. Temporary Roads, Landings and Water Drafting

The proposed action includes approximately 16.4 miles of temporary road segments to access harvest units: 1.2 miles in the Beaver Fire; 14.3 miles in the Happy Camp Complex; and 0.8 miles in the Whites Fire. New temporary roads are proposed on a total of 3.4 miles; 13 miles are proposed temporary roads on existing roadbeds, of which 5.6 miles are decommissioned road beds proposed for opening/use/re-decommissiong. The total road mileage is divided among several short segments designed for temporary use, and dispersed among numerous 7th field subwatersdeds (Appendix B, Table 1). After use, all project temporary roads will be hydrologically stabilized, which includes constructing waterbars, outsloping road prisms if appropriate, removing crossings and obliterating access to the road.

Roads can have a major impact on sediment and the drainage network. Disturbance associated with temporary roads and crossings were modelled in the CWE analysis. At the 5th-field watershed scale, the proposed action including these PEs, does not add any incremental increase in disturbance risk. At the 7th field watershed scale, the proposed action including these PEs adds only a slight increase in risk beyond the baseline, and only in some watersheds. Effects to sediment at the watershed scale are expected to be insignificant and undetectable downstream.

Project design, Watershed PDFs and BMPs will be implemented to avoid unstable areas and to minimize potential adverse effects at the site-scale *during project implementation*, including the following: fill materials generated from road treatments will be reincorporated back into subgrade to the extent possible; all excess fill materials will be spoiled outside of RRs; all project-related temporary structures, materials and debris will be removed from riparian areas and stream channels prior to winter shutdown; activities which require culvert replacement or removal will occur during the least critical periods for water and aquatic resources: when streams are dry or during base flow conditions, and in compliance with spawning and breeding seasonal restrictions; upgrades or improvements to stream crossings will be built to Forest Plan standards; new temporary roads or landings will not be constructed in any RR associated with stream channels, on toe zones of landslides, active landslides or inner gorges.

Watershed PDFs and BMPs will be implemented post-project to minimize adverse effects at the site-scale *until vegetative recovery can occur*, including the following: following harvest activities, maintain at least 50 percent slash on temporary roads and block them after the harvest season (prior to the first winter after use); temporary roads will be sub-soiled; all temporary roads will have their takeoffs from system roads obliterated or blocked to avoid unauthorized use; hydrologic stabilizations, which may include removal of culverts and fills at stream crossings, out-sloping of road surfaces and/or obliteration of temporary road segments; erosion and sedimentation control structures will be maintained and repaired per the guidance in the Forest Service Handbook 2409.15 R5 Supplement.

Figure 4. Stream crossing proposed for re-opening in Cliff Valley Creek.

Even with implementation of BMPs and PDFs, watershed specialists were concerned about temporary road construction exacerbating currently at risk watershed processes related sediment supply and delivery. Temporary roads, both re-opened and new, that are hydrologically linked via stream crossings were of greatest concern, as were log landings (re-opened and new) in RRs, and unstable areas crossed by roads. The proposed action includes nine temporary road stream crossings. These features were analyzed by watershed specialists on a site-specific basis using GIS data and field surveys. A total of 3.4 miles of new temporary roads are proposed, 3.3 miles in Happy Camp Complex and 0.1 miles in the Whites Fire. These new temporary roads consist of multiple short segments of road on ridgetops designed to facilitate skyline logging systems. They are all outside of RR and disconnected from the drainage network so there is not any meaningful risk of effects to downstream fish habitat as a result of these short ridge top new alignments.

Temporary road actions include nine stream crossings (2 perennial and 7 intermittent streams) that are above the range of fish (greater than ½ mile above CH) in Lower Grider Creek, Cliff Valley Creek, and China Creek. Temporary road actions proposed in Lower Grider, Kuntz and O'Neil creeks will require restoration actions to address existing erosion related concerns. Field surveys determined if reopened roads, crossings, and landing sites were actively eroding or at risk for erosion pre-project. If the project uses these roads that have existing erosion problems, they will have to be appropriately hydrolgically restored according to current standards which

would yield post-project hydrologic benefits in these watersheds. For example, the temporary road proposed for use in lower O'Neil Creek is in the outer portion of O'Neil Creek RR but currently captures an intermittent stream channel along several stretches of the road. If the project uses this road, the drainage features will be fixed so the road can be used and appropriately hydrologically stabilized post-project. In this case, project use of the road poses only a low short term risk to aquatic habitat and a long term benefit would be expected due to appropriate hydrologic stabilization of this existing road bed. The temporary road actions in lower Kuntz Creek involve a similar low short term risk of effects due to use of the road, and long term benefits from fixing existing erosion problems on the road.

Crossings on decommissioned roads in Cliff Valley and China creeks proposed for reopening have been, for the most part, appropriately hydrologically stabilized. Project use and re-closing of these roads and crossings involves a low to moderate short term risk to aquatic habitat and no long term benefit. Temporary stream (perennial and intermittent) crossings would likely have short duration effects to sediment production limited to the first winter after use. Due to implementation of effects minimization measures (BMPs and PDFs) effects are expected to be site-scale and limited to the immediate area downstream of work.

Watershed specialists identified all potential stream crossings on temporary roads and reviewed them in the field to determine what actions would be taken and what effects to downstream fish habitat may occur. Table 32 lists the sites that remain in the Consultation Action. There were several other potential crossing sites initially included in the proposed action and reviewed in the field. These sites are not listed in Table 32 as they were found to not have channel crossings or were dropped from the project (comprehensive list of crossings reviewed is available in project record).

Table 32. Temporary roads/stream crossings.

Receiving Stream Name	Road Type	Confirmed Stream Type	Comments
Grider Creek	Decomm. Road 46N41YA	2 perennial	One crossing is legacy site; the Project will reduce sediment long term
Walker Creek	Decomm. Road 46N63	No crossing	No crossing features; old road bed cut in bedrock
Cliff Valley Creek	Decomm. Road 46N77	1 Intermittent	Stable, moderate risk
China Creek	Decomm. Road 46N78	5 Intermittent	Stable, low risk
Kuntz Creek	New Temporary Road	No crossing involved in road (except crossing of private diversion ditch)	Road has drainage problems; use of road is low risk; the Project will reduce sediment long term
O'Neil Creek	Existing Temporary Road #2 and #3	1 intermittent	Road has drainage problems; intermittent channel captured by road prism; use of road is low risk; the Project will reduce sediment long term

The effects on unstable lands related to re-opening temporary roads on existing roadbeds and decommissioned roads or building new temporary roads is incorporated into the project landslide risk assessment. The main effect on landslide risk from road crossings is the increase in debris flow volume when and if the debris flow removes the crossing, incorporating crossing material into the debris flow. Debris flow volume is directly correlated with the probability of damage to structures, infrastructure (roads, power corridors, water lines, etc.)

and natural resources. The more crossings in a watershed, the more likely that if a debris flow should occur the volume will be increased. Crossings built on new temporary roads or re-constructed on decommissioned or existing temporary roads will be removed before the rainy season (see Chapter 2 of DEIS). The excess material will be removed before debris flow events are likely, making the increase in risk small.

Based on site reviews and proper implementation of BMPS and PDFS, the intensity of effects would be low for individual crossings. Further, it was determined during site reviews that sediment sources on some of the roads would be remediated, resulting in a long-term reduction in sedimentation. Construction of new temporary roads outside of RRs and use of existing road alignments and temporary crossings will have insignificant effects to the Sediment habitat Indicator group and anadromous salmonid habitat, and minor effects to SONCC Coho salmon.

