Biological Assessment
For
Threatened, Endangered, Proposed, and Sensitive Species
That May be Affected by the
Mt Ashland LSR Habitat Restoration and Fuels Reduction Project

Oak Knoll Ranger District
Klamath National Forest

April 16, 2007

Prepared and finalized by: _____ Date: April 16, 2007
Brian Thomas, Fisheries Biologist, Supervisors Office

Approved by: /s/ *Alan Vandiver* Date: April 24, 2007
Ranger Name, Alan Vandiver District Ranger

PROJECT NAME: Mt Ashland LSR Habitat Restoration and Fuels Reduction Project

ADMINISTRATIVE UNIT: Klamath National Forest, Oak Knoll Ranger District

FOURTH FIELD WATERSHED: Middle Klamath River

FIFTH FIELD WATERSHEDS: Beaver Creek, Cottonwood Creek

SEVENTH FIELD WATERSHEDS:

Beaver-Grouse Creek
Headwaters Cottonwood Creek
Long John Creek
Upper Cow Creek
Deer-Beaver Creek
Hungry Creek

WATERSHED ANALYSES: Beaver Creek Ecosystem Analysis, 1996

NEPA DOCUMENTATION: Mt Ashland LSR Habitat Restoration and Fuels Reduction Project Draft Environmental Impact Statement, 2007 (in progress).

ESA SPECIES CONSIDERED:

Southern Oregon/Northern California Coasts coho salmon Evolutionarily Significant Unit (coho salmon)

ESA CRITICAL HABITAT CONSIDERED:

Southern Oregon/Northern California Coasts coho salmon Critical Habitat (CH)

ESA DETERMINATIONS:

May Affect but is Not Likely to Adversely Affect Southern Oregon/Northern California Coasts coho salmon and their designated Critical Habitat

SENSITIVE SPECIES CONSIDERED:

1) Upper Klamath-Trinity Rivers Chinook salmon (Chinook salmon)
2) Klamath Mountains Province steelhead trout (steelhead trout)

SENSITIVE SPECIES DETERMINATIONS: The Project is not likely to result in a trend toward listing or loss of viability of steelhead trout or Chinook salmon in the short term, and will have beneficial effects to habitat conditions in the long term through reduced risk of uncharacteristic wildfires and improved conditions in the Riparian Reserves.

ESSENTIAL FISH HABITAT (EFH): The project will not adversely affect Chinook salmon EFH

I. INTRODUCTION

The purpose of this biological assessment/biological evaluation (BA) is to determine effects of three alternatives for the Klamath National Forest's (KNF) Mt Ashland LSR Habitat Restoration and Fuels Reduction Project on anadromous fish species listed under the Endangered Species Act as Endangered or Threatened, on designated Critical Habitat for those species, and on species listed as "Sensitive" by the Pacific Southwest Region of the USDA Forest Service.

Project activities are located in the Beaver Creek Ecosystem Analysis Area on the KNF, in the vicinity of Klamath River, California. The Project occurs on Matrix-General Forest, Managed Wildlife Area, and Riparian Reserve land allocations as defined in the KNF's Land and Resource Management Plan (LRMP) (USDA Forest Service 1995). The 5th field and 7th field watershed names and hydrologic unit codes (HUC) where Project activities occur are:

HUC - 5: 1801020609	Beaver Creek
HUC - 5: 1801020607	Cottonwood Creek
HUC – 7: 18010206070101	Headwaters Cottonwood Creek
HUC – 7: 18010206090101	Upper Cow Creek
HUC – 7: 18010206090102	Long John Creek
HUC – 7: 18010206090103	Beaver/Grouse Creek.
HUC – 7: 18010206090201	Deer-Beaver Creek
HUC – 7: 18010206090202	Hungry Creek

This BA is prepared in accordance with legal requirements set forth under Section 7 of the Endangered Species Act of 1973, as amended (ESA), [16 U.S.C. 1531 et. seq. 50CFR 402], Essential Fish Habitat (EFH) consultation under 305 (b) (4) (A) of the MSA and is consistent with standards established in Forest Service Manual direction (FSM 2672.42; USDA Forest Service 1991). The ESA species list for the KNF was obtained on-line on October 25, 2006, at http://arcata.fws.gov/specieslist, and the Sensitive species list is from the USDA Pacific Southwest Region Sensitive Species List, June, 1998. The BA analyzes effects to the following Evolutionary Significant Units (ESUs), designated critical habitat, and EFH of anadromous fish:

Endangered:	None
Threatened:	Southern Oregon / Northern California Coasts ESU coho salmon (*Oncorhynchus kisutch*), and their designated CH
Proposed:	None
Sensitive:	Upper Klamath-Trinity Rivers Chinook salmon (*O. tshawytscha*) Klamath Mountains Province steelhead trout (*O. mykiss*)
EFH:	For coho and Chinook salmon

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

- Appendix A1: CWE Model Tables (USLE, GEO and ERA for each Alternative)
- Appendix A2: CH/EFH Distribution Map for Project Area
- Appendix B: Best Management Practices (BMPs)
- Appendix C: Table of Populations and Habitat Indicators for use on the Klamath National Forest in the Northwest Forest Plan Area – includes the Primary Constituent Elements of coho Critical Habitat, and footnotes.
- Appendix D: Checklists for Documenting the Environmental Baseline and Effects of Proposed Action(s) on Relevant Indicators for the Project
- Appendix E: Life History and Biological Requirements of Pacific Salmonids
- Appendix F: Background information on Analyses related to Sediment, Flow, and Disturbance Indicators.
- Appendix G: Proposed Action -Details on Project Elements, Table of Activities in RRs

II. CONSULTATION TO DATE

The Project is consistent with the March 19, 2004, Biological Opinion (BO) issued by National Marine Fisheries Service (NOAA Fisheries or NMFS) for the KNF's LRMP. The March 19, 2004 BO does not authorize any incidental take of listed species, and an incidental take statement is not included. Individual land management actions, groups of actions, and programmatic actions are to be consulted upon subsequently using appropriate analytical methods, in accordance with the procedures established in the Interagency Cooperation regulations for implementing section 7 of the ESA (50 CFR 402), as well as interagency agreements and guidance on streamlining consultation with the action agencies.

The March 19, 2004 BO further states that effects to salmonids at the site scale will be analyzed in future project-level section 7 consultations. To fulfill obligations under section 7(a)(2) of the ESA for individual or groups of projects and to be exempt from section 9 take prohibitions, the administrative units may use the interagency consultation streamlining guidance (1999), or subsequent updated procedures such as the December 2003 Counterpart Regulations, to avoid jeopardizing the continued existence of listed salmonids. Interagency Level 1 teams evaluate the effects of proposed actions against the environmental baseline at project and watershed scales.

A new Analytical Process (AP) was established on November 5, 2004 for timber sales that "may affect" listed salmonid species within the Northwest Forest Plan (NFP) area to address lawsuits and rendered decisions. The Forest follows this new AP to assess the Project in this BA.

The AP replaced the 1996 Matrix of Pathways and Indicators (NMFS 1996) with a "Table of Populations and Habitat Indicators for Use in the Northwest Forest Plan Area."

The new set of fish and fish habitat Indicators (the “Table”) is found in Appendix C. The Table describes the Primary Constituent Elements of Critical Habitat for coho salmon as well as the important elements necessary for analysis of habitat for steelhead trout, Chinook salmon, and Essential Fish Habitat. The Table provides values and ranges of conditions of Indicators to determine whether baseline conditions are "Properly Functioning", "At Risk", or "Not Properly Functioning". In project-level analyses, these values and range of conditions describe the range of variability for anadromous fish habitat. As noted in the Table in Appendix C of the AP -- the range of criteria presented in the AP is not absolute and may be adjusted for local watersheds given supportive documentation. The KNF –NMFS Level 1 team adjusted the Matrix of Pathways and Indicators over the last few years, and the Table was refined again in October 2005 to reflect local geologic and climatic influences on aquatic habitat and watershed conditions within the Klamath River Basin physiographic area. The adjustments for the mid Klamath River region (within the KNF boundaries) use values from streams that are considered pristine and as supported by the KNF LRMP EIS data to determine “Properly Functioning” Indicator conditions for anadromous streams on the KNF. Values were also estimated for "At Risk" and "Not Properly Functioning" Indicator conditions. In some cases, a stream’s morphology, aspect or size may not support “Properly Functioning” criteria values for one or more habitat Indicators. If an Indicator for a particular stream is determined by the project fisheries biologist to be functioning at its capability (due to morphology, aspect, or size), it is rated as “Properly Functioning” even if it does not meet criteria values in the Table. Appendix D in this BA summarizes the baseline conditions and effects of the Project described in Section V.

Between November 2004 and May 2006, NMFS staff attended Interdisciplinary Team (IDT) meetings and field trips to review the Project objectives, to better understand the baseline condition, and to determine the probable effects of the Project. During this period the KNF and NMFS Level 1 team discussed the proposed Project to review potential effects and to include appropriate measures to minimize adverse effects to coho salmon and its CH. NMFS and KNF staff conducted site level reviews of proposed activities in the Project watersheds (i.e, Beaver Creek and Cottonwood Creek 5th fields) to determine the potential risks to anadromous fish and their habitat and to evaluate resource protection measures that are aimed to prevent adverse effects to SONCC coho salmon and CH on June 6, 2006, June 13, 2006, and July 6, 2006. During the June 13, 2006 field visit, NMFS staff preliminarily concurred that proposed activities in RRs in the Project area were not likely to adversely affect SONCC coho salmon and their CH. Several drafts of the BA were reviewed by NMFS Level 1 between June and January 2007. The BA was agreed to by Level 1 on February 20, 2007 via email. Additional information on how the turbidity indicator is analyzed was added to the BA on April 12, 2007 (see Appendix’s C and F), but this did not change the Project effects determination. NMFS agreed to the Final BA on April 16, 2007.

III. PROPOSED ACTION

1) **Type of Project** (fuels reduction)

The purpose of the Project is to restore and maintain healthy forest ecosystems that are resistant to catastrophic stand-replacing wildland fires.

Project Summary

The proposed action is to thin stands, treat fuels, and conduct associated activities (pre-commercial thinning) on approximately 4,706 acres in 256 stands. This proposal includes road activities to improve hydrologic conditions and create a more efficient transportation system within the project area. The proposed activities would likely occur within seven years.

Location

The Project area is located in the upper elevations of Long John Creek, Beaver/Grouse Creek, Upper Cow Creek, Deer-Beaver Creek, Headwaters Cottonwood Creek, and Hungry Creek 7th field watersheds on the south side of the Siskiyou Crest, approximately 25 miles northwest of Yreka, California. The legal description is: Township 40 South, Range 1 West, Sections 26, 34, 35, and 36; T40S, R1E, Sections 29-32; T41S, R1W, Sections 1-3, 10-14; T41S, R1E, Sections 5-8, 18; T48N, R8W, Sections 20-22, and 28, Mount Diablo Meridian. UTM Lat/Long: 1228157418694. The Project area includes 770 acres of private land; however, no actions are proposed on private land.

All Project activities will occur within six 7th-field watersheds (Long John Creek, Beaver/Grouse Creek, Upper Cow Creek, Deer-Beaver Creek, Hungry Creek, and Headwaters Cottonwood Creek). Long John Creek, Beaver/Grouse Creek, Upper Cow Creek, Hungry Creek, and Deer-Beaver Creek 7th fields are situated within the Beaver Creek 5th field watershed. Headwaters Cottonwood Creek 7th field is situated within the Cottonwood Creek 5th field. A maximum of 4,718 acres (this includes acreages listed under III.A.1, timber harvest prescriptions (4,706 acres), and directly manipulated road surface acreage (12 acres)) will be affected by the Project within the action area of 69,664 acres, or 6.7 percent of the land base within Beaver Creek 5th field. See description of action area on page 22.

Proposed Action (Alternative 2 – Preferred Alternative) Described As Project Elements

It was determined from the effects analysis that Alternative 2 has more impacts/effects than Alternative 4 or 5. It was determined that Alternatives 4 and 5 have less project activities and impacts, and therefore their effects would be less than the impacts/effects of Alternative 2. Alternative 4 has less skyline, tractor, tractor endline, combination ground-based systems and mechanical harvester acres than Alternative 2. The total acreage is less than Alternative 2 (3354 acres versus 3875 acres). Alternative 5 has less skyline cable, tractor, combination ground-based systems, and mechanical harvester acres than Alternative 2. Alternative 5 does have more helicopter acres than Alternative 2, but helicopter harvest is the least ground disturbing activity of the six harvest methods that

will be used for the project.

Primary Project Elements (PEs):

- Forest Restoration (e.g., prescription, yarding methods, stand layout)
- Fuels Reduction (underburning, fire line construction, hand piling, pile burning, mastication)
- Road Related Activities (temp road construction, road decommissioning, haul road maintenance, landing construction and maintenance, hazard tree removal)
- Water Drafting

Forest Restoration PE

Prescriptions for the three alternatives will consist of variable density thinning from below, which would take place with modifications for the stands topographic aspect, slope position, species composition, and relationship to other key habitat features (refer to Appendix G, Table G-1, General Thinning Prescriptions for Trees Greater Than 9 Inches DBH). Trees in the smaller size classes (three to twenty inches in diameter) would be removed; the removal of white fir would be emphasized.

Variable Density Thinning - (trees >9” DBH (see Appendix G, Table G-1 for thinning descriptions).

Alt 2 (Proposed Action) – 3875 acres.
Alt 4 - 3354 acres.
Alt 5 – 3781 acres.

Six Logging/Yarding systems will be used (see Appendix G for yarding system descriptions).

- Tractor
- Tractor Endlining
- Skyline
- Helicopter
- Mechanical Harvester
- Combination Ground Based Systems

Table 1 – Comparison of Alternatives 2,4,5 (Acres forest restoration per harvest)

Alternative	Skyline Cable Acres	Helicopter Acres	Tractor Acres	Tractor Endline Acres	Combination Ground-based system acres	Mechanical Harvester Acres	Total Acres
2	1602	1071	387	41	555	219	3875
4	1528	861	220	17	541	187	3354
5	1471	1245	335	41	494	195	3781

Table 2 – Comparison of Alternatives 2, 4, 5 (Number of Stands of forest restoration by Harvest System)

Harvest System	Alternative 2 –No. of Stands	Alternative 4 – No. Of Stands	Alternative 5 – No. Of Stands
Tractor	34	20	31
Tractor Endlining	3	2	3
Skyline	75	70	73
Helicopter	65	51	74
Mechanical Harvester	11	8	10
Combination Ground Based Systems	19	17	18

Precommercial thinning (PCT) (trees <9” DBH) will occur on approximately 408 acres (all alternatives)

Fuels Reduction PE

Fire fuels generated on slope grades under 45% will be treated by mastication. Mastication involves the mechanical chipping, grinding, and scattering of fuels using a rotating hydraulic head attached to a tracked excavator or tractor. Wood chips from mastication provide physical soil cover to areas disturbed by Project activities, and allows a masticator to operate on the layer of wood chips with minimal soil disturbance. This resulting compacted bed of fuel is usually no more than six inches in depth, allowing much less air circulation to the fuel and quicker decomposition. The result is a lower risk of fire starts and propagation of fire in mastication treatment areas. All mastication will occur outside of Riparian Reserves.

Fire fuels generated on slope grades over 45% will be treated by handpiling and pile burning.

Handpiling of fuels is accomplished by hand crews using hand tools and chain saws. Hand piles are small in size, routinely no more than six feet in diameter. Pile burning of hand piles generally results in small areas of exposed soil surrounded by larger areas of unburned material. Hand piles will be constructed more than 170 feet away from the wetted width of any stream channel if slope is less than 35% or if existing ground cover is >50%.

Firelines will be constructed by handcrews. No fireline construction will occur in RRs.

Underburning. Underburns will be conducted at low intensity and soil cover requirements will be met on site to minimize erosion. No ignition will occur in RRs though some fire may back down or creep into RRs from underburns lit upslope or nearby.

Some stands will have a combination of these methods since there is a good deal of variation in the slopes within these stands. See table 1 below for description of the amount of fuels reduction in acres per alternative.

Road Related Activities PE (**see Appendix G – Table G-10 for a summary of road-related activities occuring within RRs)**

<u>Haul Routes:</u> The Project area has three different haul route options depending on stand location. The **Expected haul** is down (southerly) 40S16 and out the Klamath River Hwy to Yreka, California, with limited volumes down 41S07 and onto Road 11 (Beaver Creek Road) and east to I-5 at Hilt, California. It is unlikely, but some volume may come out of the area by going north over the Siskiyou Crest on the Rogue River National Forest's Road 22 and into Ruch, Oregon; or possibly from the 4 Corners area east on 40S06 to 40S11 and up to the Siskiyou Crest and the paved Ski Bowl Road, then eastward down the crest to I-5.

Pre- and post-haul road maintenance will occur in the form of grading, outsloping, armoring and/or adding surface aggregate, adding drainage dips, and either closing roads (ie winter closure) or adding waterbars if the roads are left open year-round, and are all options that will be employed. Project road maintenance will be consistent with road maintenance activities addressed by the {September 8, 2004} NMFS letter of concurrence for *Facility Maintenance and Watershed Restoration*, and associated *Facility Maintenance and Watershed Restoration(FMWR)* BA (USDA Forest Service 2004), and Supplement to the FMWR BA (USDA Forest Service 2005).

All Project-related roads listed above will also receive maintenance during haul operations, when necessary, to accommodate safe haul operations (e.g., dust abatement, spot rocking).

Hazard trees: Hazard trees (trees posing a hazard to logging or hauling operations) will be removed along log haul routes, to meet OSHA requirements.

Temporary Road Construction: No new authorized roads will be constructed. Temporary spur roads will be constructed to access units and landing locations. The number and miles of these roads varies for each alternative. The number and miles of temporary spur roads for each alternative are listed below:

Alternative 2 – 22 roads. Total length = 6.86 miles.
Alternative 4 – 16 roads. Total length = 4.96 miles.
Alternative 5 – 9 roads. Total length = 2.27 miles

Road Decommissioning: One authorized road (40S20) will be decommissioned following timber harvest and fuel treatments. The length of this road is 0.49 miles.

The following existing Forest Service un-authorized roads will be decommissioned following timber harvest and fuel treatments. The roads to be decommissioned are:

Alternative 2		**Alternative 4**		**Alternative 5**
40S09.1A 0.15	0.77	40S09.1A	0.77	40S12.1
40S09.1A1 0.42	0.11	40S09.1A1	0.11	40S13.1
40S09.2 0.08	0.18	40S09.2	0.18	40S13.2
40S12.1 0.12	0.15	40S12.1	0.15	40S14.1
40S13.1 1.14	0.42	40S13.1	0.42	40S14.2
40S13.2 0.10	0.08	40S13.2	0.08	40S16.1

40S14.1	0.12	40S14.1	0.12	40S16.5	0.04
40S14.2	1.14	40S14.2	1.14	40S16.5B	0.17
40S16.1	0.10	40S16.1	0.10	40S20.1	0.47
40S16.5	0.04	40S16.5	0.04	40S20.1A	0.76
40S16.5B	0.17	41S09A.1	0.21	40S07.3	0.80
40S20.1	0.47	41S10.2	0.07	41S09A.1	0.21
40S20.1A	0.76	41S10.3	0.14	41S10.2	0.07
41S07.3	0.80	41S15.1	0.19	41S10.3	0.14
41S09A.1	0.21	48N30A.1	0.18	41S15.1	0.19
41S10.2	0.07	48N37.1	0.64	41S15.3	0.73
41S10.3	0.14			41S15.3A	0.53
41S15.1	0.19			48N30A.1	0.18
41S15.3	0.73			48N37.1	0.64
41S15.3A	0.53				
48N30A.1	0.18				
48N37.1	0.64				
Total:	**8.00**	**Total:**	**4.54**	**Total:**	**6.94**

The road decommissioning will involve the excavation and removal of ten stream crossings (see Table 6 below). The roads and the number of stream crossings are as follows:

40S14.2 – Two stream crossings.
40S20 - One stream crossing
40S20.1 – Two stream crossing.
40S20.1A – Two stream crossings.
41S15.1 – One stream crossing.
41S15.3A – Two stream crossings.

All road decommissioning will be done in a manner consistent with the *Facility Maintenance and Watershed Restoration* Letter of Concurrence (USDC NOAA Fish, 2004) and associated *Facility Maintenance and Watershed Restoration* BA (USDA Forest Service 2004).

Landings: The following landing use was estimated for analysis purposes

Alternative 2:

a) For the entire project approximately 47 log landings will be used for helicopter, cable, and tractor logging/yarding. Forty of these are new landings scattered throughout the project area. The remaining 7 are existing landings. These will require some form of minor clearing and/or blading. Cable landings (14 total) will be parallel settings with a mobile yarder on roads.
b) There are fifteen new tractor landings planned for the 34 tractor harvest stands. In addition there are seven existing tractor landings.
c) There are seven new helicopter landings and four new helicopter service landings planned for the 65 helicopter harvest stands.
d) Two existing landings are within RRs, within 150 feet of a perennial non fish bearing stream. Both landings are on system road 40S15. One landing is located at the northeast corner of unit 337. The other is located on the south end of unit 234.

Alternative 4:

a) Forty one log landings will be used. Thirty four of these are new landings. There are eleven cable landings.
b) There are twelve new tractor landings planned for the 20 tractor stands. The number of existing tractor landings is the same as in Alternative 2.
c) The number of new helicopter and helicopter service landings is the same as in Alternative 2.

Alternative 5:

a) Thirty eight log landings will be used. Thirty one of these are new landings. There are seven cable landings.
b) There are thirteen new tractor landings planned for the 31 tractor stands. The number of existing tractor landings is the same as in Alternative 2.
c) The number of new helicopter and helicopter service landings is the same as in Alternative 2.

Table 3. Number of landings by Alternative 2, 4, 5

Type of Landing	Alternative 2	Alternative 4	Alternative 5
Cable Logging/Yarding			
Existing Landings	0	0	0
New Landings	14	11	7

Table 3. Number of landings by Alternative 2, 4, 5			
Tractor Logging/Yarding			
Existing Landings	7	7	7
New Landings	15	12	13
Helicopter Logging/Yarding			
Existing Landings	0	0	0
New Landings	11	11	11
Total # of Landings	**47**	**41**	**38**

Water Drafting PE

Existing drafting sites will be used. USDC 2001Water Drafting Specifications will be followed. A maximum of 10% of any given streams' discharge will be withdrawn for such purposes at any one time; rates will not exceed 350 gallons per minute (USDC NOAA Fisheries 2001). There are two drafting sites within SONCC coho salmon CH. One is located on Beaver Creek off system road 40S16 approximately 150 yards upstream from the Hungry Creek confluence. The other is located on Cow Creek approximately 100 yards upstream from where system road 40S16 crosses the stream (approximately 0.25 miles upstream from the confluence with Grouse Creek). None of the three remaining drafting sites listed below are situated closer than 1.3 miles upstream of SONCC coho salmon CH.