The proposed action includes use of existing landings where available, and construction of new landings. A maximum of 75 existing landings and 135 new landings are proposed for use. Proposed landing locations are on maps in Appendix A. A maximum number is proposed to allow flexibility for contractors during implementation of the Project, however, far fewer landings will actually be used. Landing size will be commensurate with operational safety. Helicopter landings will be up to two acres in size. Skyline landings will use roads where ever possible. New skyline landings off the road system and ground-based landings will average one acre in size, but will not be larger than 1.5 acres in size. Both new and existing landings will be hydrologically stabilized after use.

The project includes PDF Watershed-5 that restricts new landings in RR to only those that have been reviewed and approved for use by watershed specialists. Conditions that provided for field-surveyed log landings to be approved for use included: on stable landforms and slope positions; in the outer zone of the RR; or separated from perennial streams by existing, stable road segments. Landings were not approved for use if they required removal of mature vegetation or significant earthwork or fill manipulation.

Site-scale effects to sediment from log landings would depend on landing location, existing condition, and size/use. A new landing within a site-tree distance of Coho CH represents a high risk of affecting sediment in CH. These effects could be of moderate duration and low to moderate intensity, depending on the volume of potentially unstable material and occurrence of stochastic weather-related events. However, only a limited number of new landings in RRs were approved (landings #DZ03, DZ10, DZ23, L043, L044 and L090) and only if they were on stable/already compacted landforms and slope positions, were in the outer zone of the RR, or were separated from stream channels by existing, stable road segments. Landings were not approved for use if they would require removal of mature vegetation or significant earthwork or fill. Landing L072 was proposed in RR within Whites Gulch, but a new location has recently been identified that is outside of RR.

Table 33. New landings in RR, approved for use.

7th field Watershed	Landing ID	Type	Comments
Caroline Creek-Klamath River	DZ03	Heli	In outer site tree of RR associated with Klamath River (CH). Trees that provide shade to the Klamath River would not be removed and ground disturbance would occur in an area of mine tailings and already compacted ground.
Cliff Valley Creek	L090	Skyline	In RR associated with non fish bearing tributary, over 3 miles above CH. Old stable and outsloped road bed within heavily burned and steep intermittent drainage. Strict implementation of Watershed PDFs and BMPs are critical during use and hydrologic stabilization actions. Detectable impacts to downstream fish habitat are not likely.
Franklin Gulch-Scott River	DZ10	Heli	In RR associated with lower Scott River (CH). The area is a

			flat already-compacted terrace above the Scott River. Trees that provide shade to the river would not be removed. Earthwork to expand the area would not occur.
Lower Grider Creek	DZ23 L043 L044	Heli	In outer site tree of RR associated with Grider Creek (CH). These landings are proposed in a heavily burned area between high use roads (switchback near Grider Campground) and within gound based salvage units. There are several intermittent stream channels that drain through the area but landing locations are rocky and relatively flat. No trees that provide shade to Grider Creek would be removed and post project hydrologic stabilization treatments, potentially including planting, would help recover this area to a forested condition.

Watershed PDFs and BMPs will be implemented to minimize impacts to sediment from existing and new landings in RRs including the following: new landings will not be constructed in any RR associated with stream channels (exceptions to this project design feature are landings #DZ03, DZ10, DZ23, L043, L044, and L090), on toe zones of landslides, active landslides or inner gorges; existing landings will be used to the extent possible; existing landings in stream-course RRs will not be expanded towards stream channels, or on to active landslides, or where vegetation that provides shade to a stream would need to be cut; existing landings in RRs will be shaped and treated for erosion control at the end of each season of use, and hydrologically restored at project completion (including subsoiling and covering with slash/mulch as needed); reused landings in RRs will have site specific erosion control measures to reduce risk of sediment delivery into streams; refueling will not take place within the RR; a spill containment kit will be in place where refueling and servicing take place; at project conclusion, landings will be configured for long-term drainage and stability by reestablishing natural runoff patterns; all landings will be covered with at least 50 percent effective soil cover; use of certified weed free materials including straw, wood chips, or mulch may be used where on-site material is insufficient; identified (selected) landings will be subsoiled, then covered with at least 50 percent effective soil cover. Use of existing landings and construction and restoration of new landings will have insignificant effects to the Sediment habitat Indicator group and anadromous salmonid habitat, and minor effects to Coho salmon.

Water drafting (locations are shown on maps in Appendix A) can result in indirect effects through short term and localized increases in turbidity when substrates are disturbed as the water hose is set into and pulled from the water. Watershed PDFs (37 and 38) will be implemented to minimize effects of water drafting on sediment supply and delivery including the following: draft water only at designated water drafting sites; when drafting from waters designated as Coho salmon CH, implement NOAA Fisheries Water Drafting Specifications (2001) and implement Forest Service Best Management Practices. Existing water drafting sites will be used to avoid new streamside disturbance associated with construction of drafting sites. Turbidity that may result during water hose sets and removals will be localized, limited to pre-designated sites (see Appendix A), and fish are expected to temporarily move away from these areas once they sense a water truck approaching. A measurable increase in turbidity is not expected beyond the immediate drafting area. This conclusion is based on field observations that indicate turbidity is diluted to background water clarity conditions within a few seconds of placement/removal of water drafting hardware. Thus, water drafting will result in insignificant effects to the Sediment habitat Indicator group and anadromous salmonid habitat, and minor effects to Coho salmon.

Summary of Indirect Effects. At the 5th-field watershed scale, the proposed action, including roads and stream crossings, does not add any incremental increase in disturbance. At the 7th field watershed scale, the proposed action including roads, landings, stream crossings and water drafting add only a slight increase to post-fire disturbance, in some watersheds. At the watershed scale, the proposed action will have insignificant effects to sediment and anadromous salmonid habitat, and minor effects to Coho salmon. At the site-scale, roads, stream

crossings and landings in RRs represent a high risk for effects and were reviewed by watershed specialists in the field to determine if BMPs and PDFs would effectively minimize impacts. There is potential for site-scale impacts to sediment particularly at road stream crossings. In some areas determined to be legacy sediment sites, conditions will be improved by the project therefore site scale long term benefits are expected. None of the temporary road crossings are within anadromous salmonid habitat, they are all greater than ½ mile from SONCC Coho salmon CH. Temporary roads with stream crossings are expected to have site-scale, short-term adverse effects to sediment and minor effects to Coho salmon.

Proximity and Probability. Maps in Appendix A show that temporary roads and stream crossings are not within proximity to fish-bearing streams. Watershed specialists confirmed locations and conditions in the field at all proposed road/stream crossing sites. At the watershed-scale, roads and stream crossings have a low probability of effects on the Sediment Indicator group, anadromous salmonid habitat and Coho salmon. At the site scale, there may be short term negative effects to aquatic habitat due to temporary road crossing actions. Watershed specialists confirmed that a fewof the crossings were existing sediment legacy sites that are currently contributing sediment to drainages, and that the project will reduce sediment at these sites in the long term. At the site-scale, the probability of effects from landings in RRs is not insignificant (there is a risk of adverse effects). Thus, the magnitude of effects from landings in RRs will be discussed further below.

Magnitude: All proposed new landings in RRs were reviewed in the field. Watershed specialists determined that that soil disturbance would be minimized and that BMPs and Watershed PDFs will effectively minimize impacts. The magnitude of effects is limited in scope to landing #DZ03, DZ10, DZ23, L043, L044, and L090 and potential impacts will be minimized through implementation of BMPs and PDFs. The magnitude of effects to the Sediment habitat Indicator group is insignificant. New landings in RRs will have insignificant effects on sediment and anadromous salmonid habitat, and minor effects on Coho salmon.