Drafting Sites and distances up stream from SONCC coho salmon CH for Beaver/Grouse 7th field watershed and Long John Creek 7th field watershed are:

Beaver/Grouse Creek 7th field
1) Road 40S06 Crossing #1 – approximately 1.3 miles
2) Road 40S06 Crossing #2 – approximately 1.4 miles

Long John Creek 7th field
1) Road 40S16A Crossing – approximately 2.5 miles.

A) Timing

Project activities are scheduled to occur between April 15 and October 15. This period may be extended on either end of the stated seasonal range based on occurrence of all of the following criteria: 1) a long-term dry weather forecast, 2) the ability to winterize activities at the end of every day, 3) acceptance of recommendations from the district fisheries biologist and/or hydrologist (after meeting the first two criteria), and 4) authorization by the District Ranger (after meeting the first three criteria). Wet Weather Operation Standards (WWOS) will be followed whenever activities occur outside of the normal operating season (NOS)

(USDA Forest Service 2002). All landings, and skid trail construction, road decommissioning, and road re-conditioning will be conducted during appropriate periods of weather and soil moisture to ensure BMP attainment and the avoidance of adverse effects to listed species (USDA Region 5 Soil Quality Handbook, 1998 and BMP 5.6). Favorable forecast periods will also be of a suitable length to allow completion or winterization of the task undertaken before precipitation events occur.

B) Resource Protection Measures

The proposed action includes resource protection measures for the Project design to avoid or minimize impacts to SONCC coho salmon and their CH in the short and long term. Please refer to the activity-specific design standards for Treatment Stand Location; Helicopter Yarding; Tractor, Mechanical Harvester and Cable Yarding; Under Burning, Hand Piling and Pile Burning; Roads and Landings; Hazard Tree Removal, Water Drafting, and Equipment Refueling and Maintenance sections below.

Treatment Stand Location

The Project was designed by an interdisciplinary team to minimize surface erosion at the site scale by:

- Locating stands near existing roads to minimize the need for road and landing construction,
- Limiting new temporary road construction and locating them outside of RRs, with the exception of two temporary road segments, T401 and T206B, both located in RR's in the Long John Creek 7th field watershed.
- Adhering to the May 2002 Wet Weather Operations Standards (WWOS, USDA Forest Service 2002)
- Adhering to KNF LRMP Soil Cover Standards (USDA Forest Service 1995).

Helicopter Yarding

- Logs will be suspended when being yarded across channels.
- Project activities will be conducted during appropriate periods of weather and soil moisture to ensure BMP attainment.
- May 2002 Wet Weather Operations Standards will be followed (WWOS, USDA Forest Service 2002)
- Riparian reserves, including stream sides, wet meadows and geologically unstable lands, are excluded from stands and post-sale activity.

Tractor, Mechanical Harvester and Cable Yarding

- Dedicate no more that 15% of a stand to primary tractor skid trails, cable yarding corridors and landings.
- Skidding equipment will be generally restricted to slopes <35% and operate during dry soil conditions (dry down to 10 inches) or follow the May 2002 Wet Weather Operation Standards (WWOS, USDA Forest Service 2002). There may be short sections of skid trails where slopes exceed 35%. Any sections of skid trails having slopes exceeding 35 % will have slash or certified straw placed on them to achieve at least 90% soil cover.
- Skid trail locations will be designated by the KNF sale administrator/COR/Inspector prior to implementation. Skidding equipment will be confined to designated skid trails.
- Track mounted masticators are limited to operation on slopes <45%.
- Minimize soil erosion by water-barring all skid trails, mulching with straw or fine slash (achieve 90%+ cover) the last 25 feet of all skid trails where they enter landings or roads where needed.
- Logs will be suspended when being yarded across channels. Skid trail crossings of localized, hydrologically disconnected ephemeral channels (no RR present) will be uncommon and in such cases require remedial shaping.
- Prevent road runoff from draining onto skid trails, cable yarding corridors or landings by use of waterbars, mulching with straw or fine slash, etc.
- Retain existing coarse woody debris (CWD) whenever possible providing the amount of logs retained meets fuel management objectives.
- Meet the KNF LRMP Soil Cover Standards for each harvest unit as measured before the fall rainy season (late October). Post-treatment total soil cover should range from 60-70% depending on slope steepness and fuel reduction treatments.
- At least 50% cover, as fine organic matter (<3 inch material), will be retained in all units.

Underburning, Hand Piling and Pile Burning

The following measures are for protection of intermittent and perennial streams, springs and wetlands and active landslides and inner gorges.

- Prescribed fire will not be ignited in RRs. Prescribed fire will be allowed to back down into RRs. Underburning will be kept at a low intensity backing fire adjacent to RRs.

- If percent soil cover is below soil cover guidelines or predicted to be below after burning, ignition will cease at this point (see BMPs 6.2 and 6.3).

- Hand piles can be constructed 15-30 feet away from the wetted width of the stream channel if the stream channel is >1 foot wide and the slope is less than 35% or if existing ground cover is >50%. No pile burning can occur within 30 feet of perennial stream channels.

- Hand piles will be spread out and not “stacked” above one another to keep them from connecting and affecting a greater area than anticipated during burning. Hand piles will not be closely aligned in any orientation that could increase the potential for erosion to occur.
- Hand piles will be small in size, 6 feet or less in diameter.

Roads and Landings

- Existing roads and landings will be utilized to minimize new construction.
- Roads will be cleared, and graded as necessary to allow log truck and equipment access using minimum disturbance methods and minimum clearing widths.
- New temporary roads constructed for this project will be graded to outslope.
- Erosion control measures described in BMP 1.13 will be applied to the temporary roads and existing non-system roads that will be used during the project.
- The temporary roads will be outsloped, covered with slash if needed and blocked after the harvest season (prior to the first winter after use). The temporary roads will be decommissioned (hydrologically restored) at project completion (Road decommisioning includes removal of culverts and fills at stream crossings, outsloping of road surfaces, and obliteration (recontouring) of temporary road segments).
- New landing construction will not be done in riparian reserves and landings will be shaped and treated for erosion control at the end of each season of use.
- Refueling and maintenance of Project motorized equipment, including helicopters, will occur at least 200 feet away from any channel

Hazard Tree Removal

- A tree is considered a hazard if all or a portion of the tree has a high potential to fall or roll onto a roadway or facility and cause personal injury or property damage. Distance to trees on the uphill side may exceed one tree height if they are likely to roll or slide onto the roadway, site, or facility (i.e., there are insufficient barriers to prevent trees from reaching the roadway, trail or facility). The hazard tree identification process will be used for trees along road systems.

- Hazard trees that require felling within RRs are routinely left on site. These trees may be needed to maintain and/or restore large woody debris function and abundance within RRs.

- Naturally fallen or felled hazard trees may be removed from RRs if:
    a. Trees must be removed to provide safe road passage or campground access; OR:
    b. The trees would pose a substantial risk to the forest road drainage system integrity, AND:
    c. A fisheries biologist determines through site inspection and written

documentation that removal of individual hazard trees within interim RRs is not inconsistent with the Aquatic Conservation Strategy Objectives. Removal would only be appropriate when a local area survey of the affected RR clearly indicates that the functioning level with respect to large wood will not change from current levels after individual tree removal (USDA Forest Service 2002a).

Water Drafting

- All Project water drafting will follow NOAA-Fisheries Water Drafting Specifications (USDC NOAA Fisheries 2001), including but not limited to the following:
    1. Drafting will not reduce the stream flow by more than 10%,
    2. When water is drafted intakes will be screened with 3/32" mesh (for rounded or square openings) or 1/16" mesh for slotted opening.
    3. Pumping rate shall not exceed 350 gallons per minute or 10% of the stream flow.
    4. Pumping will be terminated when the water tank is full.

- Water drafting sites for dust abatement on roads will occur at designated sites for that purpose. Erosion control measures will be employed on the access and/or main road to prevent water leakage from causing stream sedimentation. Hazardous material spill prevention and containment equipment will be present on water trucks. Water trucks and pumping equipment will be in a well-maintained condition, free of fluid leaks and have hoses in good operating condition.

Equipment Refueling and Maintenance

- Refueling and maintenance of Project motorized equipment, including helicopters, will occur at least 200 feet away from any channel (USDA Forest Service 2003).
- BMP 2.12 (Appendix D) will guide all fueling and lubricating actions and, in particular, fuel containment systems will be in place on landings as necessary.

C) Riparian Reserves

Mapped RRs are shown on the Project map. One site potential tree height as per Forest standards in the Project area is 170 feet on each side of a qualifying stream channel. Since Northwest Forest Plan ROD-defined standard slope distance for riparian reserve widths of two site potential tree heights or 300 feet for anadromous and resident fish bearing streams (whichever is greater) and one site potential tree height or 150 feet for non fish-bearing streams (whichever is greater), the riparian reserve width of 340 feet for fish-bearing streams and 170 feet on each side of an active stream channel for non fish-

bearing streams will be used. See Appendix G- Table G-1 for a summary of Project activities occurring within RRs.

Project activities are excluded or limited in RRs, as described in the Riparian Reserve Indicator discussion. No ground disturbing yarding equipment will be allowed to enter RR buffers, with the exception of road crossings within RRs. Possible hazard tree felling in and removal from RRs is described above.

D) Best Management Practices

Best Management Practices (BMPs) were developed with the State of California Water Quality Control Board to protect water quality (USDA Forest Service 2000). Compliance with all BMPs related to timber management practices will greatly minimize or avoid adverse affects to listed fish. Project BMPs were chosen by the KNF interdisciplinary team needed to prepare NEPA and all other environmental documents related to the Project, and therefore will be in effect during all project activities (see Appendix B for list of applicable BMPs).

E) Wet Weather Operation Standards

Wet Weather Operation Standards (WWOS; USDA Forest Service 2002) will be used to guide operations, especially haul, during periods of wet weather. Earth scientists will examine field conditions to determine when the soil and/or road have dried out enough to enable operations to resume without risk of watershed impacts. The earth scientists will make recommendations to the Timber Sale Administrator who will provide direction to the Timber Sale Contractor as to when operations may resume to ensure that BMPs will be met and adverse impacts will be avoided. The KNF LRMP Soil Cover Guidelines pgs. 4-21 (USDA Forest Service 1995a) will be met to minimize soil compaction and erosion during and after timber harvest within each stand and underburned areas.

IV. Description of Action Area, Affected Species, Critical Habitat, Essential Fish Habitat

Action Area: The Action Area is defined for ESA purposes as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 402). The Action Area for this BA is where PEs are occurring plus the anadromous fish habitat downstream of where PEs are occurring to the point where those streams meet the maintstem of the Klamath River, as described in Table 1, and Table 2. The Action Area is within the five 7th-field watersheds within two 5th-field watersheds (listed in Table 1) on the Oak Knoll Ranger District that are direct or indirect tributaries to the Klamath River. In the preliminary consideration of the Project's potential effects on anadromous fish,

an area larger than the Action Area was considered—the analysis area. The analysis area includes stream reaches in which Project activities are proposed, and streams upstream and downstream of the treatment areas at the site, 7th field, 5th, and 4th field (Klamath River) watershed scales. Review of the analysis area resulted in setting the analysis area boundaries downstream to the confluence of Beaver Creek and the Klamath River, but not including the Klamath River.

Affected Species and presence of CH: The status and general life history of anadromous salmonids potentially affected by the proposed action is in **Appendix E**. The distribution of anadromous fish within the Action Area is shown in Appendix A2. Conclusions regarding the anadromous fish, their habitat (including CH) occurrence are based on field review of habitat suitability, professional judgment, District fish survey records, and CA Department of Fish and Game information. Field surveys, CA Department of fish and Game information and professional judgment of fisheries biologists was compiled into the KNF steelhead trout distribution layer in the KNF Geographic Information Systems electronic library. The steelhead trout distribution conservatively defines occurrence of coho salmon, CH, Chinook salmon, and Chinook salmon habitat except where site-specific field surveys refine Chinook salmon, coho salmon, and CH distribution (such as the habitat is found to be inaccessible for coho salmon, Chinook salmon, or both). The KNF considers the use of the KNF Steelhead Trout Distribution layer to define Chinook salmon habitat, and coho salmon CH, as a conservative (inclusive) approach for assessment of effects to coho and Chinook habitat (including CH) because coho and Chinook salmon may not occupy the same waters as steelhead due to the differences in jumping abilities. The maximum jumping height for coho is 2.2 meters; Chinook salmon is 2.4 meters; and steelhead is 3.4 meters (Meehan, 1991). Therefore, steelhead trout can access more habitat than coho or Chinook salmon (i.e., steelhead trout can make a 3-meter jump to migrate up a stream, but coho and Chinook salmon cannot.).

Table 4. Summary of Project Activities Alternative			
Proposed Activit	Alternative 2 Proc		Alternative 5

Table 4. Summary of Project Activities Alternative			
y	Proposed Action		
Total Acres Treated	4706		4612
Acres Commercial T	3875		3781

	Table 4. Summary of Project Activities Alternative			
	h i n n i n g			
	A c r e s L o g g i n g S y s t e m s			
	H e l i c o p t e r	1 0 7 1		1 2 4 5
	S k y l i n e	1 6 0 2		1 4 7 1
	T r	3 8		3 3

Table 4. Summary of Project Activities Alternative				
	actor	7		5
	Mechanical Harvester	219		195
	Tractor Endline	41		41
	Comb. Gro	555		494

Table 4. Summary of Project Activities Alternative				
	und Based			
	Acres of PCT	408		408
	Acres Additional Fuels Redu			

Table 4. Summary of Project Activities Alternative				
	ction			
	UB	120		120
	PCT/HP/UB	303		303
	Post-Harvest Fuels Treatment			
	Han	677		682

Table 4. Summary of Project Activities Alternative				
	dpile/burn			
	Underburn	1382		1428
	HP/UB	979		959
	Mastication	809		745
	Mastication/	436		375

Table 4. Summary of Project Activities Alternative				
	HP			
	Spur Road Construction (miles)	6.86		2.27
	Landing Construct	25		21

Table 4. Summary of Project Activities Alternative			
i o n (a c r e s)			

Table 5. Details and Summary of Forest Restoration Project Activities by 7th and 5th field watershed scales - Alternative 2. (also see Appendix G)

7th and 5th Field **watersheds**	**Watershed Area In Acres**	**Cable Yarding Acres**	**Tractor Yarding Acres**	**Tractor Endline Acres**	**Helicopter Yarding Acres**	**Mechanical Harvester Acres**	**CGB Acres**	**Total Thinning acres**
Summarized by 7th fields								
Long John Creek	**5,679**	**722**	**256**	**38**	**363**	**191**	**205**	**1775**
Beaver/Grouse Creek	**6,497**	**645**	**88**	**3**	**611**	**17**	**139**	**1503**
Upper Cow Creek	**8,127**	**105**	**18**	**0**	**14**	**11**	**51**	**199**
Deer-Beaver Creek	**2,708**	**107**	**23**	**0**	**19**	**0**	**55**	**204**
Headwaters Cottonwood Creek	**4,814**	**23**	**2**	**0**	**64**	**0**	**105**	**194**
TOTALS for 7th fields	**35,197**	**1602**	**387**	**41**	**1071**	**219**	**555**	**3875**
Totals for Beaver Creek and Cottonwood Creek 5th fields								
Beaver Creek	**69,664**	**1579**	**385**	**41**	**1007**	**219**	**450**	**3681**
Cottonwood Creek	**63,563**	**23**	**2**	**0**	**64**	**0**	**105**	**194**
"Entire Analysis Area" (Beaver Creek 5th field watershed, plus Cottonwood Creek 5th field watershed.	**133,227**	**1602**	**387**	**41**	**1071**	**219**	**555**	**3875**

Table 6. Details and Summary of Road Related Project Activities by 7th and 5th field watershed scales - Alternative 2

(also see Appendix G)

7th and 5th Field **watersheds**	**Proposed Temporary Road Construction and Decommissioning miles (acres)**	**Decomming Existing Roads (miles)**	**New Landing Constructi on (acres**	**Existing Landings (acres)**	**Water Drafting Sites**	**Temp Road Stream Crossings to be Decommed**	**Existing Road Stream Crossings to be Decommed**
Long John Creek	**3.01 (=5.47 acres)**	**5.54**	**10**	**3**	**2**	**1**	**10**
Beaver/Grouse Creek	**2.05 (=3.73 acres)**	**1.59**	**9.5**	**.5**	**2**	**0**	**0**
Upper Cow Creek	**1.30 (=2.36 acres)**	**0.38**	**4**	**0**	**0**	**0**	**0**
Deer-Beaver Creek	**0.12 (=0.22 acres)**	**0.49**	**1.5**	**0**	**1***	**0**	**0**
Headwaters Cottonwood Creek	**0.38 (=0.69 acres)**	**0.00**	**0**	**0**	**0**	**0**	**0**
TOTALS for 7th fields	**6.86 (= 12.47 acres)**	**8.00**	**25**	**3.5**	**5**	**1**	**10**
Summarized at the 5th field Watershed Scale: Beaver Creek and Cottonwood Creek 5th fields							
Beaver Creek	**6.48 (=11.78 acres)**	**8.00**	**25**	**3.5**	**5**	**1**	**10**
Cottonwood Creek	**0.38 (=0.69 acres)**	**0.00**	**0**	**0**	**0**	**0**	**0**
"Entire Analysis Area" (Beaver Creek 5th field watershed, plus Cottonwood Creek 5th field watershed.	**6.86 (=12.47 acres)**	**8.00**	**25**	**3.5**	**5**	**1**	**10**

V. EXISTING ENVIRONMENT AND EFFECTS TO ANADROMOUS FISH AND THEIR HABITAT INDICATORS

Historically, ponderosa pine and sugar pine dominated stands on south and west aspects, comprising up to 60 percent of the conifers in these stands, whereas Douglas-fir was primarily found on the lower 1/3 of slopes with these aspects. North and east aspects were dominated by Douglas-fir and white fir with the true fir community occupying the higher elevation areas. During the early years of logging, pines were the most sought-after species and large pines were almost completely removed from areas accessible to railroad and steam-donkey logging. After the harvestable pines were depleted, Douglas-fir and true fir were harvested (USDA Forest Service 1996). Tractor and cable logging in the 1960s through the late 1980s removed many of the remaining larger trees and created some even-aged conifer plantations.

Approximately 55% of the Mt. Ashland LSR is in an early forest stage (stands averaging less than ten inches in diameter) or a mid-successional forest stage (stands averaging eleven to twenty four inches in diameter), including the majority of the Project Area. Within early and mid-successional stands in the Project Area, the composition of tree species has changed over the last century as a result of selective logging and fire suppression.

In the past, fires were common in the Klamath and Siskiyou mountains. Lightning was the primary ignition source. A fire history study was conducted on Thompson Ridge (roughly 60 air miles to the west of the Project Area) in forest types similar to what is found in the Project Area and determined that prior to European settlement the median fire return interval (the number of years between two successive fire events in a given area) was 14.5 years and the annual area burned was roughly 300 acres (Taylor and Skinner 1998).

This section now describes the existing habitat conditions and an analysis of the direct and indirect effects of the Project on listed anadromous fish and their habitat (including CH) at the site, the 7th and/or the 5th field watershed scales. The habitat requirements (expressed by the Indicators) are similar for all salmonids considered in this BA. Existing conditions and effects are rated using criteria in Appendix C. Appendix D summarizes the existing environment and effects for all Indicators, with data sources identified.

The analysis of the potential effects to anadromous fish and their habitat is based on **Alternative 2**, the **preferred alternative**. This alternative was determined to have the most impacts to anadromous fish and their habitat. A comparison of the effects of Alternative 2 versus Alternatives 4 and 5 is listed at the end of this section.

The analysis of the potential effects to anadromous fish and their habitat is organized by direct and indirect effects and by effects to Indicators of anadromous fish habitat

conditions. The Indicators originate from Appendix A of the AP (*Table of Population and Habitat Indicators)*. The evaluation is described below and summarized in Section VIII and Appendix D of this BA. "Population characteristics" and "Population and habitat" pathways listed in Appendix A of the AP were not evaluated for anadromous fish since the AP states those pathways are for bull trout at this time. The population status is discussed in Appendix E. The pathways in the Table are addressed based on the best available information. The KNF used scientific data, field reviews, and the Cumulative Watershed Effects (CWE) modeling to determine the existing conditions and to estimate potential risk (probability) and magnitude of sediment delivery from surface erosion (using the Universal Soil Loss Equation - USLE), and mass-wasting (using the GEO model component,) and flow-related watershed conditions (using the ERA model component) in the Action Area (Appendix F). The results are discussed below under the Sediment/Turbidity/Substrate character, Change in Peak and Base Flow, and Disturbance Indicators.

Consideration of the intensity and extent of the proposed action as well as the proximity of anadromous fish to proposed activities and the distribution and life history of anadromous fish (Appendix E) in the Action Area assisted in making the final ESA effects determination for the Project. The proximity of PEs relative to anadromous fish and their habitat are described in Table 7. The various PEs considered for analysis include forest restoration; fuels reduction; road related activities (including hazard tree removal, road use, water withdrawal road maintenance and temporary road construction, landing use and construction); water drafting and post harvest activities (pre-commercial thinning, and tree planting).

For this BA, it is assumed that spawning, rearing, feeding, and migration can occur within all habitat occupied by any of the ESUs of anadromous fish addressed in this document, unless otherwise stated.

The probability for short and long-term indirect effects to anadromous fish is associated with direct effects and effects to instream habitat in the context of existing conditions. Thus, direct effects are discussed first and then existing conditions are discussed under each key habitat Indicator, followed by an effects discussion for each Indicator.

Table 7 – Closest Distance between Project Activities/Project Element Groups and anadromous reaches, SONCC coho salmon CH Presence by 7th, and 5th Field Watersheds

Watershed	Stream Name (s)	Anadromous Reach Length (miles)	Distance to SONCC coho salmon CH (miles), by PE. Note: SONCC coho salmon CH is equivalent to Steelhead Trout habitat.
Beaver/Grouse Creek 7th field	Grouse Creek	2.53*	0.06 – Forest Restoration, Fuels Reduction, and Post-Restoration Activities 1.3 – Water Drafting 0.15 – New Temporary Road Construction 0.2 – New Landing Construction
Upper Cow Creek 7th field	Cow Creek	1.63*	0.3 – Forest Restoration, Fuels Reduction, and Post-Restoration Activities 0.3 – New Temporary Road Construction 1.2 – New Landing Construction
Long John Creek 7th field	Long John Creek and	3.62**	0.06 – Forest Restoration, Fuels Reduction, and Post-Restoration Activities 0.0 – Water Drafting

Table 7 – Closest Distance between Project Activities/Project Element Groups and anadromous reaches, SONCC coho salmon CH Presence by 7th, and 5th Field Watersheds			
	West Branch Long John Creek, Lower Cow Creek		0.2 – New Temporary Road Construction 0.3 – New Landing Construction
Deer-Beaver Creek 7th field	Deer Creek	***	0.1 – Forest Restoration, Fuels Reduction, and Post-Restoration Activities 0.3 – New Temporary Road Construction 0.2 – New Landing Construction
Headwaters Cottonwood Creek 7th field	Cottonwood Creek	****	1.3 – Forest Restoration, Fuels Reduction, and Post-Restoration Activities 1.3 – New Temporary Road Construction 1.2 – New Landing Construction
Beaver Creek 5th field	Beaver Creek	11.0*****	0.06 – Forest Restoration, Fuels Reduction, and Post-Restoration Activities 0.0 – Water Drafting 0.15 – New Temporary Road Construction 0.2 – New Landing Construction

* Grouse Creek – Occupied by steelhead, and coho salmon: CH for coho salmon
** Cow Creek – Occupied by steelhead and coho salmon: CH for coho salmon. Long John Creek – Occupied by steelhead. Coho salmon suspected to occur: CH for coho salmon. West Branch Long John Creek: Steelhead suspected to occur, but this stream is considered unoccupied CH. This is based on the presence of physical barriers (waterfalls, steeper channel gradients, and diminished flows) that currently impede coho salmon migration into this stream.
*** Natural barriers near the mouth of Deer Creek prevent anadromous migration into this stream.
**** No anadromous fish habitat is present in the sections of the headwaters of Cottonwood Creek located within the Project area boundary. The closest CH is 1.2 miles downstream, and is occupied by steelhead trout and is considered unoccupied SONCC Coho Salmon CH. This is based on the presence of physical barriers (waterfalls, steep channel gradients, and diminished flows) that currently impede coho and Chinook salmon migration into the upper part of this creek.
***** Beaver Creek – Occupied by steelhead, coho salmon and Chinook salmon: CH for coho salmon.