5. Legacy Sediment Site Treatments

Legacy sediment site treatments are proposed to reduce sediment supply and delivery through restoration of known sites in the Elk Creek watershed. These treatments will be scheduled for treatment in compliance with the Clean Water Act as a condition of the North Coast Regional Water Quality Control Board waiver of waste discharge requirements (Order No. R1-2010-0029). The portion of Elk Creek within the project area contains approximately 148 legacy sites. Most of the legacy sites are located on or adjacent to the Forest road transportation system. The other legacy sites are located on existing landings or roadbeds (historic roads, abandoned temporary roads, or decommissioned roads). Legacy site treatments will include the following:

- Culvert upgrades (about 45 sites) – replace culverts to accommodate the 100-year peak flow;
- Diversion prevention (about 51 sites, 17 include culvert upgrade) – construct armored rolling dips to prevent streams from diverting down roadways, should the culvert plug or fail;
- Aquatic organism passage (three sites)– replace existing stream crossing with bottomless arch culvert to improve or restore aquatic organism passage;
- Retaining wall (about 7 sites) – construct Hilfiker wall, rock buttress, reinforced embankment, or equivalent, where road prism has slumped or failed;
- Fill reduction (about 16 sites) – remove excess fill materials from the top of stream crossings to reduce the amount of fill available for discharge should the culvert plug or fail; add riprap to armor fill slopes;
- Fill removal (about 27 sites) - remove all fill materials from stream channels, swales, road shoulders and sliver fills; these treatments would occur on closed NFTS roads and existing roadbeds;
- Repair/maintain existing infrastructure (about 16 sites)– clean culvert inlets, ditches, etc., repair damaged culvert inlets, shorten “shotgun” culvert outlets, place riprap below culvert outlets to reduce hill slope erosion, remove cut slope slide materials,

In addition, road storm-proofing treatments between individual legacy sites will occur on about 33 miles of Forest system roads (15N02, 15N75, 16N05, 16N39 and 45N19). Treatments between legacy sites may include the following: where possible reconstruct road prism to an out sloped configuration, otherwise reduce inboard ditch length by adding additional relief culverts or dips; reduce road prism width; remove berms; place rip-rap below outlets of ditch relief culverts; recondition road subgrade and travel surface - apply crushed aggregate; add rolling dips where needed to control road surface runoff; stabilize road prism slumps with retaining walls or rock buttresses.

The potential for indirect effects to the Sediment indicators is highest for culvert upgrades or passage projects that are within active stream channels. The culvert projects will likely generate some short-term turbidity downstream. The proposed culvert upgrade actions in Elk Creek watershed were included in the programmatic BA Klamath National Forest Facility Maintenance and Watershed Restoration BA (USFS 2004), and thus covered by the associated letter of concurrence (NMFS 2004). Turbidity from these types of projects was determined to have an insignificant, temporary impact where actions occurred less than 300 feet from areas occupied by fish; and where in-channel actions were greater than 300 feet from fish, no effect to fish was expected. In the long term, turbidity levels will return to pre-construction conditions as the site settles/stabilizes. Observation has confirmed that such settling/stabilization usually occurs after the first few precipitation events. None of these sites are within habitat accessible to anadromous salmonids. PDFs (Watershed-20 and 24) will be implemented for all projects to minimize impacts to sediment and aquatic habitat. All together, these legacy sediment site treatments will result in meaningful benefits to water quality and fish habitat in Elk Creek watershed, as well as improved passage for aquatic organisms and watershed products.

Summary of Indirect Effects. Legacy site repair will result in insignificant and short-term effects to the Sediment habitat Indicator group and anadromous salmonid habitat, minor effects to Coho salmon, and long-term beneficial effects to both sediment and Coho salmon through reducing sediment sources in the Elk Creek watershed.

Proximity and Probability. Maps in Appendix A indicate the proximity of legacy site repairs to CH. All project legacy sediment site crossing upgrade work will be outside of SONCC Coho salmon CH, and all but six sites are located at least 300 feet away from CH. The six sites that are relatively close to CH (300-400 feet upstream of CH) are culvert upgrades along side tributaries to Elk Creek, and East Fork Elk Creek. Implementation of these actions will adhere to all protection measures outlined in the Facilities Maintenance and Watershed Restoration Programmatic BA (2004), and Appendix E of this BA. Work will be scheduled to occur when channels at culvert upgrades are likely to be dry.

Two of the three aquatic organism passage improvement crossings (upgrading culverts to open bottom structures) are approximately 350 feet upstream of CH in Elk Creek in Twin and Malone Creeks. The third aquatic organism passage improvement crossing is approximately 2.5 miles above CH in upper East Fork Elk Creek.

The probability of negative effects to sediment is highest in the short term after implementation in sites that are close to CH (~300 feet away). However, the probability of effects to the Sediment habitat Indicator group and anadromous salmonid habitat is insignificant due to the requirement to work in a dry channel and adhere to all protection measures outlined in the Facilities Maintenance and Watershed Restoration Programmatic BA (2004) and associated Letter of Concurrence. Experience with similar projects supports that BMPs and Watershed PDFs as described in the programmatic BA (and Appendix E of this BA) will effectively minimize impacts related to sediment to insignificant levels. This work will result in long-term benefits to sediment and Coho salmon as sediment sources are reduced and passage of watershed products in Elk Creek Watershed is improved.

Water Quality

Effects on the Water Quality habitat Indicator group associated with changes to sediment supply and delivery

are discussed above (e.g. turbidity) under the Sediment habitat Indicator group. The potential for changes to base flows are associated with water drafting, and are discussed above under direct effects. This discussion includes effects of each PE on the following Water Quality habitat Indicator group based on the potential for indirect effects (see Analysis Methods section):

- Water Temperature: Potential effects are associated with alteration of stream shade along perennial streams associated with the following Project activities that will occur within RRs. reforestation/site preparation, hazard tree removal, fuels reduction, temporary road and landing construction and legacy site treatments.
- Chemical Contaminants/Nutrients: Potential effects are associated with use of mechanized equipment within RRs associated with the following activities: reforestation/site preparation, hazard tree removal, fuels reduction treatments, construction of temporary roads and stream crossings, landings and legacy site treatments.
- Refugia: Potential effects are associated with alteration of stream shade associated with the following activities that occur within RRs: reforestation/site preparation, hazard tree removal, fuels reduction, temporary road and landing construction and legacy site treatments. Channel aggradation associated with mass wasting and debris flows has the potential to affect channel morphology and affect fish passage to thermal refugia in tributaries. This potential effect is discussed above under the Sediment habitat Indicator group.

The WSFR Hydrology Report indicates that there are currently eight 7th field watersheds with high risk of temperature regime alteration: Buckhorn Gulch-Beaver Creek, Kohl Creek, Lower Grider Creek, O'Neil Creek, Walker Creek, Caroline Creek, Granite Creek and Middle Elk Creek. All of these watersheds have elevated risk due to the effects of the 2014 wildfires. There are twenty-one and forty-five watersheds with a moderate and low risk, respectively.

Maintaining or restoring stream shade as a way to control water temperature is important. Ambient air temperature over the stream drives maximum water temperature, along with other factors that influence humidity and other micro-climate conditions (Bartholow et al 1989, Essig 1999). The width of RRs, not just shade canopy is key to maintaining micro-climate conditions. FEMAT (1993) called for protection of two site potential tree heights or 300 feet, for all fish-bearing streams. Spence et al. (1996) note that the absolute minimum buffer width for maintaining cool air flow over the stream is one site potential tree height. The proposed action includes RR widths of two site potential tree height along fish-bearing streams and one site potential tree height along non-fish bearing streams. RRs are protected from salvage harvest, but some vegetation management will occur within RRs (fuels treatment, hazard tree removal, legacy site treatments). Watershed PDFs, as described below, will be implemented to maintain water quality, including existing stream shade.

Poole and Berman (1999) noted that large wood jams can contribute to stream cooling by forcing more stream flow into shallow ground water, which is called the hyporheic zone. The water drops slightly in temperature before emerging downstream. Temperature effects associated with large wood are discussed below under the Riparian Function habitat indicator group.

Activities within RRs have the highest risk of affecting the Water Quality habitat Indicator group. Table 34 summarizes the scope of proposed activities that will occur within RRs.

Table 34. Acres of RR that are adjacent or within WSFR treatment units.

Treatment Type	WSFR Project Unit acres adjacent or within RRs
Fuels	6,206
Salvage Harvest	1,990

Hazard Tree Removal	5,684

1. Salvage Harvest and Reforestation

RRs have been established along all streams to protect water quality (for widths of RRs see PDF Watershed-3). Risks to sediment supply and delivery are discussed above under the Sediment habitat Indicator group. Cutting trees for salvage harvest will not occur within RRs, during any and all methods of removal (tractor, skyline and helicopter). Figure 3 displays an example of how RRs and other unstable areas will be excluded from salvage harvest. The acres of salvage harvest are shown above (Table 1) and indicate the amount of RRs that fall within harvest units. But salvage harvest itself will not occur within any RRs. Acres of RRs within or near units are listed in Table 34 because those areas represent a higher risk to water quality due to proximity to stream courses. Skyline yarding corridors that run parallel to streams will not occur within RRs and, in the rare instance when a corridor needs to cross a stream channel, full suspension (*i.e.*, saw logs are not allowed to touch the stream) is required (PDF Watershed- 29). A majority of units only have seasonal streams near or within them and trees in these treatment areas are burned. Acknowledging that standing dead trees do provide some shade to streams albeit short term, Project design provides for protection of standing trees along perennial streams. Therefore salvage harvest will not alter stream shade. Existing skyline yarding corridors will be reused when possible except where a less ground disturbing option is available. Because salvage harvest will not remove trees within RRs, salvage harvest will have insignificant effects on water quality and anadromous salmonid habitat and minor effects on Coho salmon.

Reforestation includes site-preparation, planting, and release of over 7,873 acres, to increase the likelihood and speed by which burned areas are reforested. Reforestation includes manual site preparation, skyline yarding, mastication, mechanical yarding and slash piling of dead trees. Treatments within RRs are limited to the Happy Camp and Whites fire areas in instances where moderate or high severity burned plantations overlap RRs. Proposed actions include lop and scatter of small dead trees and brush, accomplished by hand treatments. Site preparation and planting activities are proposed within salvage units and otherwise within plantations that burned at high or moderate severity. These treatments target plantations that were heavily burned during recent fires and are within units where ground-disturbing actions are proposed. The hand treatment is designed to provide near-term soil cover in locations where the natural buffering capacity of the RR has been reduced by fires. The treatment is likely to reduce short term erosion at the site level, and to help promote and encourage natural regeneration and soil recovery in the RRs treated.

Potential effects to chemical contamination associated with use of mechanized equipment for reforestation activities within RRs during site preparation will be minimized through implementation of Watershed PDF-27, which limits refueling to designated landings that are not hydrologically connected to streams and, as an added precaution, requires a spill containment kit to be on site.

Summary of Indirect Effects. Due to the following minimization measures: 1) site preparation activities within RRs will only occur in plantations (plantations have relatively young and smaller trees) and are solely designed to have beneficial effects to soil and vegetation recovery; 2) implementation of Watershed PDF-11, which limits removal of trees to those that are less than 8" in diameter when removal is needed to address fuels accumulations; 3) tree cutting and lop-scatter methods are limited to hand work; and 4) refueling is not allowed within RRs. Site preparation and reforestation is expected to have insignificant effects on the Water Quality habitat Indicator group and anadromous salmonid habitat, and minor effects on Coho salmon. Releasing over-crowded trees and reducing fuels within RRs will result in long-term beneficial effects because the remaining trees will grow to a larger size quicker and the severity of future fire may be reduced as a result of reduced fuels.

Proximity and Probability. Maps in Appendix A show that treatment units are in proximity to anadromous salmonid habitat. However, the probability of effects is insignificant, as described above.

2. Fuels Reduction

Table 34 above shows the extent of fuels treatments that will occur within or adjacent to RRs. Watershed PDFs for fuels treatments (33, 34, 35, and 36) have been designed to maintain stream shade, understory vegetation and water quality during fuels treatment within RRs. For example, within RRs, prescribed fire effects will mimic a low intensity backing fire, except for handpiles/windrows where higher intensity may occur to consume pile material. Fuels reduction activities are likely to reduce the severity of future fire events, particularly when fire occurs in the same area greater than 5 years in the future. Refer to the Sediment habitat Indicator group discussion above for a more detailed discussion of effects minimization measures.

Summary of Indirect Effects. Due to the Watershed PDFs that will implemented, and because shade canopy will not be affected by fuels treatment activities, fuels reduction actions will have insignificant effects on the Water Quality habitat Indicator group and anadromous salmonid habitat, and minor effects on Coho salmon.

Proximity and Probability. Maps in Appendix A and tables in Appendix B show that treatment units are in proximity to anadromous salmonid habitat. However, the probability of effects is insignificant, as described above.

3. Hazard Tree Abatement

Hazard trees will be removed from roadside areas as described above under the Sediment habitat Indicator group discussion above, including within RRs. The risk of effects to water quality and stream temperatures are where there are groups of hazard trees (especially if there are mature live trees) to be removed along roads that parallel to or repeatedly cross perennial streams. Removal of dead trees and individual hazard trees that are not grouped will have no measurable effect on shade or stream temperatures. Based on field reviews and mapped hazard tree areas (see maps in Appendix A), removal of groups of hazard trees within RRs along perennial stream channels will not occur to an extent that will measurably reduce existing shade canopy. Many hazard trees designated for felling are burned, and now provide only near term and greatly reduced levels of shade to adjacent streams. The groups of hazard trees that will be removed are along short stretches of mostly non-fish bearing intermittent or ephemeral channels.

Summary of Effects. The highest risk of effects associated with hazard tree removal is where groups of trees, especially mature live trees, will be removed within RRs. The extent of removal of groups of trees is limited, based on hazard tree marking reviewed to this point. Hazard trees to be removed are burned or otherwise compromised and pose a safety hazard. Due to policy direction for administration of the road system, there isn't discretion as to whether to fell hazard trees. Based on review of hazard tree marking adjacent to streams, removal of hazard trees along roadsides will have insignificant effects on water quality and anadromous salmonid habitat, and minor effects on Coho salmon.

Proximity and Probability. Maps in Appendix A and tables in Appendix C show that treatment units are in proximity to anadromous salmonid habitat. However, the probability of effects is insignificant (extremely unlikely to occur), as described above.

4. Temporary Roads, Landings and Water Drafting

The proposed action includes approximately 16.4 miles of temporary road segments to access harvest units: 1.2 miles in the Beaver Fire; 14.3 miles in the Happy Camp Complex; and 0.8 miles in the Whites Fire. The total road mileage is divided among several short segments and all temporary roads will be hydrologically restored/stabilized after use. This hydrological stabilization includes: constructing waterbars; outsloping road prisms if appropriate; removing crossings; and obliterating access to the road.

There are a total of ~3.4 miles of proposed new temporary roads, consisting of many short segments proposed on ridgetops to facilitate skyline logging systems. These short spurs will create new alignments on the landscape however field review verified that all proposed new temporary road segments are outside of RR and

not hydrologically connected to downstream fish habitat.