Efficiency Measure for analysis: (Geographic areas where PEs do not affect anadromous fish or their habitat within the Action Area)

Thinning activities comprise both Beaver/Grouse Creek 7th field watershed and the headwaters of Cottonwood Creek 7th field watershed. There are 153 acres of thinning activities on a ridge in headwaters Cottonwood Creek. PEs will not affect anadromous fish or their habitat within Headwaters Cottonwood Creek and Hungry Creek 7th field watersheds because:

Headwaters Cottonwood Creek 7th field: Only 153 acres will be thinned as part of the proposed action and it occurs 170 feet from the four intermittent streams that are the headwaters of Cottonwood Creek. The buffer of 170 feet from the headwaters of these intermittent streams creek is sufficient to prevent changes in stream shading and sediment delivery (Spence et al 1996); and the closest habitat occupied by salmon and steelhead trout is 1.2 miles downstream from Project activities.

There are no water drafting sites present and two landings will be used in this 7th field. Neither of these landings are hydrologically connected to any stream channel. One temporary road will be constructed in this 7th field and decommissioned after completion of Project activities. This temporary road is not hydrologically connected to any stream channel. I conclude that PEs in the Cottonwood Creek drainage will not affect anadromous fish in Headwaters Cottonwood Creek 7th field watershed and Cottonwood Creek 5th field watershed because of the distance

between the activities (The units are located on a ridge top and the closest habitat occupied by salmon and steelhead trout is 1.2 miles downstream) and the anadromous fish in Cottonwood Creek. In addition, the intact and functioning condition of RRs in this 7th field will arrest any sediment that might be mobilized by project activities.

Hungry Creek 7th field: Hungry Creek contains no treatment stands, only part (<1/4 mile) of unauthorized (unclassified or non-system) road 41S07.3 proposed to be opened, used, hydrologically stabilized then closed. The road comes off of the 41S07 on the ridge and comes around a point into Hungry Creek 7th field for less than 1/4 mile before going over the ridge into Beaver/Grouse Creek 7th field; the majority of the road is located within the Beaver/Grouse Creek 7th field watershed.

This road is not connected to any stream channel or RR.

Efficiency Measure for analysis: (Geographic area refined to reflect hydrologic processes that may affect anadromous fish and their habitat).

The Action Area includes the Beaver Creek 5th field watershed. The 7th field watersheds within this 5th field watershed are discussed below as discrete units relative to their effects to fish and their habitat, as appropriate.

Deer Creek in the Deer-Beaver 7th field watershed does not contain anadromous fish. Natural barriers near the mouth prevent anadromous fish migration into this stream. This 7th field overlaps both sides of Beaver Creek. There are no project activities on the east side of this 7th field (Fly Stain Creek drainage). Therefore, the east side of this 7th field will not be analyzed further.

Since Deer Creek does not contain anadromous fish, the distance of the PEs to anadromous fish habitat is for Beaver Creek. Beaver Creek is not included in the existing condition for this 7th field since Beaver Creek is analyzed at the 5th field scale (Beaver Creek 5th field watershed). Therefore, effects to anadromous fish and their habitat from PEs in the Deer-Beaver Creek 7th field watershed will be analyzed at the 5th field scale.

Efficiency Measure for analysis: (Indicators that will not be affected by the PEs)

In addition to locations where anadromous fish and their habitat will not be affected, there is also one Indicator that will not be affected. No Project-related mechanisms exist for potentially affecting listed salmonid species or their habitat (including CH) via the following Indicator:, 1) Physical Barriers. There is no mechanism for effects and there will be no effect to this Indicator because:

1. No fish passage barriers will be removed or constructed and existing fish passage barriers will not be affected by the project.

Therefore this indicator will not be discussed any further.

Efficiency Measure for analysis: (Refined PEs and locations for direct, indirect, and cumulative effects analysis)

Some Project activities are expected to have a neutral impact on all habitat indicators. Neutral activities contained within the forest restoration PE are: pre-commercial thinning (PCT). Neutral activities contained within the fuels reduction PE are: hand piling and pile burning. Pre-commercial thinning, Hand piling and pile burning do not involve substantial ground disturbance, cause only localized disturbance to soil/ground cover, rarely mobilize sediment that can be borne to a stream course and do not affect canopy cover. All three neutral impact activities cause only minor and localized ground disturbance. Based on comparable RR conditions assessed by Spence et al. (1996, pages 226 and 228), Project RRs widths are considered adequate to buffer these low intensity ground disturbing elements (with the expection of hand piling and pile burning which will occur within the first site potential tree height of RRs), since additional sediment that

might be mobilized will not be delivered to streams. Therefore, these activities have neutral impact on stream temperature, sediment-related processes and peak-base flow indicators. Similarly, these activities will not affect any other indicators since:

- No sediment will be delivered to streams;
- No stream-shading trees are removed (relative to Temperature Indicator);
- Masticator and chainsaw maintenance and fueling will occur outside RRs (relative to Chemical Indicator);
- Large Wood is not removed (relative to the Large Woody Debris Indicator)

These activities will therefore receive no further effects analysis below.

Efficiency Measure for analysis: (site, 7th and 5th field watershed anadromous fish habitat exposure analysis) Four 7th field watersheds within **the Action Area** contain anadromous fish habitat that may be affected by project activities: Beaver/Grouse Creek, Long John Creek, Deer-Beaver Creek, and Upper Cow Creek watersheds. Potential effects to anadromous fish and their habitat in these four 7th field watersheds were evaluated at the site and the 7th field watershed scales and aggregated with other PEs in other watersheds in the Action Area to determine effects at the 5th field watershed scale and over the entire analysis area (Tables 2, 2a, 2b, 3, 3a, 3b, and Appendix A1 – tables A-1 to A-9). Based on field reviews and consideration of proximity of anadromous fish and their habitat (Table 4) along with the probability of direct and indirect effects, the area where there is potential for exposure to anadromous fish within the Action Area (and therefore subject to the extensive effects analysis) is:

At the site scale: Table 4 describes the distance between PEs and occurrence of Chinook and coho salmon and their habitat (including CH), steelhead trout, and steelhead trout habitat. The only direct effect to anadromous fish is from water drafting since this is the only instream activity occurring within anadromous fish bearing reaches. Therefore, only water drafting has the potential to affect anadromous fish at the site level. No other activities occur within anadromous fish habitat. Indirect effects from proposed PEs may occur downstream in 7th, and/or 5th field watersheds, however, and are described below.

Streams at the 7th field watershed scale: Beaver, Grouse, Long John, and Cow Creeks.

Beaver/Grouse Creek 7th field watershed: Grouse Creek is the anadromous fish bearing stream in this 7th field. It contains 2.53 miles of coho salmon habitat and steelhead trout habitat. Grouse Creek is not considered occupied by Chinook salmon (per the KNF GIS and CDFG fish distribution maps and recent surveys). Eight thinning stands are located within 0.06 miles of Grouse. Three landings are located 0.2 miles (1000 feet) from Grouse Creek. Water drafting will occur in Grouse Creek, about 1.37 miles above coho salmon habitat, based on the Grouse Creek stream surveys in 2005 and consideration of habitat suitability. PEs in the Beaver/Grouse Creek watershed will not directly affect coho salmon.

Long John Creek 7th field watershed: The principle streams in this 7th field watershed are Long John Creek and Cow Creek. Coho salmon and steelhead trout are suspected to occur in the lower 1.42 miles of Long John Creek, approximately 520 feet (0.10 mile) from Project thinning activities, the lower 1.75 miles of Cow Creek, and the lower 0.45 miles of West Branch Long John Creek. Cow Creek contains good coho spawning habitat and rearing habitat for juveniles. In summer, coho salmon fry prefer pools or other slower velocity areas such as alcoves, with woody debris or overhanging vegetation. Juvenile coho salmon over-winter in slow water habitat with cover as well. The steep, boulder/cobble dominant channel in Long John Creek probably does not afford very much suitable habitat for summer rearing or over-wintering for juvenile coho—reducing the likelihood of continuous presence in Long John Creek. Long John and Cow Creeks are not considered occupied by Chinook salmon (per the KNF GIS and CDFG fish distribution maps and recent surveys). Water drafting will occur in Cow Creek about 0.25 miles upstream of the Grouse Creek confluence. Direct effects to anadromous fish in Cow Creek will be minimized by following NMFS water drafting guidelines listed as resource protection measures (See Direct Effects section below). One stream crossing (non system road # 41S15.1) within SONCC coho salmon CH will be decommissioned. This road crosses the mouth of Long John Creek. The crossing is a low water ford so no culvert will be removed, therefore no work will occur in the stream channel. The nearest landings are about 1,500 feet (0.3 miles) from Long John and Cow Creeks, respectively. In addition to the fuels reduction in thinning units, underburning (One stand # 440) will occur in the headwaters of the Long John Creek watershed, about 1500 feet (0.30 miles) from Long John Creek. The headwaters of three unnamed intermittent tributaries to Long John Creek extend into this unit. The 170 foot RR buffers on these intermittent stream channels are sufficient to prevent changes in stream shading and sediment delivery; and the closest habitat occupied by coho salmon and steelhead trout is 1.40 miles downstream from this unit.

Upper Cow Creek 7th field watershed: The principle stream in this 7th field watershed is Cow Creek. Coho salmon and steelhead trout are suspected to occur in the lower 3.38 miles of Cow Creek (The lowermost 1.75 miles is located in Long John Creek 7th field). Cow Creek contains good coho spawning habitat and rearing habitat for juveniles. In summer, coho salmon fry prefer pools or other slower velocity areas such as alcoves, with woody debris or overhanging vegetation. Juvenile coho salmon over-winter in slow water habitat with cover as well. Chinook probably don't occupy Cow Creek (per the KNF GIS and CDFG fish distribution maps and recent surveys). There are no water drafting sites present in this 7th field. The closest Project activities are approximately 0.3 miles upslope from Cow Creek.

Deer-Beaver Creek 7th field watershed: Beaver Creek is the anadromous fish bearing stream in this 7th field. The entire section of Beaver Creek within this 7th field (approximately 2 miles) contains Chinook salmon habitat, coho salmon habitat and steelhead trout habitat. Deer Creek in the Deer-Beaver 7th field watershed does not contain anadromous fish. Natural barriers near the mouth prevent anadromous fish

migration into this stream. This 7th field overlaps both sides of Beaver Creek. There are no project activities on the east side of this 7th field (Fly Stain Creek drainage). Therefore, the east side of this 7th field, as mentioned above, will not be analyzed further.

Since Deer Creek does not contain anadromous fish, the distance of the PEs to anadromous fish habitat is for Beaver Creek. Beaver Creek is not included in the existing condition for this 7th field since Beaver Creek is analyzed at the 5th field scale (Beaver Creek 5th field watershed). Therefore, effects to anadromous fish and their habitat from PEs in the Deer-Beaver Creek 7th field watershed will be analyzed at the 5th field scale.

Streams at the 5th field watershed scale: Beaver Creek
Beaver Creek: The principle stream in this 5th field watershed is the mainstem of Beaver Creek. Anadromous fish and their habitat (including CH) occur in Beaver Creek throughout this 5th field. Water drafting will occur in beaver Creek about 150 yards upstream of the Hungry Creek confluence. Direct effects to anadromous fish in Beaver Creek will be minimized by following NMFS water drafting guidelines listed as resource protection measures. Stand 297 is about 100 yards from anadromous fish habitat in Beaver Creek in the Deer-Beaver Creek 7th field watershed. The other PEs in the Beaver Creek watershed will not directly affect coho salmon.

4th field watershed scale stream: Klamath River
The Klamath River has Chinook salmon, coho salmon, and steelhead trout.
This mainstem of the Klamath River is **not part of the Action Area** because the Project will not cause effects to the anadromous fish or their habitat in the Klamath River: No direct or indirect effects to anadromous fish in the Klamath River are expected from the PE's because of the low intensity impacts at the site, 7th and 5th field watershed scales, and the distance between project elements and the Klamath River. The closest project activities are approximately 9.25 miles upstream from the Klamath River on Beaver Creek in the Deer-Beaver Creek 7th field watershed. Water drafting will not occur in the Klamath River for this project.

Direct Effects to anadromous fish and habitat:

Proximity and Probability: See Table 4 for proximity of PEs to anadromous fish and their habitat. The only activity occurring within habitat occupied by coho salmon, Chinook salmon, or steelhead trout is water withdrawal for dust abatement. Water will be drafted from the following stream reaches with anadromous fish: mainstem Beaver Creek, and Cow Creek. There are potential direct effects to steelhead trout and Chinook and coho salmon from water drafting in Beaver Creek and Cow Creek. The direct effects to these species are impingment of juveniles against the screens placed around the intake hoses during water drafting operations. There is a very low probability of impingement of juvenile fish against the screening due to the low pumping rate volumes (not to exceed 350 gallons/minute or 10% of the flow of the anadromous fish-bearing stream; allowing adult and juvenile anadromous fish to move away from the screens. Direct effects to anadromous fish will be minimized by following NMFS water drafting guidelines listed

as resource protection measures (and repeated below).

Magnitude: The frequency of effects is during actual water drafting occurring during the NOS of April 15 to October 15. Drafting will be done in accordance to NMFS's *Water Drafting Specifications* (NMFS 2001) including, but not limited to:

1. Drafting will not reduce the stream flow in anadromous fish-bearing reaches by more than 10%,
2. When water is drafted from anadromous fish bearing reaches, intakes will be screened with 3/32" mesh (for rounded or square openings) or 1/16" mesh for slotted opening.
3. Pumping rate will not exceed 350 gallons per minute or 10% of the flow of the anadromous fish-bearing stream.
4. Pumping will be terminated when tank is full to prevent erosion at the bank.

By following these specifications and considering the mobility of fish in these creeks, and the unlikelihood of impingement, the effects of water drafting in anadromous fish bearing reaches is discountable (extremely unlikely to occur) or will have only insignificant (not meaningfully neasured, detected or evaluated) direct effects on coho and Chinook salmon or steelhead or on their habitats (including CH) with no long term direct effects. Water drafting from non-anadromous fish bearing reaches (i.e. upper Grouse Creek, unnamed tributary to upper Grouse Creek at 40S06 crossing, and from upper Long John Creek) will not directly affect anadromous fish.

Indirect Effects to anadromous fish and habitat (by Habitat Indicator)

For specific information about the proximity of PEs to anadromous fish and their habitat, see Table 4 in addition to the information provided in the Indicator discussions.

The Record of Decision to implement the Northwest Forest Plan (NFP ROD) emphasized green-tree retention during timber harvest -- retaining at least 15% of the area associated with each cutting unit (stand) NFP ROD, page C-41. The 2004 NMFS Biological Opinion, page 32, for LRMPs in the Northwest Forest Plan area recognized a primary Standard and Guideline for matrix land as: at least 15% of the green trees on each regeneration harvest unit located on National Forest land must be retained for canopy cover. Given this Standard and Guideline, the 2004 NMFS BO, page 83, restates the ability of RRs to act as buffers from timber harvest activities. The BO does not describe specific prescriptions for timber activities, but must assume compliance with the Standard and Guidelines for 15% retention of forested stands. It also restates the findings from FEMAT, page V-35: The RR buffer widths are designed to provide a high level of fish habitat and riparian protection. The proposed action meets this 15% retention Standard and Guideline since at least 50% of the basal area will be retained throughout the project (Dave Johnson (USFWS) personal communication). The RRs in the project area are intact and properly functioning. Therefore, it is reasoned that if RRs are effective buffers for 15% retention type timber harvest, the RR buffers will also be effective for less

intensive treatment as proposed for this Project. Also, the quantitative analysis done via CWE modeling accounts for the different thinning prescriptions and tree removal techniques. Therefore, all thinning activities, regardless of the logging system, are analyzed as one project element.

In the following analysis, duration of effects is described by the terms "short-term" and "long-term". "Short-term" (ST) and "long-term" (LT) refers to a time period 0-2 years, and a period of 3 years or more after implementation, respectively.

Water Quality: Stream Temperature.

Existing Condition:

7th field watersheds:

Water temperatures in anadromous fish bearing reaches in the Action Area (Table 5, p.36) are considered to be Properly Functioning. Stream temperature surveys in 1994, 1999 and 2002 showed that stream temperatures ranged from 16.7 C to 17.3 C in Grouse/Beaver Creek, Long John Creek, and Upper Cow Creek 7th field watersheds. In addition, field review of the Riparian Reserves (RRs) in these watersheds on 6/6/06, 6/13/06, and 7/6/06 by Brian Thomas, and Julie Perrochet determined that the RRs are intact and properly functioning in Grouse Creek, Long John Creek and Cow Creek, based on the amount of stream side shade.

Stream temperatures in Deer-Beaver Creek are considered to be Properly Functioning based on field review of intact and properly functioning Riparian Reserves and streamside shade in this 7th field. Field review of RRs in Deer-Beaver Creek 7th field was conducted on 6/6/06 by Brian Thomas and on 7/6/06 by Brian Thomas and Julie Perrochet.

5th Field Watersheds

In Beaver Creek 5th field watershed water temperatures are Properly Functioning in the upper 5.25 miles of Beaver Creek from the West Fork Beaver Creek confluence to the confluence of Grouse and Long John Creeks. From West Fork Beaver Creek confluence downstream to the Klamath River confluence, Beaver Creek is considered At Risk for stream temperature. This is due primarily to reductions in riparian vegetation on private lands in the lower sections of Beaver Creek, instream water withdrawals for irrigation on private lands, and past hydraulic mining operations; all of which contribute to the increase in stream temperature in this section. Stream temperature surveys in 1994 showed a maximum stream temperature of 23 C in this section of Beaver Creek.

Post-Project Condition:

PEs that have no probability (*i.e.*, will have a neutral effect) of affecting water temperature include forest restoration (yarding) and fuels reduction (mastication, hand

piling and pile burning). Because these PEs do not involve the manipulation of stream shade canopy, and because the RRs in the Project area are intact and properly functioning with respect to shade, the PEs listed above will have a neutral effect on this indicator. These PEs will have neutral effects on SONCC coho salmon and their CH, as well as to other anadromous fish and their habitat, with respect to water temperature.

The only Project Element activities which occur in RRs, and may have an effect on water temperature are: variable density thinning up to 20" DBH, thinning (<9" DBH), underburning, road crossing work, use of two existing landings within RRs, hazard tree removal, and water drafting. Their effects are discussed below.

Forest Restoration PE

Proximity and Probablity: Portions of the RRs in 77 stands will be thinned to address existing conditions (fuels risk, laddering, over stocking of trees, high basal area) with the intent of improving silvicultural and fuel loading conditions. The total acreage of the RRs in these stands is 567 acres.

Variable density thinning activities will remove trees up to 20" DBH within the second site potential tree height in RRs in 16 stands in Beaver Grouse Creek 7th field, 3 stands in Deer-Beaver Creek 7th field and 16 stands in Long John Creek 7th field. The total amount of these stands within RRs is 107 acres. No treatment stand acreages in Upper Cow Creek 7th field watershed are within RRs. Ten of these stands in Beaver/Grouse Creek and Long John Creek 7th fields respectively, are located within anadromous fish bearing reaches. One stand in Deer-Beaver Creek 7th field is also located within an anadromous fish bearing reach.

The total variable density thinning stand acreage within RRs in SONCC coho salmon CH, Chinook salmon and steelhead trout habitat in the three 7th fields is:

Beaver/Grouse Creek – 30 acres
Long John Creek – 16 acres
Deer-Beaver Creek – 9 acres

The remaining stands in Beaver/Grouse Creek (6 stands), Long John Creek (6 stands), and Deer-Beaver Creek (2 stands) 7th fields are located 0.05 miles to 1.1 miles upstream of SONCC coho salmon CH, Chinook salmon and steelhead trout habitat.

Thinning activities using hand lopping, hand piling and pile burning will remove trees (<9" DBH) within 340ft. of both sides of perennial anadromous fish-bearing stream channels in 20 stands in Beaver/Grouse Creek 7th field watershed, 3 stands in Deer-Beaver Creek 7th field and 19 stands on Long John Creek 7th field. The total portions of these stands located within RRs is 460 acres.

In Beaver/Grouse Creek 7th field, seven of the stands are located within anadromous fish bearing reaches. In Long John Creek 7th field, three of the stands are located within

anadromous fish bearing reaches. None of the three stands in Deer-Beaver Creek 7th field are located within anadromous fish bearing reaches.

The total thinning <9" DBH stand acreage within RRs of anadromous fish bearing reaches in the two 7th fields is:

Beaver/Grouse Creek – 38 acres
Long John Creek – 64 acres

The remaining stands in Beaver/Grouse Creek (13 stands), Long John Creek (16 stands), and Deer-Beaver Creek (3 stands) are located 0.05 to 2 miles upstream of anadromous fish bearing reaches.

Magnitude: The potential to reduce stream canopy shade from thinning is negligible to non-existent, because there is no variable density thinning within the first site potential tree height in riparian reserves adjacent to flowing or standing water. Canopy shade will not be affected by removal of trees <9" DBH and hand piling of material <9" DBH.

Fuels Reduction PE

The effect of under burning on stream shade is negligible to non-existent because no prescribed fires will be ignited in RRs. Low intensity fire from underburns originating from ignition points higher on the hillslopes will be allowed to back into streamside areas. These low intensity fires are not expected to affect canopy cover in RRs (Mt. Ashland LSR Watershed Report 2007 (USDA Forest Service 2007))

Road Related Activities PE

Proximity and Probability: There are eleven stream crossings within the identified segments of roads (10 existing non-system crossings and 1 new temporary road crossings) that will be decommissioned following project completion. Nine of these stream crossings are in intermittent watercourses that are tributaries in Long John Creek (7), and Cow Creek (2). During road decommissioning (stream reconstruction and fill removal), some streamside vegetation will be removed at these crossing, but the amount shade lost will not be substantial enough to have a detectable effect to water temperature. Two of the eleven crossings are in perennial streams. One is in a headwater tributary to Long John Creek, and the other is at the mouth of Long John Creek. Here, the low volumes of water with low surface areas would be exposed to sunlight for only a short period of time as water flows downstream through the restored sites. Water flowing down stream from these crossing sites will be cooled by the addition of tributary water. McGurk (1988) states: "Cooling can occur if significant amounts of cooler tributary water, either surface or groundwater, enter the stream." Therefore, the addition of shaded, cool water into Long John Creek and Cow Creek downstream from these two crossings, respectively will result in neutral temperature-related effects to SONCC coho salmon CH and anadromous fish habitat.