Roads can have a major impact on sediment and the drainage network. Temporary roads can affect water quality through increased sedimentation (discussed above under the Sediment indicator) or through alteration of stream shade associated with stream crossing construction or if construction of a temporary road occurs within RRs and tree removal is required. On existing road alignments, vegetation has previously been disturbed. None of the roads or stream crossings associated with project temporary roads require removal of shade trees along perennial streams. Watershed PDFs (5, 18 and 20) will be implemented to minimize other impacts. Temporary roads and stream crossings will have insignificant effects on the Water Quality habitat indicator group and anadromous salmonid habitat, and minor effects on Coho salmon.

Landing use and construction and potential effects to sediment are discussed above under the Sediment habitat Indicator group. Landings located within RRs represents one of the greatest risk to water quality because landings disturb vegetation in close proximity to stream channels. The project has a risk of affecting water quality through construction or use of the following landings that are within RRs (see locations on map in Appendix A): Landings # DZ03, DZ10, DZ23, L043, L044, and L090). No trees providing effective canopy shade to streams will be removed as a result of landing use or construction. The following Watershed PDFs will be implemented to minimize effects of landings: existing landings will be used to the extent possible; existing landings in stream-course RRs will not be expanded towards stream channels or where vegetation providing shade to streams would need to be removed. Site reviews of all proposed landings to be constructed within RRs indicate that no shade trees would be removed and implementation of Watershed PDFs will effectively minimize impacts to water quality.

Water drafting can result in minor, short-term and localized decreases in flow, especially in smaller streams, affecting water quality. This is particularly true during drought conditions, which may occur during project implementation. However, NOAA specifications (2001) don't allow drafting volumes to exceed 10% of stream flow within fish-bearing streams, to allow for adequate downstream flow to support fish, aquatic insects, amphibians, and other biota. Project BMPs don't allow drafting volumes to exceed 50% of stream flow outside of CH. Additionally, KNF fish biologists will be consulted prior to water drafting operations so that they can ensure that sites with rearing Coho salmon are avoided and sites that are not suitable for fish (primarily due to high stream temperatures) are prioritized for use. Due to PDFs that have been designed to minimize drops in stream flow and associated changes to water quality (PDF 18), the requirement to adhere to NOAA's (2001) water drafting specifications and KNF BMPs, the proposed action will have insignificant effects on water quality and anadromous salmonid habitat, and minor effects on Coho salmon.

Heavy mechanized equipment will be utilized during construction of temporary roads and landings. The use of heavy equipment within RRs represents a risk to water quality because fuel or hydraulic fluid spills could occur. BMPs 2.8 and 2.11 of the Region 5 Forest Service BMP Handbook (USFS 2011), as well as the Watershed PDF-27 will be implemented to minimize the risk of spills. BMPs include requirements that equipment be properly maintained and cleaned, including daily inspections; fueling and servicing of equipment in designated areas outside of RR, with the exception of hydrologically disconnected project landings; having a spill plan in place prior to implementation; removal and disposal of leaks/spills; and requirement to have a spill kit on site. PDF-27 prohibits refueling within RRs except at designated landings in locations where they are disconnected from water features and requires that a spill containment kit be on site where refueling and servicing take place. Based on implementation of minimization measures, fuel spills are not expected and effects on the Water Quality habitat Indicator group and anadromous salmonid habitat will be insignificant, with minor effects on Coho salmon.

Summary of Indirect Effects. Based on BMPs, Watershed PDFs and other project design features that will minimize the potential adverse effects of roads and stream crossings on the Water Quality habitat Indicator group, and because none of the crossings will be within anadromous salmonid habitat, and all but 2 temporary

road/stream crossings will be dry during construction and use, temporary roads and crossings will have insignificant effects on the Water Quality habitat Indicator group and anadromous salmonid habitat, and minor effects on Coho salmon.

New landings within RRs have a high risk of impacts to the Water Quality habitat indicator group including to stream shade and chemical contamination. Although watershed-scale effects are expected to be insignificant, site-scale effects may not be insignificant. Therefore, the magnitude of site-scale effects will be discussed further.

The potential impacts of water drafting on the Water Quality habitat Indicator group is associated with fuel or oil spills near streams. BMPs and PDF-27 are expected to minimize the risk of a leak or spill such that effects on the Water Quality habitat Indicator group and anadromous salmonid habitat, and minor effects on Coho salmon.

Proximity and Probability. Maps in Appendix A show that treatment units are in proximity to anadromous salmonid habitat but outside of CH. The probability of effects is insignificant, as described above, with the exception of landing construction within RRs. Landings #DZ03, DZ10, DZ23, L043, L044, and L090 are within RRs, thus the magnitude of site-scale effects will be discussed below.

Magnitude: The proposed new landings in RRs were all reviewed in the field. Watershed specialists determined that no shade trees would be removed and that soil disturbance would be minimized. Watershed PDF 27 will prohibit refueling unless the landing is hydrologically disconnected. The magnitude of effects is limited in scope to landing #DZ03, DZ10, DZ23, L043, L044, and L090 and potential impacts will be minimized through implementation of BMPs and PDFs. The magnitude of effects to the Water Quality habitat Indicator group is insignificant. New landings in RRs will have insignificant effects on the Water Quality habitat Indicator group and anadromous salmonid habitat, and minor effects on Coho salmon.

5. Legacy Sediment Site Treatments

The potential for indirect effects to water quality is highest for culvert upgrades or passage projects that are within active stream channels that require disturbance to adjacent riparian vegetation. None of the culverts are within habitat accessible to anadromous salmonids or within CH, and most culvert upgrade sites will be dry during construction and use. The culvert projects will likely disturb streamside vegetation in localized areas where culverts are located, and to a limited extent on each side of roads outside of CH. However, this work will occur on existing road alignments, where vegetation has been previously disturbed or removed. Culvert upgrade work has been programmatically analyzed in the Klamath National Forest Facility Maintenance and Watershed Restoration BA (USFS 2004). Disturbance to streamside vegetation providing effective canopy shade will be limited in scope and minimized at each site through BMPs and Watershed PDFs (21-24).

The potential for indirect effects to Coho salmon from legacy sediment site repairs is highest for projects that are within or near CH. None of the culvert projects are within habitat accessible to anadromous salmonids. Most of the culvert projects are well outside of CH, however, six are within 300 feet of CH. The culvert upgrade projects will likely disturb streamside vegetation in localized areas outside of CH, and to a limited extent on each side of roads. However, this work will occur on existing road alignments, where vegetation has been previously disturbed or removed. Culvert upgrade work has been programmatically analyzed in the Klamath National Forest Facility Maintenance and Watershed Restoration BA (USFS 2004). Disturbance to streamside vegetation providing effective canopy shade will be minimized at each site through BMPs and Watershed PDFs (21-24) and effects to the Water Quality habitat Indicator group and anadromous salmonid habitat will be insignificant, with minor effects to Coho salmon. All together, these legacy sediment site treatments will result in meaningful benefits water quality and fish habitat in Elk Creek watershed, as well as improved passage for aquatic organisms and watershed products.

Summary of Indirect Effects. Because this PE is not within anadromous salmonid habitat, these projects are

expected to have insignificant effects to water quality and anadromous salmonid habitat, and minor effects to Coho salmon. Effects to Sediment are discussed above. Legacy site repair will result in long-term beneficial effects to Coho salmon and anadromous salmonid habitat through significant reductions in sediment sources (refer to information provided above under the Sediment habitat Indicator group). Long-term beneficial effects may also include prevention of road crossing failures and associated disturbance to vegetation at the site-scale and downstream.

Proximity and Probability. Maps in Appendix A and tables in Appendix B show that treatment units are in proximity to anadromous salmonid habitat but outside of CH. The probability of effects is insignificant.