Any hazard trees that are felled in RRs during Project road-related activities could potentially result in reductions in streamside shade. It is expected that only a few trees, if any, will be felled within RRs. Since few hazard trees will be felled, there is a neutral probability that hazard tree felling in RRs will result in reductions to streamside shade.

Magnitude: Vegetation manipulation associated with road crossing and culvert work may result in localized reduction of shade cover over streams in the immediate area, especially where vegetation is removed from road fill surfaces at crossings. While all riparian shade cover may be eliminated in areas where road crossing fills are removed, this loss of shade will be limited to fill surfaces on either side of crossings. Vegetation cover is expected to quickly recover at these sites. With the exception of these localized and short-term reductions in stream shade at crossings, Project activities will not reduce stream shade/canopy below 80%. Field research has shown that water temperatures did not increase when taken upstream (at greater than 80% shade canopy cover) and downstream of a stream reach with 80% canopy cover (McGurk 1988). Where localized reduction in canopy cover below 80% is unavoidable, field review by a fisheries biologist will ensure that these reductions are minimized, so that water temperature will not be adversely affected.

The slight amount of riparian vegetation removed by crossing work or hazard tree removal activities at stream crossings, and the addition of cool water entering the stream systems downstream of these activities crossings will result in neutral/undetectable stream temperature effects to SONCC coho salmon CH and anadromous fish habitat.

There are two existing landings planned for use that occur within RRs. Their use will have no effect on adjacent stream water temperature because none of the vegetation providing stream shade will be altered.

Vegetation clearing during construction of the 40 new landings will not affect stream shade or stream temperature, since all new landings will be located at least 170 feet from intermittent or non-fish bearing stream channels and 340 feet from fish-bearing stream channels in the Project area (i.e., outside of RRs). This will have a neutral effect on stream temperature.

Water Drafting PE

Proximity and Probability: With the exception of one water drafting site on Beaver Creek and another one on Cow Creek, Project water drafting sites are located upstream of anadromous fish ranges (Table 4). Following the NOAA Water Drafting Specifications will ensure that affected flows are not reduced from levels otherwise naturally occurring at the point of diversion by more than 10% (USDC 2001). Due to the large volumes of Cow Creek and Beaver Creek, the distance of the drafting sites from anadromous reaches and the combination with the aforementioned guidelines, the magnitude of the decrease in base flow resulting from water drafting will be undetectable within or wherever Project-area flows reach SONCC coho salmon CH, Chinook salmon, or steelhead trout habitat.

Magnitude: Several tributaries will provide cool water that more than compensates for any possible small reductions in flow caused by water drafting in tributaries to Grouse Creek and Long John Creek. Affected flows are not reduced from levels otherwise naturally occurring at the point of diversion by more than 10%. The effect of this PE on stream temperature will be neutral.

Indicator Summary for Water Quality: Stream Tempature : The stream temperature functioning level will be Maintained in anadromous fish bearing reaches at the site and in streams in the 7th and 5th field scale watersheds and over the entire analysis area (Appendix D, USDA Forest Service 2006). Because project activities result in only limited ground disturbance and Resource Protection Measures are incorporated into the Project design to minimize effects to RRs, Project-related temperature effects to SONCC coho salmon, Chinook salmon, steelhead trout and their habitat are considered neutral. The improvement in forest health in RRs and the reduced risk of high intensity fires in the project area is considered a long term benefit to this Indicator.

Water-Quality: Chemical Contamination

Existing Condition: (Project 7th fields)**.**

No CWA 303d designated reaches occur in the Action Area. Chemical contamination has not been identified in the Action Area, nor are any point sources of contamination known.

Post-Project Condition:

Proximity and Probability: The sources for chemical contamination of the aquatic environment from Project activities are related to spills associated with equipment fuels or fluids. Refueling and maintenance of motorized equipment will occur at least 200 feet away from any channel (USDA Forest Service 2003). BMP 2.12 (Appendix B will guide all fueling and lubricating actions and, in particular, fuel containment systems will be in place on landings as necessary.

Magnitude: There are no effects expected at the site of operations of the Project, therefore, there is no effect expected at the 7th or 5th field scale. In the event of a chemical spill, effects would be evaluated and emergency consultation with NOAA-Fisheries would be initiated if warranted. Project implementation will have a neutral effect on this indicator.

Habitat Access - Physical Barriers

Existing Condition: There are no barriers in Cow, Long John, Grouse, and Beaver creeks except decreasing stream size and natural flow regimes in upper reaches that limit access to anadromous fish in those creeks. These streams are therefore considered Properly Functioning. Natural barriers near the mouth of Deer Creek prohibit anadromous fish

migration into this stream. Since these barriers are natural, this stream is considered Properly Functioning also.

Post-Project Condition:

Neutral effect. An effects analysis is not applicable for this indicator.

Water Quality and Habitat Elements related to sediment regime: Suspended Sediment-Substrate character

For this habitat element, fines in the spawning area and riffle embeddedness in Table 8, along with the CWE modeling data (Appendix A1 - Tables A-1, A-2, A-3, A-4, A-5, and A-6) are evaluated to determine the functioning level for suspended sediment, turbidity, and substrate character since Nephelometric Turbidity Unit (NTU) values are not available. The CWE values, as verified and clarified by field and map review are used to determine the risk of the Project activities affecting fish and fish habitat conditions.

Existing Condition:
Based on fish habitat surveys, Beaver, Grouse, and Deer Creeks are in Not Properly Functioning condition for two habitat conditions directly related to substrate: fines and embeddedness (Table 8). Upper Cow Creek and Long John Creek are At Risk for fines and embeddedness. These high values are likely due to the fact that the upper elevations of each of the four 7th field watersheds in the Action Area consist primarily of decomposed granite (DG). The sampled values for fines ranged from 34 to 42% for Beaver, Long John and Grouse creeks. Fines in Cow Creek averaged 20%. The riffle embeddedness values for all four streams ranged from 48 to 53%. The CWE modeling shows that Beaver/Grouse and Long John Creek 7th fields are at risk of sediment delivery from mass wasting (the GEO values are over 1.0.). The risk of mass wasting in Deer-Beaver Creek and Upper Cow Creek 7th fields and the Beaver Creek 5th field watershed, and over the entire analysis area does not exceed threshold of concern (1.0). In addition, field review of the Riparian Reserves (RRs) in these watersheds on 6/6/06, 6/13/06, and 7/6/06 by Brian Thomas and Julie Perrochet determined that the RRs are intact and properly functioning.

Water quality of streams within the area is very good. Turbidity is very low (i.e. invisible to the eye), except during times of intense precipitation when surface erosion and mass wasting activity is high. In general, this type of precipitation occurs mainly during the winter precipitation season (November through March). Exceptions to this generality occur during high intensity, short duration summer thunderstorm events (USDA Forest Service 2007).

Table 8. Existing Condition of Anadromous Fish Habitat Characteristics Compared to LRMP Productive-Habitat Criteria and Indicators for Mid-Klamath Tributaries (Appendix C).					
Stream Name	Maximum Water Temp. (^{o}C)	Pools per 7 Stream-Widths (Ratio)	LWD Pieces per mile	Spawn Fines % (area average)	Riffle Embeddedness % (area average)
LRMP/ Appendix C	<20.5	>1.0	>100/>20	<15	<20
Beaver/Grouse Creek (7th field)	17	1	5	42	50
Upper Cow Creek (7th field)	17	0.3	6	20	40
Long John Creek (7th field)	15	1.2	5	33	52
Deer-Beaver Creek (7th field)	18	0.9	1	50	58
Beaver Creek (5th field)	22	0.6	8	24	37
Klamath River (4th field)	Listed on the 303D list of impaired watershed for temperature, nutrients, and dissolved oxygen. (Klamath Basin Total Maximum Daily Loads - Fact Sheet).				

Post-Project Condition:

Forest Restoration PE

Thinning

Proximity and Probability: Portions of the RRs in 77 stands will be thinned to address existing conditions (fuels risk, laddering, over stocking of trees, high basal area) with the intent of improving silvicultural and fuel loading conditions. The total acreage of the RRs in these stands is 567 acres.

Variable density thinning activities will remove trees up to 20" DBH within the second site potential tree height in RRs in 16 stands in Beaver Grouse Creek 7th field, 3 stands in Deer-Beaver Creek 7th field and 16 stands in Long John Creek 7th field. The total amount of these stands within RRs is 107 acres. No treatment stand acreages in Upper Cow Creek 7th field watershed are within RRs. Ten of these stands in Beaver/Grouse Creek and Long John Creek 7th fields respectively, are located within anadromous fish bearing reaches. One stand in Deer-Beaver Creek 7th field is also located within an anadromous fish bearing reach.

The total variable density thinning stand acreage within RRs in SONCC coho salmon CH, Chinook salmon and steelhead trout habitat in the three 7th fields is:

Beaver/Grouse Creek – 30 acres
Long John Creek – 16 acres
Deer-Beaver Creek – 9 acres

The remaining stands in Beaver/Grouse Creek (6 stands), Long John Creek (6 stands), and Deer-Beaver Creek (2 stands) 7th fields are located 0.05 miles to 1.1 miles upstream of SONCC coho salmon CH, Chinook salmon and steelhead trout habitat.

Thinning activities using hand lopping, hand piling and pile burning will remove trees (<9" DBH) within 340ft. of both sides of perennial anadromous fish-bearing stream channels in 20 stands in Beaver/Grouse Creek 7th field watershed, 3 stands in Deer-Beaver Creek 7th field and 19 stands on Long John Creek 7th field. The total portions of these stands located within RRs is 460 acres.

In Beaver/Grouse Creek 7th field, seven of the stands are located within anadromous fish bearing reaches. In Long John Creek 7th field, three of the stands are located within anadromous fish bearing reaches. None of the three stands in Deer-Beaver Creek 7th field are located within anadromous fish bearing reaches.

The total thinning <9" DBH stand acreage within RRs of anadromous fish bearing reaches in the two 7th fields is:

Beaver/Grouse Creek – 38 acres
Long John Creek – 64 acres

The remaining stands in Beaver/Grouse Creek (13 stands), Long John Creek (16 stands), and Deer-Beaver Creek (3 stands) are located 0.05 to 2 miles upstream of anadromous fish bearing reaches.

For the thinning activities in treatment stands containing RRs, the intact, functional and buffering capability of RRs buffering the stream channel from treatment stands will minimize the probability of any mobilized sediment reaching stream channels.

The intact, functional and buffering capability of RRs between stands located outside of RRs and streams in the Project area will minimize the probability of any mobilized sediment reaching stream channels.

Magnitude: Intact, functioning RRs will not be significantly affected by Project harvest activities, thus their sediment filtering and stream buffering capacity will be fully retained. In a review of the ability of RRs of different widths to buffer streams from adjacent disturbances, Broderson (1973) documented that riparian buffers of approximately one site potential tree height (170 feet on each side of streams in this Project) would be effective to remove sediment under most conditions. This PE will therefore have insignificantly negative affects on suspended sediment, turbidity, and stream substrate.

Helicopter, Tractor and Cable Yarding

Proximity and Probability: The stream distances of the stands to SONCC coho salmon CH are summarized in Table 4 above. The width of intact, functioning RRs within the

Project area is 340 feet on each side of fish bearing stream channels and 170 feet on each side of perennial non-fish bearing and intermittent stream channels. The distance from the closest stands to SONCC coho salmon CH ranges from approximately 0.06 miles to 1.2 miles (Table 7). The intact, functional and buffering capability of RRs between the stands and streams in the Project area will minimize the probability of any mobilized sediment reaching stream channels.

Helicopter yarding is the least ground disturbing harvest method, with the majority of disturbances originating from falling and choking logs together for transport (Klock 1975). The minimal amount of ground disturbance associated with helicopter logging (Klock 1975), the buffering capacity of intact and functioning RRs, and Project design features and BMPs all serve to minimize the likelihood of sediment reaching a stream by this harvest method. There is a small but insignificant potential for mobilized sediment to cause increased turbidity in streams, that would in turn affect SONCC coho salmon CH, Chinook salmon or steelhead trout habitat.

Tractor yarding and Tractor endlining. No tractor yarding equipment will enter any RR buffer, which are in intact condition and 340 feet wide on either side of fish bearing stream channels and 170 feet on either side of perennial non-fish bearing streams and intermittent streams. Only 11 tractor yarding stands and one tractor endlining stand are located adjacent to SONCC coho salmon CH, Chinook salmon or steelhead trout habitat and the distance of these stands from the stream channel ranges from 0.1 to 0.7 miles. The remaining 23 tractor yarding stands and two tractor endlining stands are located 0.4 to 2.2 miles upstream or upslope of SONCC coho salmon CH.

Tractor yarding will cause small, localized soil displacement in yarding corridors resulting from dragging logs. This can result in increased rates of erosion and sedimentation (Chamberlain, et al. 1991) that is expected to be captured within the Riparian Reserves buffers designated for the Project (descrived in Resource Protection Measures). Yarding corridors will be placed in natural openings when possible, to minimize the felling of trees and to maintain ground stability provided by adjacent tree roots. Existing skid trails will be used whenever possible within the tractor logging stands. Full-bench skid trail construction will be avoided wherever possible (BMP 1.10). End lining will be used wherever possible to keep equipment on the main skid trails. KNP LRMP Soil Cover Standards will be followed to protect disturbed soil, since skid trails that exceed 35% will be mulched with on-site fine slash, chips or weed-free straw, where necessary. Skid trails will be waterbarred after use to control runoff and to prevent off-site sedimentation (BMP 1.17). Recent BMP monitoring of skid trails on the Klamath National Forest determined that waterbars were 96-100% effective (T. Laurent 2003) in controlling erosion and preventing sediment from reaching a stream course. Some sediment generated from localized soil displacement in yarding corridors and the 11 tractor stands located adjacent to SONCC coho salmon CH, Chinook salmon or steelhead trout habitat may reach stream channels but this amount is expected to be insignificantly small (notmeaninguflly measured or detected), and will be further diluted during transport downstream so that effects to anadromous fish or their habitat is unlikely.

Mechanical Harvester. In addition to regular skyline, helicopter, and tractor logging, there will be 219 acres of mechanical harvester logging. The slopes of these stands are at least 35% but less than 50%. These stands will experience ground disturbance more closely associated with ground-based yarding. Project design features and BMPs for these areas are the same as those described under tractor yarding. Only one stand is located adjacent to SONCC coho salmon CH, Chinook salmon or steelhead trout habitat. This stand is about 0.1 miles from Long John Creek. The other five stands are located 0.5 to 1.7 miles upstream or upslope of SONCC coho salmon CH. Some sediment may reach stream channels by this method but this amount is expected to be insignificantly small, and will be further diluted during transport downstream.

Combination Ground-Based Systems. These stands (555 acres) are a combination of mechanical harvester and tractor. There are flatter areas within these stands where the slopes are <35%, which will permit a tractor to operate. These stands will experience ground disturbance similar to that described above under Tractor Yarding. Project design features and BMPs for these areas are the same as those described under tractor yarding. Only four of these stands are located adjacent to SONCC coho salmon CH, Chinook salmon or steelhead trout habitat. The distances of these stands from the stream channel ranges from 0.06 to 0.3 miles. The other fifteen stands are located 0.25 to 1.9 miles upstream or upslope of SONCC coho salmon CH. Some sediment may reach stream channels by this method but this amount is expected to be insignificantly small, and will be further diluted during transport down stream.

Skyline cable yarding will cause small, localized soil displacement in yarding corridors resulting from dragging logs. This can result in increased rates of erosion and sedimentation (Chamberlain, et al. 1991). When properly waterbarred (BMP 1.11) and covered with slash/mulch (BMPs 1.14 and 1.17), past monitoring has confirmed that no significant surface erosion leaves skyline harvest units (USDA 2005a). Yarding corridors will be placed in natural openings when possible, to minimize the felling of trees and to maintain ground stability provided by adjacent tree roots.

Use of cable yarding systems in the four 7th field watersheds will not increase sediment delivery to streams to a degree that alters the functioning of existing aquatic habitat. Project design standards, including properly functioning RR buffers adjacent to harvest units, BMPs, and compliance with S&Gs during project execution, is expected to result in insignificantly small (not meaningfully measured or detected) amounts of sediment mobilization out of skyline stands.

Magnitude: Tractor, Tractor Endlining, Mechanical Harvester, and cable yarding will not occur during wet weather conditions. Soils will be dry down to 12 inches or greater in depth during the NOS or any periods of operation approved for outside of the NOS. Water barring and provision of soil cover to skid trails and yarding corridors will reduce the potential for sedimentation as described under tractor yarding, mechanical harvester, combination ground-based systems, cable and helicopter yarding above. Intact, functioning RRs will not be significantly affected by yarding activities, thus their

sediment filtering and stream buffering capacity will be fully retained. In a review of the ability of RRs of different widths to buffer streams from adjacent disturbances, Broderson (1973) documented that riparian buffers of approximately one site potential tree height (170 feet on each side of streams in this Project) would be effective to remove sediment under most conditions.

The anticipated small amounts of sediment resulting from yarding are expected to be diluted and dispersed by discharge volumes during 'first flush' precipitation events occurring in the fall season. If any mobilized sediment were to actually reach a stream course, it would be diluted to insignificantly small amounts by increasing tributary flows downstream through the reaches containing SONCC coho salmon CH, Chinook salmon or steelhead trout habitat, being indistinguishable from baseline level conditions. This PE will therefore have insignificantly negative affects on suspended sediment, turbidity, and stream substrate and is unlikely to affect anadromous fish or their habitat.

Fuels Reduction PE

Proximity and Probability: Mastication (hand piling and pile burning were already described as having neutral effects at the beginning of this section) has no probability of measurably affecting turbidity, suspended sediment loads, and stream substrate. Mastication will involve ground disturbance in treatment areas outside of RRs. This disturbance will remain localized, however, and the masticator will create a bed of mulch on which it operates. This mulching will protect any soil disturbed during mastication operations. Masticated mulch is expected to prohibit sediment mobilization from masticated areas down slope towards stream channels. If any mobilized sediment were to actually reach a stream course, it would be diluted to insignificantly small amounts by increasing tributary flows downstream through the reaches containing SONCC coho salmon CH, Chinook salmon or steelhead trout habitat.

Underburns will be conducted at low intensity and soil cover requirements will be met on site to minimize erosion. Burning outside RRs is not likely to affect anadromous fish in their habitat. There is a low probability of effects to suspended sediment, turbidity, and stream substrate from underburning since no underburning will be initiated in RRs, though fire will be allowed to back down into RRs from ignition points higher on the hillslopes (USDA Forest Service 2007).

Firelines will be constructed by hand outside of RRs. The intact and fully functioning RRs will buffer any sediment generated from fireline construction. If any mobilized sediment were to actually reach a stream course, it would be diluted to insignificantly small amounts by increasing tributary flows downstream through the reaches containing SONCC coho salmon CH, Chinook salmon or steelhead trout habitat.

Magnitude: The potential effects are considered insignificant, and similar to the effects analysis results provided in the Pre-commercial Thin and Release Actions and Fuel Hazard Reduction Actions Programmatic BA/BE. 2001. Klamath National Forest, with long term benefits to watershed conditions. This PE will therefore have insignificantly negative affects on suspended sediment, turbidity, and stream substrate and is unlikely to affect anadromous fish or their habitat.

Road Related Activities PE

Landings

Proximity and Probability: Two existing tractor landings are within RRs. Each is within 170 feet of a perennial non fish-bearing stream. These landings are located on road 40S15. One is located at the east end of stand 337 and the other is located on the south end of stand 234. Both landings are adjacent to an unnamed perennial non fish-bearing stream that is a tributary to Long John Creek. These landing are 1.0 and 1.4 miles upstream of SONCC coho salmon CH, respectively.

These landings will require clearing and minimal shaping. The Project hydrologist

concluded that use and maintenance of these landing could elevate local surface erosion, but sediment delivery to streams would be minimal (USDA Forest Service 2007). The leveling, blading and use of these three existing landings is expected to have insignificant negative effects on sediment delivery to adjacent streams and SONCC coho salmon CH, Chinook salmon or steelhead trout habitat further down stream. This is due to directing landing surface drainage patterns away from channels, and the intact and functioning condition of RRs that will buffer effects from landing maintenance and use. These RRs will provide sediment interception and filtration zones. Finally, the distance of landings from SONCC coho salmon CH, Chinook salmon and steelhead trout habitat, as displayed in Table 7, will result in insignificantly negative effects to suspended sediment, turbidity or stream substrate from any sediment that is mobilized.

There are 5 other existing landings, all of which are located outside of RRs and will require maintenance grading for drainage. There will also be 40 new Project landings constructed, all of which will also be located outside of RRs. The distance of these landings from SONCC coho salmon CH, Chinook salmon and steelhead trout habitat ranges from 0.15 to 2.7 miles. All newly constructed landing fill slopes will be seeded, fertilized, and mulched with certified weed-free straw, as needed, prior to the first winter rain. This will minimize surface runoff and sediment mobilization. Mulching will replace lost soil cover. Soil quality standards, Project design features, and BMPs will be met to minimize erosion risk (Mt. Ashland LSR Habitat Restoration and Fuels Reduction Soils Report (USDA Forest Service 2007a). Intact and functioning RRs will buffer effects from the construction and/or use of landings located outside of RRs, since they will provide sediment interception and filtration zones, resulting in neutral sediment delivery effects to nearby stream channels.

Magnitude: Landing construction could elevate local surface erosion, but sediment delivery to streams would be minimal, because of size and location. Riparian buffers would filter sediment and landing runoff would not enter road drainage systems (USDA Forest Service 2007).

There are only two existing landings located in RRs, and they are not associated with active slides or inner gorge areas (USDA Forest Service 2007). These will be contour ripped (4 to 6 inches deep), seeded, fertilized, and covered with weed-free straw. They will be graded to disperse runoff away from stream courses. A sediment filtration trap will be installed at the outlet area of the landing to dissipate any sediment from reaching stream courses. Finally, the intact condition of RRs, in which these two existing landings are located, will help intercept and filter sediment that is mobilized down slope from them. Therefore, these two existing landings will have an insignificantly negative effect on sediment delivery to adjacent streams, and SONCC coho salmon CH, Chinook salmon and steelhead trout habitat down stream.

Construction of 40 new landings, and the use of, and leveling and blading of the remaining existing landings will have a neutral effect on anadromous fish or their habitat because the activity is of low intensity, BMPs will be followed (see Appendix B for list of BMPs applicable to landings) and confined to specific areas outside of RRs and away

from SONCC coho salmon CH, Chinook salmon and steelhead trout habitat, so no effects to anadromous fish or their habitat is expected.

Haul Road Use/Maintenance

Proximity and Probability: Haul from Project stands will be on a limited number of Forest Service arterial roads, all of which receive routine maintenance. Dust abatement during Project road use will minimize airborne dust delivery from roads to stream channels. If Project activities occur outside the normal operating period (April 15 – October 15), a Project-specific wet weather operations plan will be developed and implemented prior to the end of the normal operating period. Wet weather operation Standards (USDA 2002b) will be used to guide haul and maintenance equipment operation. During wet periods an earth scientist will examine field conditions to determine when the soil and/or road have dried out enough to enable operations to resume. The earth scientist will make recommendations to the timber sale administrator who will provide direction to the timber sale contractor as to when operations may resume, ensuring that BMPs will be met and adverse impacts will be avoided. The wet weather operations plan will designate appropriate road winterization measures by road segment, to prevent loss of material from the road prism. This plan will minimize the risk of non-point source erosion. Due to these measures, sediment-related effects caused by truck haul traffic and road maintenance are expected to be insignificantly negative.

Hazard tree removal is done to meet safety requirements and has Resource Protection Measures to minimize effects on fish and fish habitat to insignificant levels (USDA Forest Service, 2004 and associated Letter of Concurrence from NMFS).

Magnitude: Due to the soil protection measures, wet weather operation guidelines and dry-season dust abatement measures described above, quantities of sediment that could otherwise enter a stream will be reduced through these restrictions to operations. When mobilized during the first fall season precipitation events, suspended sediment in overland runoff will be filtered by vegetation and ground cover occurring between road segments and the nearest stream channels. Insignificantly negative effects to suspended sediment, turbidity, and stream substrate from road use and maintenance are expected.

Upgrading unauthorized roads, construction/decommissioning of 22 temporary roads, and decommissioning of 22 existing unauthorized roads)

Proximity and Probability: With the exception of decommissioning one existing unauthorized road (# 41S15.1) at the mouth of Long John Creek, the locations of temporary road work, road decommissioning, and road upgrading work, in the Project 7th field watersheds are outside of RRs within SONCC coho salmon CH, Chinook salmon and steelhead trout habitat or are well above SONCC coho salmon CH, Chinook salmon and steelhead trout habitat (see Table 7). These road-related activities are expected to have only localized sediment mobilization impacts. BMPs associated with road crossing work, grading, outsloping, and waterbarring will minimize sediment delivery to stream channels, especially during the first storm events in the fall. These benefits should accrue

through design features such as using smaller fill volumes, larger sized fill material, and reducing the likelihood of stream capture capability ('pirating') by the adjacent roadbed. All road improvements will create intermediate to long-term benefits to water quality by reducing sediment delivery to nearby channels. Insignificantly negative short-term effects and long-term positive effects on suspended sediment, turbidity, and stream substrate from these road-related activities are expected.

There are eleven stream crossings within the identified segments of roads, both existing authorized (1 crossing), unauthorized (8 crossings) and new temporary roads (2 crossings), that will be decommissioned following project completion. Nine of these stream crossings are in intermittent watercourses that are tributaries in Long John Creek (7), and Cow Creek (2). The other two crossings are in perennial streams. One is located on an unnamed tributary to Long John Creek in the SW ¼ of Section 31 (see paragraph below) and the other is at the mouth of Long John Creek.

One stream crossing (unauthorized road # 41S15.1) within SONCC coho salmon CH will be decommissioned. This road crosses the mouth of Long John Creek. The crossing is a low water ford so no culvert will be removed, therefore no work will occur in the stream channel.

There are two new temporary roads proposed in Riparian Reserves. One crosses an unnamed perennial tributary to Long John Creek in the SW ¼ of Section 31. This road (T401) begins where road 40S15 crosses this stream and accesses units 401 and 252. The other road (T206B) crosses an RR at the headwaters of an unnamed intermittent tributary to West Branch Long John Creek and connects to the new skyline landing in stand 206. These roads are 2.3 and 1.5 miles upstream of SONCC coho salmon CH, respectively.

Effects of decommissioning unauthorized road #41S15.1, the two temporary roads, and the removal of culverts over perennial (2) and intermittent streams(9) at the end of the project will be minimized by Project Design Features, including scheduling Project decommissioning activities during the NOS of April 15 through October 15, and complying with WWOS (USDA Forest Service 2002). Any activities taking place within or near flowing channels at these crossing sites will include dewatering and diversion of the streamflow in conformance with applicable BMPs. Specific dewatering methods (e.g., pipe, pump, cofferdam, etc.) at these two sites will be determined by the District and/or Forest engineer in consultation with either the district fish biologist or hydrologist. Project Design Features including (1) dewatering and diverting flows around stream crossing sites during construction activities; (2) stabilization, mulching, and seeding of treated areas; (3) long-term reduction of fine fill material; (4) armoring of unstable channel banks; and (5) reestablishment of natural drainage patterns will minimize erosion and sedimentation. Because the base of restored stream beds at the culvert removal sites will approximate natural channel elevations (Elder 2003), inconsequential streambed elevation adjustments will likely occur, thereby mobilizing only small amounts of fine sediment. Insignificantly negative short-term effects and a long-term positive effect on suspended sediment, turbidity, and stream substrate from this road-related activity are expected.

Construction and subsequent decommissioning of the remaining twenty temporary roads and seventeen unauthorized roads will not occur within RRs, so these activities will not be hydraulically connected to any stream course.

Magnitude: Sedimentation from road maintenance management activities and road improvement/decommissioning activities will be localized and of limited duration, following BMPs, Project Design Features, RR standards and guidelines, and decommissioning procedures (Elder 2003). A beneficial effect to downstream anadromous fish habitat will occur from the reduction in sediment delivery to the stream channels resulting from decommissioning twenty two temporary roads and twenty two existing unauthorized roads, including eleven crossings.

Insignificantly negative short-term effects are expected from road-related activities on suspended sediment and turbidity from this PE. Long-term positive effects on suspended sediment, turbidity, and stream substrate from road-related activities (decommissioning)

are, however, anticipated.

Water Drafting PE

Proximity and Probability: Dust abatement will require water drafting from two established sites within SONCC coho salmon CH, Chinook salmon and steelhead trout habitat. One site is located on Beaver Creek about 100 yards upstream of the Hungry Creek confluence and the other is located on Cow Creek about 150 yards upstream of where Forest Service road #40N16 crosses the stream. Drafting site maintenance will include erosion control at drafting site access points and/or main roads, to prevent water spillage from initiating sediment movement to adjacent streams. Straw bales, rocking, and containment dikes will be used as needed at the sites to capture any spilled water and prevent runoff to adjacent streams. No new access roads will be built (see RR section below). There are two other water drafting sites in Beaver/Grouse Creek 7th field watershed, and one in Long John Creek 7th field watershed. These sites are located 1.3 to 2.5 miles upstream from SONCC coho salmon CH.

Magnitude: Sediment disturbance and mobilization from water withdrawal at the these sites is expected to be insignificantly negative, due to flows in Beaver and Cow Creek that dilute low suspended sediment concentrations to levels undetectable from background conditions. Insignificantly negative effects to suspended sediment, turbidity, and stream substrate from this PE are expected.

While any one PE may have neutral or insignificant negative impacts to anadromous fish or habitat, all PEs need to be aggregated when considering this Indicator because of the strong link between the sediment regime and fish health and fish habitat. The analysis of the aggregated PEs is done through the CWE modeling and described in the Indicator Summary.

Indicator Summary for Water Quality: Suspended Sediment-Turbidity-Substrate character: The Sediment regime (turbidity, substrate character) functioning level will be Maintained in anadromous fish bearing reaches at the site and in streams in the 7th and 5th field scale watersheds and over the entire analysis area (Appendix D, USDA Forest Service 2007). Because project activities result in only limited ground disturbance project activities in RRs are few, dispersed and have effects indistinguishable from baseline conditions and Resource Protection Measures are incorporated into the Project design to minimize erosion on site, Project-related sediment effects to SONCC coho salmon, Chinook salmon, steelhead trout, and their habitat are considered insignificantly negative. The improvement in forest health in RRs, reduction in sediment delivery due to road decommissioning, and the reduced risk of high intensity fires in the project area is considered a long term benefit to this Indicator.

Indicator Summary for Habitat Elements: Substrate Character/Embeddedness: The Project activities will have an insignificantly negative effect on this Indicator (see summary for Suspended Sediment-Turbidity-Substrate character) in the short term. In the long term, the proposed action may prevent adverse effects to watershed conditions,

including substrate character and turbidity.

The Project was designed by an interdisciplinary team to minimize surface erosion at the site scale by locating units near existing roads (to minimize the need for road and landing construction), locating new road and landing construction outside of RRs (except for roads T206B and T401), and including Resource Protection Measures that were designed to minimize surface erosion on site. Resource Protection Measures include: thinning of trees up to 20" DBH within the second site potential tree height only, hand piling and pile burning and other limited activities in the first site-potential tree height in RRs (see appendix G – Table G-10), maintaining low intensity underburning, water barring skid trails, generally limiting tractors and skid trails to slopes < 35% (BMP 1.1 and 5.2), outsloping the new landings, and adhering to KNF LRMP Soil Cover Standards. Stream protection buffers have been evaluated relative to various ground disturbing activities, including logging practices, in a number of sources. Corbett and Lynch (1985) recommended buffers of 20-30 m for controlling sediment. FEMAT (1993) citing these same studies, concluded that buffers of approximately 66ft - 98ft were probably adequate to control sediment from overland flow (Spence et al 1996, Page 219, 228, 229). Therefore, there is a high probability that streams are protected from significant increases in sediment delivery through the RR buffers (170-340 feet) and the sediment retention and filtering capacities of RRs will be maintained. Where activities occur in RRs, the project hydrologist has concluded effects to water quality are insignificant (USDA Forest Service 2007). I conclude that these insignificant effects to water quality are not likely to result in adverse effects to SONCC coho salmon, Chinook salmon, steelhead trout or their habitat, including CH.

The KNF CWE modeling enables an analysis of existing condition combined with PEs at multiple scales. The modeled USLE and GEO values include effects of the PEs that may increase sediment delivery to streams due to risk of ground disturbance and location relative to unstable lands and streams in the entire analysis area. As shown in Appendix A1 (table A-1, A-2 and A-3), there is an increase in the risk for surface erosion mass wasting in all four 7th field watersheds. The project hydrologist and geologist conducted field reviews and reviewed the modeled values between existing condition and post-Project conditions. These earth scientists concluded that the change in risk would not be significant at the project and watershed scales (USDA Forest Service 2007a). The PEs related to changes in sediment delivery will not significantly affect anadromous fish habitat in Beaver Creek because, based on professional experience from project biologists and hydrologists, effects at the site, 7th, and 5th field watershed scales are insignificant to the point that any change in the sediment regime of Beaver Creek would be undetectable. Also, see Disturbance History and Regime Indicator discussion.

In the short-term effects to SONCC coho salmon CH, Chinook salmon and steelhead trout habitat from road activities is insignificantly negative because each of the road activities is dispersed across the project landscape and has insignificant effects to the sediment regime at the site level. The surface erosion (suspended sediment delivery) from road use will be controlled and mitigated by WWO guidelines, dry-season dust abatement measures, and the use of BMPs. Project design measures effectively minimize potential

water quality impacts associated with log haul and construction of temporary roads (USDA Forest Service 2007a). Hazard tree removal will follow Resource Protection Measures that have been determined to cause no more than insignificant effects because generally few trees are removed over large tracts of land, removal operations occur from the roadside, and hazard trees are left on site if felled in RRs (with minor exceptions). There is an insignificant risk of sediment delivery to Long John Creek from construction of two segments of temporary roads within RRs and the magnitude is insignificant: The risk of surface erosion has a discountable increase in Long Creek and over the entire analysis area (Appendix A1 - table A-1, A-2 and A-3). The risk of mass wasting is unchanged or decreases in Long John Creek and over the entire analysis area (Appendix A1 - Table A-4, A-5, and A-6).

Long-term positive effects to SONCC coho salmon CH, Chinook salmon and steelhead trout habitat from road-related activities (decommissioning) are, however, anticipated.

Habitat Elements – Large Woody Debris (LWD)

Existing Condition:

Table 8 describes the amount of wood within anadromous fish bearing streams that may be affected by PEs and Appendix D shows the conclusion for Functioning level for each of those streams based on the streams' capability to retain large wood and the current amount of wood estimated through stream surveys and professional judgment. All of these watersheds have channels that are high gradient (>4% slope), and are "flashy" in nature. This channel type (A) retains little LWD as pieces are generally transported downstream in high flows (Rosgen 1996). Particularly high flows were experienced in Beaver Creek watershed in 1997. The 1997 flood flushed LWD downstream from Beaver Creek, and its tributaries. The large width and flow size of Beaver Creek during high flow periods moves wood through the system or retains the wood on floodwater terraces. This Indicator is typically measured in pieces of wood within the stream channel (Appendix C). In the Project area, the District silviculturists and the fuels specialist noted that the forested areas in the stands designed for RR treatments have a greater-than-desired number of trees per acre (i.e., overstocked) due to lack of natural low-intensity fire.

Post-Project Condition:

Forest Restoration PE

Proximity and Probability: Variable density thinning activites will remove trees up to 20" DBH within the second site potential tree height in RRs in 16 stands in Beaver Grouse Creek 7th field, 3 stands in Deer-Beaver Creek 7th field and 16 stands in Long John Creek 7th field. The total amount of these stands within RRs is 107 acres. Ten of these stands in Beaver/Grouse Creek and Long John Creek 7th fields respectively, are located within anadromous fish bearing reaches. One stand in Deer-Beaver Creek 7th field is also located within an anadromous fish bearing reach.

The total variable density thinning stand acreage within RRs of anadromous fish bearing reaches in the three 7th fields is:

Beaver/Grouse Creek – 30 acres
Long John Creek – 16 acres
Deer-Beaver Creek – 9 acres

The remaining stands in Beaver/Grouse Creek (6 stands), Long John Creek (6 stands), and Deer-Beaver Creek (2 stands) 7th fields are located 0.05 miles to 1.1 miles upstream of anadromous fish bearing reaches.

The trees to be removed are selected to improve forest conditions within the LSR in the long term.

Thinning activities using hand lopping, hand piling and pile burning will remove trees (<9" DBH) within 340ft. of both sides of perennial anadromous fish-bearing stream channels in 20 stands in Beaver/Grouse Creek 7th field watershed, 3 stands in Deer-Beaver Creek 7th field and 19 stands on Long John Creek 7th field. The total portions of these stands located within RRs is 460 acres.

In Beaver/Grouse Creek 7th field, seven of the stands are located within anadromous fish bearing reaches. In Long John Creek 7th field, three of the stands are located within anadromous fish bearing reaches. None of the three stands in Deer-Beaver Creek 7th field are located within anadromous fish bearing reaches.

The total thinning <9" DBH stand acreage within RRs of anadromous fish bearing reaches in the two 7th fields is:

Beaver/Grouse Creek – 38 acres
Long John Creek – 64 acres

The remaining stands in Beaver/Grouse Creek (13 stands), Long John Creek (16 stands), and Deer-Beaver Creek (3 stands) are located 0.05 to 2 miles upstream of anadromous fish bearing reaches.

Thinning activities occur in RRs in about 9.7% (about 567 acres project-wide) of the total treated areas. FEMAT concluded that the probability of wood entering the active stream-channel from greater than one tree high is generally low (FEMAT, page V-26). The probability of affecting large wood is low because trees >9" DBH will not be removed within the first site potential tree height of anadromous fish bearing streams.

Magnitude: Literature suggests that a buffer of one site-potential tree height on westside streams is needed to fully protect riparian function related to LWD when no harvest is allowed in the buffer (Spence et al 1996, Page 218, 226). The forested areas in the stands designed for RR treatments have a greater-than-desired number of trees per acre, even in RRs, so removing these trees will have an insignificant effect to the recruitment of large wood in the streams. Also, in stands 202, 406, 425, 438, 468, 469, 470, and 711 a road prevents wood recruitment to anadromous fish bearing streams, reducing the magnitude of the impact of removing the trees to insignificant levels. The overall effect from this PE to the Indicator is neutral in short term and beneficial in long term since removal of trees <9" DBH within the first site potential tree height will encourage future large wood recruitment.

Fuels Reduction PE

Underburning

Proximity and Probability: Underburning will occur within some thinning stands and underburn stands to treat fuels after thinning activities and in stands appropriate to reduce fuels without prior mechanical treatment. Ignition will not occur in RRs to help maintain the low intensity fire level, but fire will be allowed to burn into RRs. Hand piling in RRs may be done to pile incidental roadside slash and in areas where underburning is not appropriate. Piles in RRs will be distributed so they are isolated from one another to avoid affecting burning large contiguous areas. Pile sizes in RRs will not exceed 6 ft in diameter to prevent negative impacts to soil and to ensure a low scorch height. Burning outside RRs is not likely to affect anadromous fish in their habitat. There is a low probability of effects to anadromous fish and their habitat from the burning PE in RRs.

Magnitude: The underburning will not remove large wood because a low intensity burn in all burn areas is proposed. Therefore, the magnitude is zero; effect to the indicator is neutral.

Fire Line Construction

Proximity and Probability: Firelines constructed by hand will not remove trees that contribute to large woody debris recruitment – therefore there is no probability of removing large woody debris.

Magnitude: The hand-constructed fire lines do not remove large wood and therefore the magnitude is zero. The effect to this indicator is neutral.

Road Related Activities PE

Construction/decommissioning of 22 temporary roads, and decommissioning of 22 existing unauthorized roads; hazard tree removal

Proximity and Probability: Except for the one short new temporary road (T206B) proposed within an RR and the short segment of another temporary road (T401) that crosses and runs parallel to an RR for a short distance, the construction of new temporary roads does not occur in proximity to RRs. The lengths of the new road T206B and the short segment of road T401 within RRs are 0.07 and 0.15 miles, respectively.

Tree removal due to construction of the two temporary roads within RRs (see paragraph above), road crossing decommissioning and hazard tree removal in RR's is the primary means by which loss of LWD could occur. It is expected that only a few trees, if any, will be felled within RRs during hazard tree removal, or during the other road-related activity PEs of construction of the two temporary roads within RRs, and road decommissioning at eleven crossings. Since any portions of hazard trees felled in RRs will routinely be left on site to provide for LWD recruitment, there is a very

low probability that hazard tree or other tree felling in RRs for any of these activities will result in reductions in LWD. Therefore, the probability of impacts is discountable and insignificantly negative.

Magnitude: The magnitude of effects to this Indicator from the construction of temporary road 206B to the new landing and the short segment of temporary road T401 that crosses and runs parallel to an RR for 0.15 miles, to hazard tree removal is insignificant. For the 0.22 total miles of road construction within RRs, decommissioning of eleven stream crossings and hazard tree removal, overall conditions will be "maintained" in all affected 7th field watersheds because removal of LWD is limited in extent and intensity by project design and Resource Protection Measures. When hazard trees must be fallen, large trees recruitable to the stream will be left in RRs unless they remain a threat to public safety or road structures. The Magnitude of effects to this Indicator from road construction is zero; the effect from hazard tree removal is insignificantly negative. The overall effect from this PE to the Indicator is insignificantly negative.

Landings

Proximity and Probability: The use of and leveling and blading of existing landings will not affect LWD because tree removal is not involved. No new landings will be constructed in RRs so their construction will not affect large woody debris recruitment.

Magnitude: The construction and use of the new landings will have no effect to large woody debris recruitment in Grouse Creek, Long John Creek, Cow Creek or Beaver Creek due to the distance between the landing construction and SONCC coho salmon CH, Chinook salmon and steelhead trout habitat. The effect to this indicator is neutral.

Water Drafting PE

Proximity and Probability: The use of the five existing drafting sites will not affect LWD because tree removal is not involved. Use of these sites will not affect large woody debris recruitment.

Magnitude: The use of the five existing drafting sites will have no effect to large woody debris recruitment in Grouse Creek, Long John Creek, Cow Creek or Beaver Creek due to no trees being removed. The effect to this indicator is neutral.

Indicator Summary for Habitat Elements: Large Woody Debris: The LWD function is insignificantly affected at the site scale where the two temporary road segments are constructed on the two unnamed tributaries in Long John Creek 7th field, decommissioning of eleven stream crossings, and on sections of Grouse Creek and Long John Creek where thinning in RRs within anadromous fish bearing reaches will occur over 157 acres. LWD function is maintained and no significant effects to LWD levels are expected at the 7th and/or 5th field watershed scale in the short term, with some benefit to local RR conditions in the long term. The effect to this Indicator is insignificantly negative.

{Note: The Indicators of Pool Frequency and Quality, Width-to-Depth Ratio, Streambank Condition, off-channel habitat, and Floodplain Connectivity are all similarly affected by sediment delivery and possible changes to peak/base flow. To reduce the redundancy of analysis, summaries for each of these Indicators appear below for all Project Elements combined. Their primary analysis is already captured under the Suspended Sediment-Turbidity-Substrate character and Peak/Base Flow Indicators}.

Habitat Elements - Pool Frequency and Quality

Existing Condition:

This Indicator relates to frequency and quality of primary pools, as defined in Appendix C. This Indicator is relative to streams containing SONCC coho salmon CH, Chinook salmon and steelhead trout habitat that may be affected by PEs within the Action Area: Beaver, Grouse, Long John, and Cow Creeks. Table 8 describes the number of primary pools within anadromous fish bearing streams and Appendix D shows the conclusion for Functioning level for each of those streams based on the streams capability to create primary pools and the current number of primary pools estimated through stream surveys and professional judgment.

Post-Project Condition:

> **Proximity and Probability:** The probability that the proposed Project will measurably affect pool frequency and quality in an adverse manner is discountable. The frequency of pools post-project could conceivably be modified only by actions that would a) inundate existing pools with sediment, or b) create new pools by introducing roughness elements, or perhaps by c) increasing peak flows significantly. As concluded for the Suspended Sediment above, and Peak Flow Indicators below, there is a low probability of fine sediment levels distinguishable from background occurring as an outcome of conducting the proposed action comprised of its elements.
> **Magnitude:** Changes in pool frequency and quality is expected to be zero; neutral effects to this Indicator.

Indicator Summary for Habitat Elements: Pool Frequency, Large Pools, Pool Quality: The PEs will have a neutral effect on pool frequency and quality because, 1) There is an insignificantly negative effect to suspended sediment and substrate, and 2) an insignificantly negative effect to Peak Flows and 3) an insignificantly negative effect to LWD.

Habitat Elements - Channel Condition and Dynamics

Average Wetted Width to Maximum Depth Ratio

Existing Condition:
Table 8 and Appendix D describe the Functioning level for each of the streams that may be affected by the Project.