Riparian Function

Key riparian functions include sediment retention (discussed above under the Sediment habitat Indicator group), stream shade (discussed above under the Water Quality habitat Indicator group), protection and development of channel morphological features (streambanks, floodplains and side channels) and large wood loading to stream channels. The following discussion is focused on effects to the following Riparian Function habitat indicators based on the potential for indirect effects from the PEs (see Methods section):

- Large Wood: Potential effects are associated with removal of trees within RRs associated with the following PEs: salvage and reforestation/site preparation, hazard tree removal, fuels reduction, temporary road and landing construction and legacy site treatments.
- Off-channel habitat and floodplain connectivity: These habitat indicators are not applicable to certain channel types (Rosgen types A, B, and G), which characterize many of the Action Area streams. Existing off-channel habitat and floodplain function and the potential for development of these features exists in low gradient, valley floor reaches. For example, in the lower 1.6 miles of Grider Creek there is potential for development of more off-channel habitat, however there has been channelization in this reach associated with the existing road to prevent flood damage. None of the PEs include channelization or other work within valley floor segments or floodplains within Analysis Area streams. The proposed action aims to provide protection to valley floor stream segments and floodplains though designation of RRs, inner gorges and other unstable areas, and by avoiding any modifications to streambanks or floodplains. Thus, the project will have neutral effects on off-channel habitat and floodplains.

  The Analytical Process allows use of "efficiency measures" if there is no causal mechanism to affect an indicator. For these reasons, the off-channel and floodplain habitat indicator will not be discussed further.

- Streambank Condition: The Flood of 1997 and associated debris flows altered channel conditions in many of the Analysis Area streams including streambank conditions. Altered channels, streambanks and riparian vegetation are still recovering from the 1997 flood event. The potential for effects to this indicator are associated with activities that occur in the near-stream zone within RRs. Most of the PEs avoid this area with the exception of hazard tree removal (where this occurs along roads that cross or run parallel to streams), temporary road stream crossings/culvert installations, and legacy site treatments that include stream crossings.

Landscape-level changes to forested habitat occurred as a result of the 2014 wildfires. High fire intensity areas were characterized by total or near-total conifer crown consumption, resulting in severe impacts to riparian function in some areas. Within areas of moderate burn intensity, some crown consumption occurred, but generally these areas are characterized by total or near-total crown scorch. The vast majority of trees in these burned areas have been killed by the fire or damaged beyond their ability to survive. Within areas of light burn intensity only the smaller size and lower crown class conifers were burned.

The 2014 fires changed riparian function in a mosaic pattern across the landscape. Burned understory vegetation may recover quickly and fully re-establish in 20 years or so. Regrowth of large conifers will take much longer, at least 50 years. Within burned RRs, there will be an increase in large wood loading in the near-term, as burned

trees fall and recruit to stream channels. There will be a reduction in large wood available for recruitment in the long-term, until large conifers and hardwoods re-establish. The process of regrowth and recruitment will occur at varying rates across the landscape, and burned areas will input large wood at different rates than adjacent unburned stands. Thus, a mosaic of different conditions are expected across the landscape over time.

The risk of impacts to riparian function is highest for actions that occur within RRs. As described above under the Water Quality section, FEMAT (1993) called for protection of two site potential tree heights or to the edge of the inner gorge and Spence et al. (1996) note that the absolute minimum buffer width is one site potential tree height. The proposed action includes RR widths of two site potential tree height along fish-bearing streams and one site potential tree height along non-fish bearing streams. RRs are protected from salvage harvest, but some proposed activities will occur within RRs and are the focus of this discussion. They are fuels treatment, hazard tree removal, roads/landings/stream crossings, and legacy site treatments. Watershed PDFs, as described below, will be implemented to minimize effects to riparian function.

A primary function of RRs is as a source for large wood recruitment to streams. Large wood plays a dominant role in forming pools, metering sediment, trapping spawning gravels and creating a more complex stream environment. In general, the larger the size of the wood, the greater its stability and duration in the stream channel. Heavier pieces require higher flows for mobilization and longer pieces are more likely to be caught by the stream bank and its vegetation (Spence et al., 1996). Large wood is important for forming pools in lower order streams as well (Kelly et al., 1995; Bisson et al., 1987) and pieces that span the channel can create dam pools or form complex jams which make excellent cover for aquatic species. Much of the large wood entering stream channels does so through landslides and debris torrents during large storm events. The wood component of debris torrents forms log jams, which may retain sediment for several years, thereby protecting lower reaches of the stream from sediment impacts. Poole and Berman (2000) note that large wood jams can also force stream flows underground and that this connection with the hyporheic zone can help cool stream temperatures. Large wood in headwater areas may also prevent headward erosion of gullies and stream channels (Kelly et al., 1995). Where effects to large wood are predicted herein, potential effects to stream temperature and erosion are inferred through the aforementioned mechanisms.

1. Salvage Harvest and Reforestation

The primary risks to riparian function are associated with soil disturbance (discussed above under the Sediment Indicator), effects to stream shade and chemical contamination (discussed above under the Water Quality Indicator), and effects associated with removal of standing or down trees that provide various functions in RRs (e.g. soil retention and productivity, and large wood loading to streams).

RRs have been established along all streams to protect riparian function (see PDFs Watershed-3) including large wood sources. Cutting of trees for salvage harvest will not occur within RRs during any and all methods of removal/harvest (tractor, skyline and helicopter). For an example of how RRs and inner gorges will be identified and excluded from salvage harvest refer to earlier discussion around Figure 3. Refer to the Sediment Indicator discussion above for a discussion of watershed disturbance associated with the proposed action. Skyline yarding corridors will not impact riparian function, as existing corridors will be used where possible: unless a less ground disturbing option is available. Where skyline corridors are needed parallel to stream channels they will be placed outside of RRs.

Reforestation includes site-preparation, planting, and release over 7,873 acres to increase the likelihood and speed by which burned areas become reforested. Reforestation includes manual site preparation, skyline yarding, mastication, mechanical yarding and slash piling of dead trees. Treatments within RRs are proposed where existing heavily burned plantations overlap RRs in Happy Camp and Whites fire areas (approximately 1227 acres), and where safety of forest workers can be ensured. These RR treatments are limited to lop and scatter of small dead trees and brush, accomplished by hand. The effect of these actions would be increased near term ground cover which would improve the post-fire buffering capacity of RRs and promote quicker soil and

vegetation recovery.

Summary of Indirect Effects. Because salvage harvest will not occur within RRs, salvage harvest will have insignificant effects on riparian function and anadromous salmonid habitat, and minor effects on Coho salmon.

Site preparation and reforestation will not occur in RRs. Hand treatments to lop and scatter small dead trees and brush may occur within RRs and has the potential to improve riparian function at the site level. Only hand treatment is allowed and only small trees would be cut and small material lopped and scattered to achieve ground cover. Site preparation and reforestation outside of RRs are expected to have insignificant effects on riparian function and anadromous salmonid habitat and minor effects on Coho salmon. Lopping and scattering small material, releasing over-crowded trees, and reducing fuels within RRs will result in long-term beneficial effects to riparian function, anadromous salmonid habitat, and SONCC Coho salmon. Due to reforestation and release actions, trees are likely to grow to a larger size quicker than if no action were taken, and the severity of future fire may be reduced as a result of reduced fuels.

Proximity and Probability. Maps in Appendix A and tables Appendix C show that treatment units are within proximity to anadromous salmonid habitat. However, the probability of effects is insignificant because trees in RRs will not be removed.

2) Fuels Reduction Treatments

The risk of effects to riparian function is associated with soil disturbance (discussed above under the Sediment Indicator), effects to stream shade and chemical contamination (discussed above under the Water Quality Indicator), and effects associated with removal of standing or down trees that provide various functions in the riparian zone (soil retention and productivity and large wood loading to streams).

Fuels reduction through thinning small diameter trees in RRs will occur in the proposed roadside treatments and fuels reduction zones (see map in Appendix A). Thinning will remove smaller trees that represent a fuels hazard or ladder fuels. These actions will improve the growth rate of larger trees left on site, thereby improving riparian function relative to stream shade, microclimate and large wood loading in the future. Overstocked conditions prevent or retard the attainment of mature stands and desired conditions within RRs – and the crowded, small diameter trees targeted for removal will likely not reach desired size for providing stream shade or recruitment to streams. Watershed PDF 37 requires that prescribed fire retain at least 90% of the down and standing large woody debris in RRs to protect soil productivity, soil retention capacity and large wood loading to stream channels. Some small localized flareups could occur in pockets where fuel accumulations are high but overall, prescribed fire actions are designed to minimize adverse effects on riparian function and to make stands more resilient to wildfire. Effects to Sediment associated with mastication and other ground disturbance are discussed above under the Sediment Indicator.

Summary of Indirect Effects. Due to the Watershed PDFs that will be implemented to minimize effects to riparian function (primarily the requirement to maintain key standing and down large wood pieces, and to only thin small diameter trees), fuels reduction actions will have insignificant effects on riparian function and anadromous salmonid habitat, and minor effects on Coho salmon.

Proximity and Probability. Maps in Appendix A and tables Appendix B show that treatment units are in proximity to anadromous salmonid habitat. However, the probability of effects is insignificant primarily because of the requirement to maintain key standing and down large wood pieces, and to limit thinning to small diameter trees.

2. Hazard Tree Removal

Hazard trees will be removed from roadside areas, including within RRs. The risk of effects to riparian function is associated with soil disturbance (discussed above under the Sediment Indicator), effects to stream shade (discussed above under the Water Quality Indicator), and effects associated with removal of standing or down

trees that provide various functions in the riparian zone (soil retention and productivity and large wood loading to streams).

Table 35 displays miles of hazard tree removal that are proposed within 175 feet from SONCC Coho CH by watershed. Critical Habitat reaches of lower East Fork Elk Creek, Elk Creek, Walker Creek, China Creek, Tompkins Creek, North Russian Creek, and Whites Gulch, along with several reaches of the middle Klamath River, may be affected by this action.

Table 35. Miles of roadside hazard removal within 175 feet of CH.

Fire area	5th Field watershed	Hazard Tree Removal Miles Within 175 feet of Coho CH
Beaver	Beaver Creek	1.7
	Horse Creek-Klamath River	1
	Humbug Creek-Klamath River	4.6
Happy Camp	Elk Creek	4
	Lower Scott River	4.1
	Seiad Creek-Klamath River	3.4
	Thompson Creek-Klamath River	2.1
Whites	North Fork Salmon	8.3
Total		29.2

Especially where roads proposed for hazard tree removal are parallel to, and within RR associated with SONCC Coho salmon CH streams (listed above Table 35), it is important that any trees below the road that are deemed a hazard to the road will be felled toward the stream channel, and any tree larger than 26 inches DBH will not be removed. The following Watershed PDFs will be implemented to minimize effects: Watershed-14 requires that all hazard trees cut within 25 feet of stream channels, including fish/bearing stream channels, be left on site unless they pose a safety hazard; all hazard trees that are 26 inches or greater in diameter at breast height, must be left on site, unless they pose a safety hazard; Watershed-16 prohibits trees from being cut that are on streambanks; Watershed-17 requires directional felling to protect streambanks. Most of the hazard trees along roads within the three burned areas are burned or otherwise compromised and pose a safety hazard, thus there is not discretion with regard to felling/removal.

Summary of Effects. Watershed PDFs will help maintain key riparian functions such as standing and down large wood (*i.e.*, felled trees will be left on site within the recruitment zone along streams to protect soil productivity, sediment retention and large wood loading) retention after hazard tree removal. Thus, hazard tree removal will have insignificant effects to riparian function and anadromous salmonid habitat, and minor effects to Coho salmon.

Proximity and Probability. Maps in Appendix A and tables Appendix C show that treatment units are in proximity to anadromous salmonid habitat. However, the probability of effects is insignificant primarily because felled trees will be left on site within the recruitment zone along streams wherever safety concerns permit, to protect soil productivity, sediment retention and large wood.

3. Roads, Landings and Water Drafting

The proposed action includes approximately 16.4 miles of temporary road segments to access harvest units: 1.2 miles in the Beaver Fire; 14.3 miles in the Happy Camp Complex; and 0.8 miles in the Whites Fire. The total road mileage is divided among several short segments, and all temporary roads will be hydrologically

restored/stabilized after use, including: constructing waterbars; outsloping road prisms if appropriate; removing crossings; and obliterating access to the road.

Approximately 3.4 miles of proposed temporary roads will create new road bed alignments. Field review confirmed that new temporary roads are proposed as short segments, generally on ridgetops, that would facilitate skyline logging systems. All of these new temporary road alignments are well outside of riparian areas and construction, use, and hydrologic stabilization of these segments would not impact riparian function or threaten downstream water quality.

Temporary roads can affect riparian function through increased sedimentation (discussed above under the Sediment indicator) or through disturbance within near-stream zones associated with stream crossing construction, or if construction of a temporary road occurs within RRs. Large wood will not be affected at crossings on existing road alignments as these areas have been previously disturbed and cleared. The following minimization measures and project designs features will be implemented to minimize effects to riparian function at all stream crossings: 1) none of the stream crossings are within fish-bearing habitat; 2) none of the alignments require removal of shade trees along perennial streams; and 4) Watershed PDFs (5, 18 and 20) will be implemented to minimize site effects.

Landing use and construction and potential effects to sediment are discussed above under the Sediment habitat Indicator group. Landings located within RRs represents one of the greatest risks to riparian function because landings routinely disturb soil and vegetation in close proximity to stream channels. The proposed action has a high risk of affecting riparian function at the site-scale through construction of the following landings that are within RRs (see locations on map in Appendix A): Landings # DZ03, DZ10, DZ23, L043, L044, and L090.

Based on site reviews of all proposed new landings within RRs, the fact that no large conifers would be removed, and that Watershed PDFs will be implemented that are designed to minimize impacts to riparian function (existing landings will be used to the extent possible; existing landings in stream-course RRs will not be expanded towards stream channels or where trees that provide shade to streams would need to be removed), use or construction of landings will have insignificant effects on riparian function and anadromous salmonid habitat, and minor effects to Coho salmon.

Water drafting can result in impacts to riparian function if new sites are developed or existing sites are modified. Watershed-38 and 39 require that only existing developed water drafting sites be used and that the only modifications allowed to sites within Coho salmon CH is the rocking of approaches to minimize sedimentation. Due to PDFs and BMPs (described above under the Sediment and Water Quality indicators) that have been designed to minimize effects, water drafting will have insignificant effects on riparian function and anadromous salmonid habitat, and minor effects to Coho salmon.

Summary of Indirect Effects. General project design features, BMPs and Watershed PDFs (*e.g.* none of the stream crossings are within fish-bearing habitat, stream crossings are mostly limited to intermittent or ephemeral streams that will be dry during construction and use, and none of the road alignments require removal of shade trees/large wood along perennial streams) will be implemented to minimize impacts. Thus, temporary road construction and stream crossings will have insignificant effects on riparian function and anadromous salmonid habitat, and minor effects on Coho salmon.