Post-Project Condition:

Proximity and Probability: Based on only localized and discountable effects to streambank condition at the site level from PEs occurring in RRs, with the exception of road crossing decommissioning (insignificantly negative effects due to the small size of the roads/stream crossings, no impacts to neighboring streambanks, quick recovery time of riparian vegetation at these sites, etc.), the total package of Resource Protection Measures, the insignificant magnitude of effects described to the sediment regime (turbidity and substrate character), and discountable probability of an actual increase or decrease in peak and base flows, respectively, I concluded that the width-to-depth ratios

should not change as a result of Project implementation. See discussion for turbidity-substrate character and embeddedness.

Magnitude: Road crossing decommissioning will have an insignificantly negative localized effect on streambank condition and width to depth ratio at the eleven road crossing sites, but a neutral effect on streambank condition and no changes in peak base flows and wetted width to depth ratio in SONCC coho salmon CH, Chinook salmon and steelhead trout habitat. Water drafting from all sites will have a neutral effect on streambank condition and also wetted width to depth ratio. Therefore, based on the effects to streambank condition, neutral effects to this indicator are expected.

Indicator Summary for Channel Condition/Dynamics: Width to Depth Ratio: The PEs will have a neutral effect on this Indicator.

Streambank Condition

Existing Condition:
Based on field reviews, streambank conditions in Grouse Creek, Long John Creek, Deer Creek and Beaver Creek are considered to be At-Risk due to the 1997 storm event. Grouse Creek also experienced a large summer thunderstorm in 1988 that resulted in large amounts of sediment being transported from the headwaters downstream to the confluence with Cow Creek (USDA Forest Service 2007). Cow Creek is Properly Functioning above the confluence with Long John Creek. It is At Risk from the confluence with Long John Creek to the confluence with Grouse Creek.

Post-Project Condition:

Proximity and Probability: Streambank conditions should not change as a result of implementation of any PEs. The only activities that will occur in RRs are variable density thinning up to 20" DBH within the second site potential tree height, thinning up to 9" DBH, thinning up to 9" DBH with hand crews, hand piling and pile burning, construction of two short temporary roads, road crossing decommissioning, water drafting, hazard tree removal, and the use of two existing landings. These activities will have only localized, and in all cases except road crossing decommissioning, discountable effects on streambank condition. Road crossing decommissioning will have an insignificantly negative localized effect on streambank condition at the eleven road crossing sites, but a neutral effect on streambank condition in SONCC coho salmon CH, Chinook salmon and steelhead trout habitat. Water drafting from all sites will have a neutral effect on streambank condition.

Magnitude: Based on the total package of resource protection measures; BMPs; the insignificant magnitude of effects described to the sediment regime (turbidity and substrate character), and discountable probability of any measurable increase and decrease in peak/ base flows, the probability of adversely affecting SONCC coho salmon

CH, Chinook salmon and steelhead trout habitat downstream is discountable. Project implementation will have a neutral effect on this habitat Indicator.

Indicator Summary for Channel Condition/Dynamics: Streambank Condition: The proposed action will have a neutral effect on this Indicator.

Floodplain Connectivity

Existing Conditions
Floodplains are not a significant hydrologic component in the mountainous Rosgen type A and type B channel types (Rosgen, 1996) such in Grouse, Deer, and Long John Creeks. Beaver Creek was determined to be At-Risk due to the 1997 storm event.

Post Project Condition:

Proximity and Probability: Floodplain connectivity in the Action Area is not expected to change because of Project implementation. Water drafting will occur at five sites as described in the Suspended Sediment-Turbidity-Substrate character and Peak/Base Flow Indicators and due to following NMFS 2001 water drafting specifications, flows downstream of these five sites are expected to be within the natural range of variability for the Beaver/Grouse Creek and Long John Creek 7th field watersheds. No other project effects to floodplain condition are expected.

Magnitude: Based on neutral effects to the Streambank Condition and Average Wetted Width to Maximum Depth Ratio indicators, the total package of resource protection measures; the insignificant magnitude of effects described to the sediment regime (turbidity and substrate character), and discountable probability of any measurable increase and decrease in peak and base flows, respectively, project implementation will have a neutral effect on this habitat Indicator.

Indicator Summary for Channel Condition/Dynamics: Floodplain Connectivity: Considering the effects of all PEs on this Indicator, the Project activities will have a neutral effect on this Indicator.

Habitat Elements – Off-channel habitat

Existing Condition:
Off-channel habitat is not a significant component in the steep channels (Rosgen types A and B) in the Beaver/Grouse, Deer-Beaver Creek and Upper Cow Creek 7th field watersheds. The lower 0.5 miles of Cow Creek in the Long John Creek 7th field watershed contains a few side channels that become available to anadromous fish during elevated winter flows and spring snowmelt runoff. Off-channel habitat is not a significant component in Long John Creek, Grouse Creek and upper Cow Creek (Rosgen

types A). At the 5th field watershed scale, Beaver Creek contains some side channels that become available to anadromous fish during elevated winter flows and spring snowmelt runoff. These channels provide limited aquatic habitat, however, as they do not contain much spawning gravel and have little streamside vegetation cover. Although there is limited off channel habitat, it is considered "Properly Functioning" because the channel morphology does not naturally provide for greater off channel habitat potential.

Post-Project Condition:

Proximity and Probability: This Indicator is not applicable to Long John, Grouse and upper Cow Creeks. The Project will not affect the off channel habitat created during high winter flows in lower Cow Creek and Beaver Creek, because potential sediment delivery to channels from surface erosion is low, the risk of mass wasting is not significantly increased by PEs, and the flow regime is not expected to be outside of the range of variability for the mainstem of Cow Creek (Long John Creek 7th field watershed and Beaver Creek (5th field watershed). For a discussion of effects of each PE, see the Sediment/Turbidity/Substrate Character and Change in Flow Indicator sections.

Magnitude: Magnitude of effects is zero; effects to this Indicator are neutral.

Indicator Summary for Channel Condition/Dynamics: Off-channel habitat: Considering the effects of all PEs on this Indicator, the Project activities will have a neutral effect on this Indicator.

Habitat Elements – Refugia

Existing Condition:
The Northwest Forest Plan identified Key Watersheds to create a system of large refugia comprising watersheds that are crucial to at-risk fish species and stock and provide high quality water (NFP ROD, B-12). The KNF has designated Key Watersheds. None of the PEs for the proposed action occur in any Key Watersheds. At the Action Area scale, the tributaries provide refugia for anadromous fish from elevated temperatures in the mainstem of the Klamath River. Three 7th field streams (Grouse, Cow and Deer Creeks) provide cold-water refugia habitat as well as cold water to Beaver Creek. The other streams in the Action Area contribute cold water to down-stream habitat and are considered the primary habitat constituent related to refugia for the Project. Therefore, the refugia condition for the Project is the same as described for the Temperature Indicator.

Post-Project Condition:

Proximity and Probability: The proposed action does not occur in any Key Watersheds; therefore, there is no effect to the formally designated refugia system for the Forest. Throughout the Forest, water temperature is considered the principle habitat Indicator for

refugia based on consideration of existing habitat conditions on the Forest (as supported by recent TMDL listings). No change in water temperature is expected from PEs, as discussed in the Temperature Indicator section.

Magnitude: Because the Project does not occur in a Key Watershed and does not affect water temperature, the Project activities will have a neutral effect on this Indicator in the short term. In the long term, there could be beneficial effects through reducing the potential of high intensity fires in the project area.

Indicator Summary for Habitat Elements: Refugia: Considering the effects of all PEs on this Indicator, the Project activities will have a neutral effect on this Indicator

Flow/Hydrology – Change in Peak/Base Flow

Existing Conditions

Appendix C provides criteria used to rate Peak/Base Flow conditions. Pre-project Peak/Base Flow conditions are Properly Functioning for all 7th field watersheds (see Appendix A1 – table A-7, A-8 and A-9). Beaver Creek 5th field watershed is At-Risk. The model indicates, from an empirical standpoint, that Beaver Creek is at a slight risk of increased sedimentation from mass wasting processes, and a higher risk of impacts from peak flow runoff. The higher figures for the ERA risk ratios lies in the impacts from the fire history in the watershed, with the subsequent salvage and road building activities increasing the ERA's. The Threshold values are lowered by the amount of the watershed in the rain-on-snow zone at the higher elevations. In reality, the ground cover and canopy closure levels in the rain-on-snow zone would attenuate a snow pack buildup thus reducing risk of peak flow impacts (USDA Forest Service 2007a). The lower portion of Beaver Creek is a domestic water supply for several private users.

Post Project Condition

For all PEs: At the 7th and 5th field watershed scales, the project was designed and Resource Protection Measures were added to minimize the extent of soil compaction and bare soil areas to ensure that run-off characteristics of the thinning areas are maintained, thus reducing the probability of changes in flow to discountable levels.

Forest Restoration PE

Proximity and Probability: In all four 7th field subwatersheds the thinning increases the modeled values for ERA, the Indicator that best accounts for changes in flow. Therefore, specific field reviews were conducted to take a closer look at the risk and potential for changes in flows. The Project has resource protection measures and BMPs built into the project design (such as the stand prescriptions, layout, and mark) that minimizes risk of changes to flows. After field review of the thinning treatments, the hydrologist concluded that the prescription will serve to retain binding root strength of the residual vegetation and increase evapo-transpiration potential [water potential] in the soil, by decreasing competition for water and nutrients in the soil in the short term. This also will reduce

peak flows by tying up groundwater in the longer term (USDA Forest Service 2007).

The ERA model shows the greatest degree of proposed action impacts in the Beaver-Grouse and Long John watersheds. Once again this is because of the amount of non-cohesive granitic soils. This can be largely mitigated by project design measures. None of the 7th field watershed reach their inference points of 1.0 in this model (USDA Forest Service 2007).

Magnitude: After consideration of the modeled values, past conditions and site level review by the hydrologist, effects to flows will be insignificantly negative in the short term for all four 7th field watersheds and Beaver Creek 5th field watershed. There should be benefits throughout the project area in the long term by reducing risk of high intensity wildfires that could significantly alter stream flows.

Fuels Reduction PE

Underburning

Proximity and Probability: Underburning occurs within thinned areas (approximately 2361 acres) and in two underburn stands totaling 120 acres. There is a low probability of causing changes to surface flows through underburning because of the regrowth in remaining vegetation that occurs after low intensity fires. The underburning will occur over several years, after thinning has created safe burning condition, reducing the probability of effects to surface flow.

Magnitude: Underburning is expected to have a neutral effect on flows because existing vegetation will take up water made available by the vegetation removed by burning. There are insignificant effects to fish and watershed condition in the short term, with long term benefits to fish and watershed conditions in the long term by reducing risk of high intensity wildfires that could significantly alter stream flows.

Fire Line Construction

Proximity and Probability: The fire lines are not built in RRs and therefore have a low probability of affecting flows. The hand-constructed fire lines will be obliterated after use and therefore will not change drainage patterns that may affect flows.

Magnitude: The fire lines will be covered with slash and dirt so that erosion is minimized, reducing the magnitude of effects to flows to insignificantly negative levels.

Road Related Activities PE

Temporary Road Construction, Decommissioning of 22 unauthorized roads, Hazard Tree Removal and Landings

Proximity and Probability: Except for the one short new temporary road (T206B) proposed within an RR and the short segment of another temporary road (T401) that crosses and runs parallel to an RR for a short distance, the construction of new temporary roads does not occur in proximity to RRs. The lengths of new road T206B and the short segment of road T401 within RRs are 0.07 and 0.15 miles, respectively. The remaining twenty temporary roads to be constructed are distributed in short segments throughout the project area.

Surface runoff from the two temporary roads within RRs are not expected to increase the probability of changing the flow regime because each road is located high up in the watershed and BMPs and Resource Protection Measures will minimize the probability of surface run-off from the roads entering stream channels. Hazard tree reductions involve individual trees scattered in the area, with no concentrated removals. Therefore, the probability of impacts from hazard tree removal is discountable.

Effects to peak and base flows from decommissioning of 22 existing unauthorized roads (and ten stream crossings) are expected to be insignificantly negative, with long-term positive effects, for the same reasons described in the suspended sediment/turbidity/stream substrate effects analysis above.

Magnitude: Magnitude of impacts from hazard tree removal is discountable. For hazard tree removal, overall conditions will be "maintained" in all affected 7th field watersheds because removal of LWD is limited in extent and intensity, per the Resource Protection Measures. When hazard trees must be felled, large trees recruitable to the stream will be left in RRs. Magnitude from road construction outside RRs is neutral and insignificantly negative from construction of the two temporary roads within RRs. Overall effects from this PE to the Indicator are insignificantly negative.

Landing

Proximity and Probability: The use of existing landings will not cause a change in flows; there is no causal mechanism for such a change. No new landings will be constructed within RRs.

The new landings to be constructed outside the RRs have been accounted for within the ERA modeling (Appendix A1 - tables A-7, A-8, and A-9) and those results have been clarified by the hydrologist's field reviews. These landings are not hydrogically connected to any stream course so there is no probability that these landings will cause a change in flows. BMPs 1.12, 1.16, 2.3 and Resource Protection Measures are part of the project design. **Magnitude:** The size of individual landings is guided by safety requirements and landings are kept to the smallest size practical, approximately 0.33 acres each. The construction and use of the new landings will have neutral effects to flows in Beaver Creek, Cow Creek, Grouse Creek and Long John Creek due to the small size of the landings, no new landings constructed in RRs, and the distance between the landing construction and SONCC coho salmon CH, Chinook salmon and steelhead trout habitat in Cow Creek, Long John Creek, Grouse Creek, and Beaver Creek.

Water Drafting PE

Proximity and Probability: At the site level, water drafting has the potential for short term, indirect effects downstream. Pumping rate will not exceed 350 gallons per minute or 10% of the flow of any anadromous stream and pumping is done in short periods (for example, six trips per day to a site and drafting for 20 minutes each time). Water drafting will result in only slight temporary decreases in flow over the course of a 24-hour period that is considered insignificant when drafting from Cow Creek and Beaver Creek because of their large flows. Therefore, the effects to flow (and to anadromous fish and their habitat) are considered insignificant. Screening and restricting withdrawal rates will minimize the potential for effects to SONCC coho salmon, Chinook salmon and steelhead trout.

Magnitude: The impacts from water drafting is insignificantly negative in the short term and neutral in the long term.

Indicator Summary for Flow/Hydrology: Changes in Peak and Base Flows:

In all four 7th field watersheds the thinning increases the modeled values for ERA, the Indicator that best accounts for change's in flow. Therefore, specific field reviews were conducted to take a closer look at the risk and potential for changes in flows. The Project has resource protection measures and BMPs built into the project design (such as the unit prescriptions, layout, and mark) that minimizes risk of changes to flows. After field review of the thinning treatments, the hydrologist concluded that the prescription will serve to retain binding root strength of the residual vegetation and increase evapo-transpiration potential [water potential] in the soil, by decreasing

competition for water and nutrients in the soil in the short term. This also will reduce peak flows by tying up groundwater in the longer term (USDA Forest Service 2007).

The ERA model shows the greatest degree of Project impacts in the Beaver-Grouse and Long John watersheds. Once again this is because of the amount of non-cohesive granitic soils. This can be largely mitigated by project design measures. Since the change in risk ratios is below the level of significance (1.0) in all four 7th field watersheds and Beaver Creek 5th field watershed, these modeled changes are considered insignificant (USDA Forest Service 2007).

After consideration of the modeled values, past conditions and site level review by the hydrologist, effects to flows will be insignificantly negative in the short term for all four 7th field watersheds and Beaver Creek 5th field watershed. There should be benefits throughout the project area in the long term by reducing risk of high intensity wildfires that could significantly alter stream flows.

Flow/Hydrology – Drainage Net Increases

This Indicator is rated by the amount of drainage network increases related to roads PE (Appendix C). This Indicator is relative to all four 7th field watersheds since temporary road construction will occur in each watershed. Pre and post project road miles and road density are described in Table 9.

The existing condition of each 7th and 5th field anadromous fish bearing streams that may be affected by the Project is described in Table 9 and Appendix C

Table 9 Road Miles and Road Density – Alternative 2

Watershed	Road Miles Pre-project	Road Density Pre-Project (# road miles per watershed miles^2)	Road Miles (post-project) short term change	Road Density (post-Project) short term change (# road miles per watershed miles^2)	Road Miles Post-project, long term change
Beaver/Grouse Creek (7th Field)	42.1	4.15	40.5	3.98	40.4
Long John Creek (7th field)	38.5	4.34	32.83	3.68	32.63
Upper Cow Creek (7th field)	48.4	3.81	48.02	3.78	48.02
Deer-Beaver Creek (7th field)	20.1	4.75	19.75	4.64	19.65

Post-Project Condition:

Proximity and Probability: Twenty two temporary roads will be constructed. Except for the one short new temporary road (T206B) proposed within an RR and the short

segment of another temporary road (T401) that crosses and runs parallel to an RR for a short distance, the construction of new temporary roads does not occur in RRs. The lengths of new road T206B and the short segment of road T401 within RRs are 0.07 and 0.15 miles, respectively. Neither of these roads are located in streams containing SONCC coho salmon CH, Chinook salmon and steelhead trout habitat. These roads are 2.3 and 1.5 miles upstream of SONCC coho salmon CH, Chinook salmon and steelhead trout habitat, respectively. The remaining temporary roads to be constructed are distributed in short segments outside of SONCC coho salmon CH throughout the project area.

While drainage would be altered at the specific sites where roads are constructed, the road segments are constructed so that water is not concentrated and the drainage is directed off the roads away from channels. Therefore, there is a low probability of effects to the drainage network at the watershed scale in the short term.

Magnitude: In the short term, effects of road building is considered insignificant to drainage patterns because the segments are short, distributed over the project area, and, except for the one short new temporary road (T206B) proposed within an RR and the short segment of another temporary road (T401) that crosses and runs parallel to an RR for a short distance, the construction of new temporary roads does not occur in RRs. Also, winterizing roads prior to the rainy season will prevent alteration of drainage patterns. The new road segments will not change the length of any active stream-channel (per criterion in Appendix C) in the short term because there will be no as new crossings that change flow patterns or inboard ditches between new roads and active stream channels. BMPs and Resource Protection Measures will prevent channel extension at the site level. The Project does not increase existing road miles in the long term because temporary roads will be decommissioned after project activities are completed and no new authorized roads are to be built. In addition, the 22 existing unauthorized roads will be decommissioned; therefore, there is a positive long term effect to drainage network.

There will be an insignificant change to the drainage network at the site level but the change will not affect SONCC coho salmon CH, Chinook salmon and steelhead trout habitat because there is no increase in the active channel length. The condition of this Indicator is “Maintained”.

Indicator Summary for Flow/Hydrology: Drainage Network Increase: The proposed action will have an insignificantly negative effect on the Indicator at the site level and a neutral effect to SONCC coho salmon CH, Chinook salmon and steelhead trout habitat at the watershed scale in the short term. There will be a positive effect on this Indicator in the long term because the new temporary roads will be decommissioned after use, and also 22 existing unauthorized roads.

Watershed Condition – Road Density and Location

Existing Condition:
This Indicator is rated by the miles of road related to the total square miles in the watershed (Appendix C).

Post-Project Condition:

Proximity and Probability: Only road construction relates to this Indicator. Except for the one short new temporary road (T206B) proposed within an RR and the short segment of another temporary road (T401) that crosses and runs parallel to an RR for a short distance, the construction of new temporary roads does not occur in RRs. The closest proposed road to anadromous fish habitat is 0.15 miles from Grouse Creek in Stand 383 (road T383). There is an increase in road density in the short term and the effects to SONCC coho salmon, Chinook salmon, steelhead trout and their habitat is considered insignificantly negative because of the distance between road construction and SONCC coho salmon CH, Chinook salmon and steelhead trout habitat, the buffers of RRs, and the conclusion of the hydrologist that, "The project design effectively addresses potential water quality impacts associated with log haul on unpaved roads, and construction of landings and temporary roads" (USDA Forest Service 2007).

Magnitude: The Project does not change existing road miles in the long term because temporary roads will be decommissioned after project activities are completed and also, the 22 existing unauthorized roads will be decommissioned; therefore, there is a positive long term effect to road density and location.

Indicator Summary for Watershed Condition: Road Density/Location: In the short term, the proposed action will have an insignificantly negative effect on this Indicator because while road density is slightly increased, no new roads will be built within RRs except for temporary road T206B (0.07 miles) and temporary road T401 (0.15 miles of this road is within an RR). Based on field reviews, these two road segments in RRs will not affect drainage in a manner that will adversely affect fish or fish habitat. There is a positive effect in the long term since the temporary roads and 22 existing unauthorized roads will be decommissioned after use.

Watershed Condition – Riparian Reserves

Existing Condition
The existing conditions for all Indicators describe components of the RR conditions. Field review of the Riparian Reserves (RRs) in these watersheds on 6/6/06, 6/13/06, and 7/6/06 by Brian Thomas, and Julie Perrochet determined that the RRs are intact and properly functioning at potential in Grouse Creek, Beaver Creek, Long John Creek and Cow Creek.

Portions of the RRs on these streams have been selected for fuels treatment because fuel hazards exist in portions of RRs that contain ladder fuels (especially when combined with

existing heavy surface fuels) and such fuels can be thinned to improve the condition. Also, there is heavy conifer stocking in portions of the RRs above the high range of the leave basal area prescribed for the unit so that mortality from inter-tree competition is likely to result in a fuel hazard in the future.

In the project area, there are 77 stands where riparian areas are a priority to treat because of the fuels conditions, and an opportunity for larger tree growth in the long term (through increased tree vigor. Variable density thinning of trees up to 20" DBH is proposed for 35 of these stands after considering (1) high fuel loading in riparian areas; (2) proximity to main roads with high potential for starts from passing traffic; and (5) high basal area. Thinning of trees <9" DBH is proposed for the remaining 42 stands.

Post-Project Condition:

Forest Restoration PE

Proximity and Probability: Table G-10 in Appendix G summarizes the activities that are scheduled to occur in RRs. The trees to be removed are selected to improve forest conditions within the LSR in the long term. Portions of the RRs in 77 stands will be thinned to address existing conditions (fuels risk, laddering, over stocking of trees, high basal area) with the intent of improving silvicultural and fuel loading conditions. The total acreage of the RRs in these stands is 567 acres.

Variable density thinning activities will remove trees up to 20" DBH within the second site potential tree height in RRs in 16 stands in Beaver Grouse Creek 7th field, 3 stands in Deer-Beaver Creek 7th field and 16 stands in Long John Creek 7th field. The total amount of these stands within RRs is 107 acres. Ten of these stands in Beaver/Grouse Creek and Long John Creek 7th fields respectively, are located within anadromous fish bearing reaches. One stand in Deer-Beaver Creek 7th field is also located within an anadromous fish bearing reach.

The total variable density thinning stand acreage within RRs in SONCC coho salmon CH, Chinook salmon and steelhead trout habitat in the three 7th fields is:

Beaver/Grouse Creek – 30 acres
Long John Creek – 16 acres
Deer-Beaver Creek – 9 acres

The remaining stands in Beaver/Grouse Creek (6 stands), Long John Creek (6 stands), and Deer-Beaver Creek (2 stands) 7th fields are located 0.05 miles to 1.1 miles upstream of SONCC coho salmon CH, Chinook salmon and steelhead trout habitat.

Thinning activities using hand lopping, hand piling and pile burning will remove trees (<9" DBH) within 340ft. of both sides of perennial anadromous fish-bearing stream channels in 20 stands in Beaver/Grouse Creek 7th field watershed, 3 stands in Deer-

Beaver Creek 7th field and 19 stands on Long John Creek 7th field. The total portions of these stands located within RRs is 460 acres.

In Beaver/Grouse Creek 7th field, seven of the stands are located within anadromous fish bearing reaches. In Long John Creek 7th field, three of the stands are located within anadromous fish bearing reaches. None of the three stands in Deer-Beaver Creek 7th field are located within anadromous fish bearing reaches.

The total thinning <9" DBH stand acreage within RRs of anadromous fish bearing reaches in the two 7th fields is:

Beaver/Grouse Creek – 38 acres
Long John Creek – 64 acres

The remaining stands in Beaver/Grouse Creek (13 stands), Long John Creek (16 stands), and Deer-Beaver Creek (3 stands) are located 0.05 to 2 miles upstream of anadromous fish bearing reaches.

Thinning activities occur in RRs in about 9.7% (about 567 acres project-wide) of the total treated areas. FEMAT concluded that the probability of wood entering the active stream-channel from greater than one tree high is generally low (FEMAT, page V-26). The probability of affecting large wood is low because trees >9" DBH will not be removed within one site-potential tree height of streams containing SONCC coho salmon CH, Chinook salmon and steelhead trout habitat.

Magnitude: Literature suggests that a buffer of one site-potential tree height on westside streams is needed to fully protect riparian function related to LWD when no harvest is allowed in the buffer (Spence et al 1996, Page 218, 226). The forested areas in the stands designed for RR treatments have a greater-than-desired number of trees per acre, including RRs, so removing these trees will have an insignificant immediate effect to the recruitment of large wood to the streams. Also, in stands 202, 406, 425, 438, 468, 469, 470, and 711 a road prevents wood recruitment to anadromous fish bearing streams, reducing the magnitude of the impact of removing the trees to insignificant levels. The overall effect from this PE to the Indicator is insignificantly negative with long-term benefits to SONCC coho salmon CH, Chinook salmon and steelhead trout habitat.

Fuels Reduction PE

Underburning

Proximity and Probability: Underburning will occur within some thinning Units and underburn units to treat fuels after thinning activities and in stands appropriate to reduce fuels without prior mechanical treatment. Ignition will not occur in RRs, but fire will be allowed to back down into and burn within RRs. Hand piling in RRs may be done to pile incidental roadside slash and in areas where underburning is not appropriate. Piles in RRs will be distributed so they are isolated from one another to avoid affecting burning large contiguous areas. Pile sizes in RRs will not exceed 6 ft in diameter to prevent negative impacts to soil and to maintain a low scorch height. Burning outside RRs is not likely to affect anadromous fish in their habitat. There is a low probability of effects to SONCC coho salmon CH, Chinook salmon and steelhead trout habitat from the fuels reduction PE in RRs.

Magnitude: The underburning will not remove large trees because a low intensity burn in all burn areas is proposed. Therefore, the magnitude is zero; effect to the indicator is neutral.

Fire Line Construction

Proximity and Probability: Firelines constructed by hand will not remove trees that contribute to large woody debris recruitment since firelines will be constructed outside of RRs – therefore there is no probability of removing large woody debris or riparian vegetation.

Magnitude: The hand-constructed fire lines do not remove large wood or riparian vegetation and therefore the magnitude is zero. The effect to this indicator is neutral.

Roads Related Activities PE

Construction/decommissioning of 22 temporary roads, and decommissioning of 22 existing unauthorized roads; hazard tree removal

Proximity and Probability: Except for the one short new temporary road (T206B) proposed within an RR and the short segment of another temporary road (T401) that crosses and runs parallel to an RR for a short distance, the construction of new temporary roads does not occur in proximity to RRs. The lengths of the new road T206B and the short segment of road T401 within RRs are 0.07 and 0.15 miles, respectively. The effect from removing large wood and riparian vegetation associated with these road segments was considered within the potential effects to this indicator. LWD baseline may be reduced at these sites due to hazard tree reductions that follow applicable Resource Protection Measures, but this would be confined to localized sites so the probability of impacts is discountable and insignificant.

For all other temporary road construction there is no potential for impacts to the RR indicator from this PE.

There are eleven stream crossings within the identified segments of roads (both existing unauthorized and new temporary roads) that will be decommissioned following project completion. Nine of these stream crossings are in intermittent watercourses that are tributaries in Long John Creek (7), and Cow Creek (2). During road decommissioning (stream reconstruction and fill removal), some streamside vegetation will be removed at these crossings, but the amount lost will be confined to localized sites and not be substantial enough to have a detectable effect on RR vegetation.

Any hazard trees that are felled in RRs during decommissioning of the eleven stream crossings could potentially result in reductions in streamside vegetation. It is expected that only a few trees, if any, will be felled within RRs. Since few hazard trees will be removed, there is an insignificantly negative probability that hazard tree felling in RRs will affect streamside vegetation.

Magnitude: Vegetation manipulation associated with road crossing and culvert work may result in localized reduction of riparian vegetation over streams in the immediate area, especially where vegetation is removed from road fill surfaces at crossings. While all riparian shade cover may be eliminated in areas where road crossing fills are removed, this loss of shade will be limited to fill surfaces on either side of crossings. Vegetation cover is expected to quickly recover at these sites. With the exception of these localized and short-term reductions in riparian vegetation at crossings, Project activities will not reduce stream shade/canopy below 80%.

The magnitude of effects to this Indicator from the construction of temporary road 206B (0.07 miles) to the new landing and the short segment of temporary road T401 that crosses and runs parallel to an RR for 0.15 miles, is insignificant. For the 0.22 total miles of road construction within RRs, decommissioning of 11 stream crossings and hazard tree removal, overall conditions will be “maintained” in all affected 7th field watersheds because removal of LWD and riparian vegetation is limited in extent and intensity by project design and Resource Protection Measures. When hazard trees must be fallen, large trees recruitable to the stream will be left in RRs unless they threaten public safety or road structures. The Magnitude of effects to this Indicator from road construction is

insignificant; the effect from hazard tree removal is insignificant. The overall effect from this PE to the Indicator is insignificantly negative.

Landings

Proximity and Probability: The use of and leveling and blading of existing landings will not affect LWD because tree removal is not involved. No new landings will be constructed in RRs so their construction will not affect large woody debris recruitment.

Vegetation clearing during construction of the 40 new landings will not affect stream shade or stream temperature, since all new landings will be located at least 170 feet from intermittent or non-fish bearing stream channels and 340 feet from fish-bearing stream channels in the Project area (i.e., outside of RRs).

Magnitude: The construction and use of the new landings will have no effect to large woody debris recruitment and riparian vegetation in Grouse Creek, Long John Creek, Cow Creek or Beaver Creek due to the distance between the landing construction and SONCC coho salmon CH, Chinook salmon and steelhead trout habitat. The effect to this indicator is neutral.

Water Drafting PE

Proximity and Probability: The use of the five water drafting sites will not affect LWD or riparian vegetation since these are existing sites, and tree riparian vegetation removal is not involved. Therefore there is no probability of removing large woody debris or riparian vegetation.

Magnitude: The use of the five existing water drafting sites does not involve removing large wood or riparian vegetation and therefore the magnitude is zero. The effect to this indicator is neutral.

Indicator Summary for Watershed Condition: Riparian Reserves: The LWD function and riparian vegetation is insignificantly affected at the site scale where the two temporary road segments are constructed on the two unnamed tributaries in Long John Creek 7th field, at the eleven stream crossings to be decommissioned, and on sections of Grouse Creek and Long John Creek where thinning in RRs within the second site potential tree will occur over 435 acres. LWD function is maintained and no significant effects to LWD levels or RR vegetation are expected at the 7th and/or 5th field watershed scale in the short term, with some benefit to local RR conditions in the long term. The effect to this Indicator is insignificantly negative in the short term and positive in the long term.

Prescribed fire will occur within the RRs. The Resource Protection Measures include maintaining low intensity fires, no fire line construction and ignition in RRs, and maintaining large wood. Underburning will reduce background existing dead fuels and kill low growing vegetation and small trees to reduce ladder fuels and reduce threat of wildfire getting into the live, larger trees. Because no firelines will be constructed within

RRs there will be no effects to SONCC coho salmon CH, Chinook salmon and steelhead trout habitat from the fireline construction. Hand piling in RRs may be done to pile incidental roadside slash and in areas where underburning is not appropriate. Piles in RRs will be distributed so they are isolated from one another to avoid burning large contiguous areas. Pile sizes in RRs will not exceed 6 ft in diameter to prevent negative impacts to soil (personal communication Tom Laurent, December 2, 2005) and to maintain a low scorch height.

Considering all PEs proposed within RRs, the condition of the RRs, and the effects to fish habitat Indicators (Table), only insignificantly negative effects to RR will occur. Beneficial effects include increased tree vigor due to the additional water and nutrients available to the remaining dominant overstory trees thereby insuring future stability of geologically defined RRs. In addition, larger trees will be available sooner for LWD recruitment to the streams within the intermittent hydrologic RR where thinning of trees <9" DBH will occur within one site potential tree height distance. The RRs will also be more resilient to wildfire due to the fuels reduction activities. In summary and based on above discussions of the other Indicators in Section V, there will be insignificantly negative effects to RRs in the short term, with beneficial effects over the long term at the 7th and 5th field watershed levels from forest restoration activities in RRs that improve stand health within RRs and fuel reduction activities that reduce the risk of intense wildfires.

Watershed Condition – Disturbance History and Disturbance Regime

Existing Condition:

Existing disturbance history was modeled by the KNF and is illustrated in Appendix A1 (table A-7, A-8, and A-9). The KNF CWE process describes the current landscape conditions for ERA/TOC (flow effects analysis), USLE (surface erosion) and GEO (mass wasting) that are based on an accounting of past disturbances. All three models are used to describe the level of existing watershed disturbance in the 7th field watersheds affected by the Project and in other 7th field watersheds not affected by the Project but that contribute to aggregated effects in the subject 5th field watershed and the entire analysis area. Using criteria in the Appendix C, the conditions of the Indicators for individual watersheds were determined to be Properly Functioning, At Risk, or Not Properly Functioning. For this Indicator, the Deer-Beaver Creek and Upper Cow Creek 7th field watersheds was rated as properly functioning. Long John Creek and Beaver Grouse Creek 7th field watershed and Beaver Creek 5th field watershed were rated as At Risk.

The watersheds were subject to consideration of past actions, the CWE modeling, and site level reviews in order to determine the risk of cumulative watershed effects. The KNF established an extensive network of RRs along all streams in the Action Area. A 170-foot site potential tree height was used to determine RR widths. The RRs were established and encompassed significant amounts of land along streams for the protection of stream and riparian function. The KNF conducted the Beaver Creek Watershed

Analysis (USDA Forest Service 1996), that described existing conditions and the cause of cumulative watershed effects including historic mining, timber harvest, agriculture, and flood effects. The interdisciplinary team established desired conditions for aquatic and terrestrial habitat in the watershed, and the landscape analysis was used to identify management actions needed to move KNF lands towards desired conditions. Most of the project area has a high or moderate fire behavior potential; restoration of fire was identified as an important management action. The existing road system was identified as needing spot rocking to reduce erosion on susceptible areas. The NW Forest Plan (NFP) ROD established Matrix lands for programmed timber harvest and concluded, "The Matrix is an integral part of the management direction included in these standards and guidelines. Production of timber and other commodities is an important objective for the Matrix." The KNF identified opportunities to utilize the economic value of timber to help finance the net cost of watershed stewardship such as conducting fuel reduction and to provide economic benefits to the local economy as included in the NFP. The IDT for the project determined that the project area was in fire Condition Class 2 and 3, rather than at a desired Condition Class of 1. The area has accumulated fuels (reflected in the Condition Class ranking) and reduced fire frequencies, probably due to fire suppression and landscape fragmentation related to multiple land use activities [and past fires]. Finally, the KNF conducted a Project-specific modeled and quantifiable CWE assessment.

Post Project Condition

Proximity and Probability: The amount of the area impacted by the proposed action at the 7th field watershed scale is 11% (Table G-9, Appendix G), with most 7th field watersheds receiving treatment in 7% or less of the area. The greatest fuels reduction activities are in the Beaver/Grouse Creek and Long John Creek 7th field watersheds, and the impacts from the PEs to watershed process related to sediment (turbidity and substrate character) have been found to be insignificant in the watershed report (USDA Forest Service 2007).

At the 5th field watershed scale, fuels reduction activities occur in about 5% of the watershed (Table G-9, Appendix G), with hand treatment of fuels in RRs- resulting in insignificant levels of ground disturbance.

In Beaver/Grouse Creek, there is an increase in risk from 0.94 to 0.98 to surface erosion; in Long John Creek, there is an increase in risk from 0.88 to 0.97. These risk increases have been found to be insignificant to watershed conditions. The model GEO values for all four 7th field watersheds and Beaver Creek 5th field watershed either do not chance or decrease slightly. The project hydrologist and soil scientist reviewed the unstable lands, and provided resource protection measures to prevent adverse effects to downstream beneficial uses, including fish habitat (USDA Forest Service 2007 and USDA Forest Service 2007a). In the long term, there is expected to be a beneficial effect to the disturbance regime in these watersheds from the Project by reducing the risk of uncharacteristic wildfires.

The proposed action will reduce the risk of stand-replacing fire on the landscape, promote improved LSR wildlife habitat and the associated negative watershed effects. Negative watershed effects from a fire resulting from no action can include -- depending on the intensity of the fire -- the movement of large amounts of sediment into stream channels, resulting in pool filling, decreased substrate quality, loss of stream shading, loss of future large wood recruitment, and excessive fuel loading on the landscape, especially in RRs, and maintaining the risk of stand replacing fire into the future on the landscape. Reducing the risk of high intensity fires in the project area protects riparian habitat conditions, including SONCC coho salmon CH, Chinook salmon and steelhead trout habitat conditions, in the long term.

An implicit assumption relative to watershed effects analysis at the 5th field and larger scales is that if impacts or changes are minimized on-site, then off-site project-related cumulative watershed effects will be largely eliminated (MacDonald 2000). Using the LRMP land allocations and standards and guidelines as a framework for project planning, and considering the existing conditions (observed and modeled), the suite of PEs with Resource Protection Measures can be implemented without causing adverse changes on-site thus reducing potential for off-site cumulative watershed effects. This is supported by the field reviews conducted by KNF and NMFS staff (2006), the project hydrologist, soil scientist, and geologist projections from the KNF CWE modeling.

Management to minimize disturbance: The Multi-scale Approach for Aquatic Habitat Protection and Recovery:
Lands managed by the KNF are afforded a high level of protection under the NFP and associated land allocations. The percentage of federal ownership in each watershed indicates the current and future level of protection afforded to watersheds and streams. Beaver Creek watershed is 88% federally owned. Cumulative watershed effects on lands managed under the NFP have been addressed by a comprehensive, multi-tiered approach. The first tier includes mitigation of cumulative effects on the landscape scale through land allocations and associated restrictions contained in the NFP ROD. Land allocations resulted in approximately 80% of the medium and large conifer forests in the area of the NFP being within land allocations that do not allow for programmed timber harvest. The NFP ROD Assessment team concluded that Alternative 9 would work to reverse the trend of degradation and begin recovery of aquatic ecosystems on federal lands within the range of the owl. The second tier is the protection afforded by conservative Riparian Reserve widths in "… the portions of a watershed required for maintaining hydrologic, geomorphic, and ecological processes that directly affect standing and flowing water bodies such as lakes and ponds, wetlands, streams, and stream processes, and fish habitats." The interim riparian reserve widths established by the NFP ROD were "designed to provide a high level of fish habitat protection and riparian protection..." and, "the prescribed widths are considered to approximate those necessary for attaining Aquatic Conservation Strategy objectives." The third tier is the requirement to conduct watershed analysis before conducting certain activities to describe existing data and the nature and cause of existing cumulative effects in the watershed, and describe the interactions that could cause future effects (NFP ROD pages B-20 and 21, B-30, C-32). Then, results of the watershed analysis are used to focus management that is responsive to watershed processes identified in the analysis. The fourth tier is the subsequent project-level analyses that use both information from the watershed analysis and supplementary data.

Magnitude: The KNF considered existing watershed conditions in developing the Project, and weighed the risk of further exacerbating cumulative watershed effects downstream against the need to maintain the vigor and function of forested ecosystems on federal lands to maintain or recover environmental baseline conditions. If the Project is not implemented, the risk to life and property and forested areas is not reduced. Given existing stand conditions and fire risk, the comprehensive strategy of the NFP ROD, which addressed cumulative watershed effects to a large extent, and the protection afforded by extensive networks of RRs in the Action Area, the anticipated risk of cumulative watershed effects associated with the Project is insignificant.

Indicator Summary for Watershed Condition: Disturbance History and Regime: The proposed action will have an insignificantly negative effect on this Indicator in the short term and is expected to have a positive effect on this Indicator in the long term because stand conditions are improved and the risk of high intensity wildfire is reduced.

Differences in Effects for each alternative:

Forest Restoration PE

The effects described above for each habitat indicator would be slightly less in Alternatives 4 and 5 than in Alternative 2. The total amount of thinning is less in Alternative 4 (3354acres combined) than in Alternative 2 (3875 acres). The amount of thinning in Alternative 5 (3781 acres) is also less than in Alternative 2.

The amount of tractor, skyline cable, and combination ground-based systems yarding is less in Alternatives 4 and 5 than in Alternative 2.

	Tractor	Skyline Cable	Combination Ground-Based
Alternative 2	387 acres	1602 acres	555 acres
Alternative 4	220 acres	1528 acres	541 acres
Alternative 5	335 acres	1471 acres	494 acres

The effects of yarding described for Alternative 2 would be less for Alternatives 4 and 5. There are no significant differences in the USLE and GEO risk ratios for Alternatives 4 and 5 versus Alternative 2 (Appendix A - tables A-1 to A-6). The USLE and GEO risk ratios for Alternatives 4 and 5 either show very slight decreases (0.01) versus Alternative 2 or remain the same as Alternative 2.

Road Related Activities PE

Although the number of temporary roads and mileages is less in Alternative 4 (16 roads and 4.96 total miles) than in Alterative 2 (22 roads and 6.86 total miles), the two temporary road segments that will be constructed in RRs in Alternative 2 are included in Alternative 4, so the effects to RRs are considered similar. There are 9 temporary roads totaling 2.27 miles included in Alternative 5. The two temporary road segments that will be constructed in RRs in Alternatives 2 and 4 are not included in Alternative 5. Therefore, neutral effects from construction and subsequent decommissioning of these temporary roads after project activities are completed for Alternative 5 would be expected.

The number and miles of unauthorized roads to be decommissioned is less in Alternative 4 (4.54 miles versus 8.00 miles in Alternative 2) and less in Alternative 5 (6.94 miles versus 8.00 miles in Alternative 2). The effects from road decommissioning as described for Alternative 2 would be slightly less under Alternative 4 and Alternative 5.

The two existing landings located in RRs under Alternative 2 are also included under Alternatives 4 and 5. The effects of using these landings is the same for Alternatives 4 and 5 as discussed for Alternative 2. The number of new landings is less for Alternatives 4 and 5. Thirty four landings totaling 22.5 acres for Alternative 4 and 31 landings totaling 21 acres for Alternative 5. The effects from construction and use of these new

landings is the same as is described for Alternative 2.

There is a slight decrease in the ERA/TOC risk ratio for Alternative 4 in Beaver/Grouse Creek and Long John Creek 7th field watersheds versus Alternative 2 (Appendix A – tables A-7 to A-9). The decrease for Alternative 4 is 0.03 for Beaver/Grouse Creek and 0.06 for Long John Creek. There is a 0.01 decrease in the ERA/TOC risk ratio for Beaver Creek 5th field. There are also very slight decreases in the ERA/TOC risk ratio for Alternative 5 in Beaver/Grouse Creek and Long John Creek 7th fields (0.02 for each 7th field, respectively).

The ERA/TOC risk ratios for Upper Cow Creek and Deer-Beaver Creek 7th field watersheds for Alternatives 4 and 5 are the same as Alternative 2. The ERA/TOC risk ratio for Beaver Creek 5th field for Alternative 5 is the same as Alternative 2.

The effects from hazard tree removal for Alternatives 4 and 5 are the same as described for Alternative 2.

Fuels Reduction PE

The effects from underburning, mastication, and fireline construction are slightly less in Alternative 4 (less acres of underburning and mastication versus Alternative 2) and the same in Alternative 5 since the acres of underburning and mastication are almost the same as the acres in Alternative 2.

The effects of other fuels reduction activities (hand piling and pile burning) are the same for all Alternatives.

Water Drafting PE

The number of water drafting sites is the same in each Alternative so the effects for Alternatives 4 and 5 are the same as Alternative 2.

Summary for Differences in Effects for each Alternative:

It was determined that Alternatives 4 and 5 have less project activities and impacts, and therefore their effects would be less than the impacts/effects of Alternative 2. Alternative 4 has less skyline, tractor, tractor endline, combination ground-based systems and mechanical harvester acres than Alternative 2. The total acreage is less than Alternative 2 (3354 acres versus 3875 acres). Alternative 5 has less skyline cable, tractor, combination ground-based systems, and mechanical harvester acres than Alternative 2. Alternative 5 does have more helicopter acres than Alternative 2, but helicopter harvest is the least ground disturbing activity of the six harvest methods that will be used for the project.

Alternatives 4 and 5 have less numbers and miles of existing unauthorized roads to be

decommissioned than in Alternative 2. Therefore, the effects are slightly less for Alternatives 4 and 5. The effects of temporary road construction and decommissioning are the same for Alternatives 2 and 4 (insignificantly negative) and neutral for Alternative 5 (no temp road construction in RRs).

The effects from underburning, mastication, and fireline construction are slightly less in Alternative 4 (less acres of underburning and mastication versus Alternative 2) and the same in Alternative 5 (the acres of underburning and mastication are nearly the same as in Alternative 2). Therefore, there is less fuels risk reduction in Alternative 4 than Alternative 2 creating less long term protection for the watershed. There is no detectable change in fuels reduction from these types of actions between Alternative 5 and Alternative 2.

Effects from landing construction, hazard tree removal, and water drafting are the same for all three alternatives.

The model-derived differences of a few hundredths do not reflect any meaningfully measured, detected, or evaluated differences in risks to watershed conditions between alternatives.

VIa. Cumulative Effects Section-ESA:

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."

There are no future foreseeable actions on State lands within the Project action area. There are on-going, multi-year timber harvest operations occurring on private lands within the Project action area. The sediment mobilization effects of these actions are accounted for in the CWE modeling of baseline.

On-going cattle use in the Beaver Creek watershed is primarily in the East Beaver Allotment.
Potential cumulative effects from cattle in the Dry Lake allotment occur in the headwaters of the West Fork Beaver Creek, two to four miles from mainstem Beaver Creek. The headwaters of West Fork Beaver Creek are located in the Upper West Fork Beaver Creek 7th field watershed. This watershed is located approximately three miles southwest of the lowermost project area boundary and is outside of the Action Area. The Dry Lake Allotment does not overlap geographically with the proposed action or any of the alternatives, and therefore there will be no cumulative effects to anadromous fish or their habitat.