At the watershed-scale, landings will have insignificant effects to riparian function because they are small areas of disturbance interspersed with undisturbed zones. General project design features guide locations, avoid unstable areas and require use of existing landings whereever possible. BMPs and PDFs have been designed to minimize impacts. Thus, at the watershed-scale, landing use and construction will have insignificant effects on riparian function and anadromous salmonid habitat, and minor effects on Coho salmon. However, at the site-scale, landings have a high risk of adverse effects when constructed within RRs (Landings # DZ03, DZ10, DZ23, L043, L044, and L090). Thus, the magnitude of this effect will be discussed further below.

Magnitude: All proposed new landings in RRs were reviewed in the field. The magnitude of potential effects is limited in scope to landing #DZ03, DZ10, DZ23, L043, L044, and L090. The criteria for use of existing landings are: existing landings in RR will not be expanded towards stream channels, or on to active landslides, or where vegetation that provides shade to a stream would need to be cut. Existing landings in RRs will be shaped and treated for erosion control at the end of each season of use, and hydrologically restored at project completion (including subsoiling and covering with slash/mulch as needed). Reused landings in RRs will have site specific erosion control measures to reduce risk of sediment delivery into streams.

Site review of all new landings proposed within RR confirmed that these criteria (PDF Watershed-23) and other PDFs, along with proper implementation of BMPs, would be sufficient to avoid any meaningful negative effect(s) to anadromous fish habitat. The magnitude of effects to the Riparian Function habitat Indicator group and anadromous salmonid habitat is insignificant, with minor effects on Coho salmon.

4. Legacy Site Treatments

The potential for indirect effects to riparian function is highest for projects that are within or near active stream channels. None of the culvert upgrade projects are within habitat accessible to anadromous salmonids. Most of the culvert projects are well outside of CH, however six are approximately 300 feet from CH. The culvert upgrade projects will likely disturb streamside vegetation in localized areas where culverts are located, and to a limited extent on each side of roads. However, this work will occur on existing road alignments, where vegetation has been previously disturbed or removed. Thus, only early seral stage vegetation will be disturbed. Culvert upgrade work has been programmatically analyzed in the Klamath National Forest Facility Maintenance and Watershed Restoration BA (USFS 2004). Disturbance to streamside vegetation will be minimized at each site through BMPs and Watershed PDFs (21-24). All together, these legacy sediment site treatments will result in meaningful long term benefits to riparian function in the Elk Creek watershed.

Summary of Indirect Effects. Because these project activities are not within anadromous salmonid habitat or CH, these project activities are expected to have insignificant effects to riparian function and anadromous salmonid habitat, and minor effects to Coho salmon. Long term effects include improved riparian function and reduced road-related threats to water quality. Effects to sediment have been discussed above.

Proximity and Probability. Maps in Appendix A show that treatment sites are not within anadromous salmonid habitat. As described above under the sediment discussion, there are six culvert projects that are approximately 300 feet of CH (Upper East Fork Elk Creek and Cougar Creek-Elk Creek). However, these sites are at existing road crossings that have been previously disturbed and no large trees eligible for recruitment to streams would be removed. The probability of effects to riparian function is insignificant, as described above. The legacy sediment site work will result in benefits to riparian function in the long-term as crossings are upgraded to handle larger flood events and the potential for major flood disturbance induced by undersized crossings is reduced.

VIII. Cumulative Effects

The ESA defines cumulative effects in 50 C.F.R. 402.02 as "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." The AP (on page 42) explains that, "if the effect determination is NLAA, an assessment of ESA cumulative effects is not required by the regulations…." However, the following information is provided for added perspective.

The KNF uses standardized Cumulative Watershed Effects (CWE) models (Equivalent Roaded Area, Universal Soil Loss Equation, Mass Wasting) to assess effects of past, present, and reasonably foreseeable activities. The WSFR Hydrology Report affected environment analysis includes the following projects within the Analysis Area: Eddy Late Successional Reserve, Elk Thin, Fish Meadows, Glassups Timber Sale, Happy Camp Fire Protection Phase 2, Johnny O'Neil Late Successional Reserve Habitat Restoration and Fuels Reduction, Lake

Mountain Foxtail Pine, Lower Scott Roads, North Fork Roads Storm-proofing, Oak Flat Thin, Singleton, Thom Seider Vegetation Management and Fuels Reduction, Two Bit Vegetation Management projects, work done under the Burned Area Emergency Response, grazing allotments, Timber Harvest Plans since 2005, and private land salvage (under Emergency Timber Harvest Plans). These are on-going activities and the CWE model includes them in the "current" portion of the results.

The CWE models reflect that there will be no increase in disturbance at the 5th-field watershed scale, and only minor incremental increases at the 7th field watershed scale (and short term disturbance at sites), due to project actions. As described in this analysis, at the watershed and site scale, Project effects to SONCC Coho salmon are either discountable (extrememly unlikely to occur), or insignificant (not meaningful). Therefore, cumulative impacts from adding the effects of the proposed action to present and reasonably foreseeable future actions are insignificant.

Of note is that during several Project field visits from November 2014 to March 2015, private timber harvest and associated road activities in the Beaver Fire area (Beaver, Doggett, and Kohl creek drainages) were observed to be causing sediment mobilization to streams downslope in Beaver and Doggett Creeks. This project proposes only minor amounts of ground disturbing activities in these watersheds (total of 350 acres of salvage, 1700 acres of site prep and plant, and 0.8 miles of temporary road on existing road bed in the Beaver Fire area), and project actions will help restore late seral vegetation quicker on the acres treated, when compared to no action. Even so, short term insignificant effects to the sediment regime due to this project could be viewed as additive to these ongoing sediment-related impacts from private land activities. However, due to the low level of impact caused by this project (no salvage harvest in RR, minimal new infrastructure proposed, and minor acreage of ground disturbance in these watersheds), the influence of these effects to the sediment regime in Beaver, Doggett and Kohl creeks, and in the mid Klamath River constitutes a minor and insignificant impact to Coho salmon and their CH.

Future Federal actions that have not already been consulted on will be analyzed through separate Section 7 consultations.

IX. Effects Summary

The Analytical Process requires that BAs provide a summary statement for each PE. A summary of project effects by Project Element and by 2014 fire area is in Appendix G.

> Once a PE summary is provided (above), the AP requires that BA's use a Project Effects Determination Key to answer questions based on the Indicator summary conclusions at the ESA action area scale, as follows:

PROJECT EFFECTS DETERMINATION KEY FOR SPECIES AND DESIGNATED CH

1) Do any of the Indicator summaries have a positive (+) or negative (-) conclusion?
   - Yes – Go to 2
   - No – No Effect

2) Are the Indicator summary results only positive?
   - Yes – NLAA
   - No – Go to 3

3) If any of the Indicator summary results are negative, are the effects insignificant or discountable?
   - Yes – NLAA
   - No – LAA, fill out Adverse Effects Form

X. Effects Determinations

Taking all analysis into consideration, at the ESA action area scale, it is the determination of the Fisheries Biologists that the WSFR may affect, but is not likely to adversely affect SONCC Coho salmon or its designated CH.

KNF stream surveys, California Department of Fish and Wildlife information and professional judgment of fisheries biologists has been compiled into the KNF steelhead trout distribution layer in the KNF Geographic Information Systems electronic library. The use of the KNF steelhead trout distribution to define SONCC Coho salmon and UKTR spring and fall-run Chinook salmon EFH is a conservative estimate of the distribution of SONCC Coho salmon and UKTR Chinook salmon because their distribution is less extensive than steelhead trout. For the Project, EFH is considered synonymous with steelhead distribution.

The effects analysis considers effects to Pacific salmonid habitat in general; and since habitat requirements for Coho and Chinook salmon are similar, the effects of the Project as described above for Coho salmon CH are similar for EFH.

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