The Mt. Ashland Ski Area Expansion and the Ashland Forest Resiliency Project are proposed but do not overlap geographically with the proposed action or any of the alternatives, and therefore there will be no cumulative effects to anadromous fish or fish

habitat. There are no other foreseeable actions in the action area that may exacerbate the effects considered for the Mt. Ashland Habitat Restoration and Fuels Reduction Project, resulting in an ESA effects determination of "May Affect, Likely-to-Adversely-Affect" coho salmon or their CH. Therefore, a cumulative effects analysis for ESA is not provided. Future Federal actions that have not already been consulted on will be analyzed through separate section 7 consultations.

VIb. Cumulative Effects Section-NEPA:

The analysis area for the NEPA cumulative effects analysis are the site scale, 7th field watersheds where effects to anadromous fish may occur and Beaver Creek at the 5th field watershed scale downstream of where project activities are occurring. There is no effect to anadromous fish or their habitat from project activities occurring in Hungry Creek 7th field, Headwaters Cottonwood Creek 7th field and Cottonwood Creek 5th field watersheds, as described in the Efficiency Measures section of this document. As described in the Action Area Section, there is no effect to anadromous fish or their habitat in the Klamath River.

Recent past projects (completed or near completion) are 1) Tennis Thin, and 2) Colestine Fuels Reduction Projects. These past projects complement those actions proposed in this Project to reduce the risk of future wildfire in the watersheds and are considered to have a beneficial effect to water quality in the long term. The various past and ongoing THPs actions on private land are accounted for within the CWE modeling that describes the current conditions and the effects analyses associated with the CWE modeling. The areas where THPs actions are occurring are downstream of the proposed actions or in subwatersheds where there are no proposed actions, therefore the actions on private land will not exacerbate conditions in the proposed project area. The Mt. Ashland Ski Area Expansion and the Ashland Forest Resiliency Project do not overlap geographically with the proposed action or any of the alternatives, and therefore there will be no cumulative effects to anadromous fish or fish habitat. Recreation and Pre-Commercial Thinning are ongoing and will occur in the future in the project area. However, these activities are dispersed and of low intensity and threfore will not create adverse effects to anadromous fish or their habitat when combined with project activities. Cumulatively, the effects of the proposed action and action alternatives to anadromous fish and their habitat in the short term are considered insignificantly negative and in the long term effects, are considered positive.

VII. Viability:

Chinook salmon and Steelhead trout are listed as Forest Service Sensitive species in Region 5. The LRMP includes provisions from the NFP ROD to protect and improve conditions for aquatic species, including salmon and trout: Implementation of the NFP ROD Standard and Guidelines were designed to "reverse the trend of degradation and begin recovery of aquatic ecosystems on federal lands within the range of the owl" (NFP ROD, page 46). The NFP ROD also addresses the matter of long-term persistence of late seral and early seral dependent species stating that, "implementation of the ROD fully

meets our statutory and regulatory requirements regarding fish and wildlife resources." Overall, implementation of the Mt. Ashland Habitat Restoration and Fuels Reduction Project will help maintain the health of forested ecosystems by increasing stand health and resiliency. Steelhead and Chinook habitat that occurs downstream of the Project activities and within the Action Area will be protected from project activities through BMPs and Project Design Features. These will prevent effects to aquatic habitat at the site scale, and prevent effects to steelhead and Chinook habitat downstream at the 7th and 5th field watershed scales. The effects analysis shows that there will be no change to the functional levels of the habitat Indicators in the action area. All Indicator conditions will be 'Maintained' and no individuals are expected to be affected. Therefore, the Mt. Ashland Habitat Restoration and Fuels Reduction Project will not reduce species' viability. A trend toward listing under the ESA is not anticipated and viability is not at risk because short term effects to aquatic habitat will be insignificant, the Project meets S&G's, and the project does not negatively affect anadromous fish habitat in the long term, as analyzed in Section VI of this document.

VIII. Species and Habitat - Summary/Integration of all Species and Habitat Indicators

Direct Effects to species: No direct adverse effects (see Section V).

Indirect Effects: For this, project, increased sediment delivery to anadromous fish bearing stream-reaches is the greatest threat to causing impacts to fish or their habitat. The modeling showed a slight increase in risk of increased sediment delivery in the Beaver/Grouse Creek and Long John Creek 7th field watersheds. The CWE quantitative modeling also showed increased ERA values for the entire analysis area. The potential change in sediment delivery and flow is considered insignificant (non meaningfully measured, detected, or evaluated) by the project hydrologist based on specific field reviews of road and thinning layout in the Project area. All habitat Indicators are maintained with either neutral- or insignificantly negative effects at the 7th, 5th, and 4th field watershed scales. Some long-term benefits are provided by the Project through reduction of risk of uncharacteristic wildfires that can alter sediment and flow regimes in the watersheds.

ELEMENT SUMMARY: as supported by rational provided in Section V.

The Project Elements considered for analyses are Forest Restoration- thinning and yarding systems; Fuels Reduction-underburn, fire line construction, mastication; Roads Related Activities-temp road construction, landing construction and maintenance of existing landings, road maintenance, decommissioning of temp roads and unauthorized roads, and hazard tree removal; and Water Drafting.

Forest Restoration

This PE will have an insignificantly negative effect on Suspended Sediment/Turbidity, Substrate; an insignificantly negative effect and a long-term positive effect on Changes to Peak and Base Flows, Disturbance History and Riparian Reserves; a neutral effect and a long-term positive effect to Large Woody Debris; and a neutral effect on all other Indicators. The reduction in fuels can protect watershed function by reducing the risk of an uncharacteristic wildfire, therefore, are qualitatively considered a “positive effect” to anadromous fish or their habitat in the long term.

Fuels Reduction

This PE will have an insignificantly negative effect on Suspended Sediment/Turbidity and Substrate; an insignificantly negative effect and a long-term positive effect on Changes to Peak and Base Flows and Disturbance History; and a neutral effect on all other Indicators. The reduction in fuels can protect watershed function by reducing the risk of an uncharacteristic wildfire, therefore, are qualitatively considered a “positive effect” to anadromous fish and their habitat in the long term.

Road-Related Activities

This PE (and its sub-components) will have an insignificantly negative, neutral, or long term positive effect on Suspended Sediment/Turbidity, and Substrate depending on the particular sub-component and timeframe involved; an insignificantly negative or long-term positive effect on Road Density and Location, and Disturbance History; an insignificantly negative effect on Changes to Peak and Base Flows, Large Woody Debris, and Riparian Reserves; and a neutral effect on water temperature and on all other Indicators. The effects from the road related activities to anadromous fish and their habitat is considered insignificantly negative

Water Drafting

This PE has been determined to have insignificantly negative effects to Suspended Sediment/Turbidity, Substrate and Changes to Peak and Base Flows and a neutral effect on water temperature and on all other Indicators at the site level, and no effect to anadromous fish or their habitat downstream.

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Table 10. Summary of the effects on anadromous fish of the Mt. Ashland LSR Forest Restoration and Fuels Reduction Project for project element/Indicator combinations.

Indicators	Forest Restoration	Fuels Reduction	Road Related Activities	Water Drafting

Temp.	0	0	0	0
Turbidity	-	-	0, -/+	-
Chemical Contamination	0	0	0	0
Physical Barriers	0	0	0	0
Substrate	-	-	0, -/+	-
Large Woody Debris	0, +	0	-	0
Pool Frequency and Quality	0	0	0	0
Off-Channel Habitat	0	0	0	0
Refugia	0	0	0	0
Width/Depth Ratio	0	0	0	0
Streambank Condition	0	0	0	0
Floodplain Connectivity	0	0	0	0
Change in Peak/Base Flows	-/+	-/+	-	-
Increase in Drainage Network	0	0	0	0
Road Density and Location	0	0	-/+	0
Disturbance History	-/+	-/+	-/+	0
Riparian Reserves	-/+	0	-	0

- = Insignificantly negative effects
0 = Neutral effects
+ = Long term Positive effects
-/+ = Insignificant negative effects and long term positive effects
-* = More than insignificantly negative effects

The following conclusions, with consideration of the effects from Project Elements to habitat Indicators, lead to my final determination of effects of the proposed Project on Threatened coho salmon, CH, Chinook salmon and its habitat, and steelhead trout and its habitat:

1) All baseline habitat Indicators for anadromous fish and CH described in the AP document and analyzed in this BA will be neutral, discountable, or changed insignificantly by implementation of the PEs. Changes to Indicators are not to the magnitude where the functioning ability of the Indicator is changed.

2) Harvest unit locations and layout designs reflect hydrologist, geologist, and fisheries biologist input and minimize potentially adverse effects to anadromous fish and their habitat of the proposed project to the greatest extent practicable.

3) Resource protection measures, including BMPs will be implemented which also minimizes effects of the proposed project to anadromous fish and their habitat to insignificant levels in the short term. In the long term, benefits to anadromous fish and their habitat may be realized in the event of a wildfire.

4) The NOS for the Fuels Reduction- thinning actions, road-related activating, and landing construction is from April 15 through October 15, to minimize/prevent ground disturbing activities from taking place outside of this timeframe. Burning may need to be outside this timeframe to achieve burning objectives, including safe operations. The District Ranger may grant an extension of time on either end of the NOS only when such an extension will not adversely affect anadromous fish or their habitat.

5) Less than 7% of the entire analysis area will be disturbed by Project activities. About 11% of the 7th field watersheds will be disturbed by Project activities.

6) The proposed Project is situated within the Beaver Creek 5th-field watershed. Stand treatment boundaries were reviewed at the site level to determine that there will be no significant effects to anadromous fish or their habitat. The outcome of Project Element analysis on the AP Indicators concludes that the probability for significantly affecting anadromous fish or their habitat (including CH) downstream is unlikely via the AP Indicators analysis. A combination of neutral, discountable, insignificantly negative, and positive effects to the various Indicators led to this conclusion.

PROJECT EFFECTS DETERMINATION KEY FOR SPECIES AND DESIGNATED CRITICAL HABITAT

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

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

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

IX. ESA Effects Determination:

It is my determination that the Mt. Ashland LSR Habitat Restoration and Fuels Reduction Project May Affect, but is Not Likely to Adversely Affect SONCC coho salmon.

It is my determination that that the Mt. Ashland LSR Habitat Restoration and Fuels Reduction Project May Affect, but is Not Likely to Adversely Affect SONCC coho salmon CH.

X. Sensitive Species Effects Determination

The Mt. Ashland LSR Habitat Restoration and Fuels Reduction Project will not likely result in a trend toward listing or loss of viability of steelhead trout or Chinook salmon and may have beneficial effects to watershed conditions that support these species.

XI. EFH Assessment

7th field subwatershed, and 5th field watershed scale description of SONCC coho salmon and UKTR Chinook salmon EFH (see Table 7)

Table 7 indicates the approximate distance between PEs and Chinook salmon, CH for coho salmon and steelhead trout (which is equivalent to EFH).

The KNF used their steelhead distribution map for the Analysis Area as the basis to delineate the extent of coho salmon CH, and thus Chinook salmon and coho salmon EFH. At the project level, steelhead trout may occupy some stream reaches not accessible to coho salmon and Chinook salmon. These instances are clarified for the Project in Table 7: For the stream reaches in the four 7th field subwatersheds and Beaver Creek 5th field watershed, coho salmon and Chinook salmon EFH is equivalent to coho salmon CH. The effects analysis in Chapter VI considers effects to Pacific salmonid habitat in general, and since habitat requirements for coho salmon and Chinook salmon are similar, the effects of the Project as described in Chapter VI for coho salmon CH are identical for EFH.

Therefore, it is my determination that the Mt. Ashland LSR Habitat Restoration and Fuels Reduction Project will not adversely affect, and may have long term positive effects to coho salmon and Chinook salmon EFH. Beneficial actions to aquatic habitat by the Mt. Ashland LSR Fuels Reduction Project will yield long-term improvements by improving ecosystem health and function, increasing resilience to stochastic events, promoting native vegetation, and promoting future LWD presence and recruitment. Benefits include lowered risk of severe fire and associated watershed impacts, including surface erosion, landsliding, loss of riparian vegetation, channel sedimentation, and altered flow regimes.

XI. Literature Cited

Barnhart, R.A. 1986. Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest)--steelhead. *U.S. Fish and Wildl. Serv. Biol*. Rep. 82(11.60). 21 pages.

Bell, M.C. 1986. Fisheries Handbook of Engineering Requirements and Biological Criteria. US Army Corp of Engineers, Office of the Chief of Engineers, Fish Passage Development and Evaluation Program, Portland, Oregon.

Bisson, P. A., G. H. Reeves, R. E. Bilby, and R. J. Naiman. 1997. Watershed management and pacific salmon: desired future conditions in Pacific Salmon and their Ecosystems. Status and Future Options. D.J. Stouder, P.A. Bisson, R.J. Naiman, Editors. Chapman Hill.

Broderson, J. M. 1973. Sizing buffer strips to maintain water quality. M.S. Thesis, University of Washington, Seattle, WA.

Burgner, R.L., J.T. Light, L. Margolis, T. Okazaki, A. Tautz, and S. Ito. 1992. Distribution and origins of steelhead trout (*Oncorhynchus mykiss*) in offshore waters of the North Pacific Ocean. Int. North Pac. Fish Comm. Bull. 51. 92 pages. *In* Busby *et al*. (1996).

Busby, P. J., Wainwright, T. C., Bryant, G. J., Lierheimer, L. J., Waples, R. S., Waknitz, F. W., and Lagomarsino, I. V. 1996. Status review for Klamath Mountains Province steelhead. NOAA technical memorandum NMFS-NWFSC-19.

California Department of Fish and Game. "CalFish" database. Used to gather data on steelhead trout and Chinook salmon surveys in Beaver Creek. http://query.streamnet.org/Request.cfm?Cmd=BuildQuery&ID=90717&DataCategory=9&NewQuery=BuildCriteria&XML=T&XSL=http://205.230.28.31/calfish/calfish.xsl

Corbett, A.J., and D.W. Lynch. 1985. Management of streamside zones on municipal watersheds. Pages 187-190 *in* R.R. Johnson, C.D. Zieball, D.R., Patton, P.F. Folliott, and T.H. Hamre, editors. Riparian ecosystems and their management: reconciling conflicting uses. U.S. Department of Agriculture, Forest Service, Rocky Mountain and Range Experiment Station, Fort Collins, Colorado.

Elder, Don. 2006. Cumulative Watershed Effects Analysis for Mt. Ashland LSR Habitat Restoration and Fuels Reduction Project . USDA Klamath National Forest, Supervisor's Office, Yreka, CA.

Elder, Don. 2003. Road Stormproofing and Decommissioning Objectives, Definitions and Treatments. USDA Klamath National Forest, Supervisor's Office, Yreka, CA.

FEMAT. U.S. Department of Agriculture - Forest Service, U.S. Department of the Interior - Fish and Wildlife Service, U.S. Department of Commerce - National Marine Fisheries Service, U.S. Department of the Interior - National Parks Service, U.S. Department of the Interior - Bureau of Land Management, and Environmental Protection Agency. 1993. Forest Ecosystem Management: An Ecological, Economic, and Social Assessment. Report of the Forest Ecosystem Management Assessment Team.

Hassler, T.J. 1987. Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest)--coho salmon. *U.S. Fish and Wildl. Serv. Biol. Rep*. 82(11.70). 19 pages

Healey, M.C. 1991. The life history of Chinook salmon (*Oncorhynchus tshawytscha*). Pages 213-393 *In*: C. Groot and L. Margolis (eds.), Life history of Pacific salmon. Univ. B.C. Press, Vancouver, B.C.

Klamath Basin Total Maximum Daily Loads - Fact Sheet. Staff of California's North Coast Regional Water Quality Control Board (Regional Water Board) Fact Sheet for the Total
Maximum Daily Loads (TMDLs) for the Klamath Basin, including the Klamath, Lost, Shasta, Scott, and Salmon Rivers.
http://www.waterboards.ca.gov/northcoast/programs/tmdl/klamath/pdf/012804-KlamathBasinTMDLFactSheet.pdf

Klock, G.O. 1975. Impact of five postfire salvage logging systems on soil and vegetation. Journal of Soil and Water Conservation. 30(2): 78-81.

Laurent, T. 2003. Soil Report, Meteor Timber Sale. Klamath National Forest, Yreka, CA. 40p.

MacDonald, L. 2000. Evaluating and Managing Cumulative Effects: Process and Constraints. Environmental Management, Vol. 26. No 3, pp 299-315.

McGurk, Bruce J. 1988. Predicting Stream Temperature After Riparian Vegetation Removal. *In* Proceedings of the California Riparian Systems Conference. Davis, California. 1988. Pages 157-164.

Meehan, William R. Editor. 1991. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society Special Publication 19. U.S. Department of Agriculture. Forest Service.

Meyers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, W.S. Grand, F.W. Waknitz, K. Neely, S.T. Lindley, and R.S. Waples. 1998. Status review of chinook salmon from Washington, Idaho, Oregon, and California. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-35, 443 p.
www.nwfsc.noaa.gov/publications/techmemos/tm35/chapters/07disconesu.htm#ktr

National Academy of Science. 2002. Scientific Evaluation of Biological Opinions on Endangered and Threatened Fishes in the Klamath River Basin: Interim Report. http://www.klamathbasincrisis.org/articles/NAS-Report/nas_chapter3-coho.htm

Nickelson, T.E., J.W. Nicholas, A.M. McGie, R.B. Lindsay, D.L. Bottom, R.J. Kaiser, and S.E. Jacobs. 1992. Status of anadromous salmonids in Oregon coastal basins. Unpublished.

Reeves, G.H., F.H. Everest, and J.D. Hall. 1987. Interactions between the redside shiner (*Richardsonius balteatus*) and the steelhead trout (*Salmo gairdneri*) in western Oregon: the influence of water temperature. *Can. J. Fish. Aquat. Sci*. 44:1603-1613.

Reid, L. M., M. J. Furniss. 1998. On the use of regional channel-based indicators for monitoring. DRAFT - unpublished.

Rich, A.A. 1997. Testimony of Alice A. Rich, Ph.D., regarding water rights applications for the Delta Wetlands Project, proposed by Delta Wetlands Properties for Water Storage on Webb Tract, Bacon Island, Bouldin Island, and Holland Tract in Contra Costa and San Joaquin Counties. July. Calif. Dept. of Fish and Game Exhibit DFG-7. Submitted to State Water Resources Control Board.

Rosgen, D.L. 1996. Applied river morphology. Wildland Hydrology, Pagosa Springs, Colorado

Sandercock, F.K. 1991. Life history of coho salmon. Pages 397-445 *In* C. Groot and L. Margolis (eds.), Pacific salmon life histories. Univ. British Columbia Press, Vancouver. 564 pages.

Spence, B.C., G.A. Lomnicky, R.M. Hughes, and R.P. Novitzki. 1996. An Ecosystem Approach to Salmonid Conservation. TR-4501-96-6507. Page 219, 226, 228.

Seymour, A.H. 1956. Effects of temperature on young Chinook salmon. Ph.D. thesis. University of Washington, Seattle, WA.

Strahler, A.N. 1957. Quantitative Analysis of Watershed Geomorphology. Trans. Am. Geophys. Un. 38,913-920.

Taylor, A.H. and Skinner, C.N. 1998. Fire history and landscape dynamics in a late successional reserve, Klamath Mountains, California, USA. *Forest Ecology and Management* 111:285-301.

USDA Forest Service. 2007. Klamath National Forest. Mt. Ashland LSR Habitat Restoration and Fuels Reduction Project Watershed Report. 2007.

USDA Forest Service. 2007a. Klamath National Forest. Mt. Ashland LSR Habitat Restoration and Fuels Reduction Project Soils Report. 2007.

USDA Forest Service 2005. Klamath National Forest. Supplement to the FMWR BA. July 8, 2005.

USDA Forest Service. 2004. Facility Maintenance and Watershed Restoration on the Klamath National Forest, July 28, 2004. With letter of concurrence from NMFS, dated, September 9, 2004.

USDA Forest Service. 2003. Best Management Practices Report. Klamath National Forest. http://www.fs.fed.us/r5/klamath/projects/forestmanagement/forestplan/reports/resourceplanreports/2003bmpfinalreport.pdf

USDA Forest Service et al. 2002. A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment. 10-Year Comprehensive Strategy. Final version. May 2002. http://www.nifc.gov/fireinfo/10yrIPfinal.pdf

USDA Forest Service. 2002. Field Guide for Use with Wet Weather Operation Standards (WWOs). Klamath National Forest.

USDA Forest Service 2002a. General Technical Report PSW-GTR-181. How Much Dead Wood in Stream Channels is Enough? Lisle, Thomas E.

USDA Forest Service. **2001.** Pre-commercial Thin and Release Actions and Fuel Hazard Reduction Actions Programmatic BA/BE. Klamath National Forest.

USDA Forest Service. 2000. Water Quality Management for Forest system Lands in California, USDA Forest Service. Pacific Southwest Region.

USDA Forest Service. 1996. Beaver Creek Ecosystem Analysis. Klamath National Forest.

USDA Forest Service. 1995. Record of Decision for the Final Environmental Impacts Steatement for the Klamath National Forest and Land and Resource Management Plan. Klamath National Forest. (LRMP)

USDA Forest Service. 1995a. Soil quality monitoring. Forest Service Handbook 2509.18, R5 Supplement 2509.18-1, Chapter 2.

USDA Forest Service. 1990. Soil erosion hazard rating. Soil and Water Conservation Handbook, Ch. 50, R-5 FSH 2509.22, R5 Amend. 2. PSW Region, Vallejo, California.

USDC National Marine Fisheries Service (NMFS or NOAA-Fisheries). 1996. Making Endangered species Act Determinations of Effects for Individual or Grouped Actions at the Watershed Scale. NMFS Environmental and Technical Services Division, Habitat Conservation Branch. August. (included as Attachment 3 in the 1997 Biological Opinion for the KNF LRMP.)

USDC National Marine Fisheries Service (NMFS or NOAA-Fisheries). **2001.** Water-Drafting Specifications

USDC National Marine Fisheries Service (NMFS or NOAA-Fisheries). 2004. Biological Opinion pursuant to section 7 of the Endangered Species Act (ESA) on the effects of implementing the programmatic management direction in nine Bureau of Land Management (BLM) Resource Management Plans (RMPs) and sixteen National Forest Land and Resource Management Plans (LRMPs) within the Northwest Forest Plan (NWFP) Area (and NWFP ACS).

USDC National Marine Fisheries Service (NMFS or NOAA-Fisheries). 2004. Letter of Concurrence with the Biological Assessment for Facility Maintenance and Watershed Restoration on the Klamath National Forest, dated July 28, 2004. Letter of Concurrence dated, September 9, 2004.

Weitkamp, L.A., T.C. Wainwright, G.J. Bryant, G.B. Milner, D.J. Teel, R.G. Kope, and R.S. Waples. 1995. Status review of coho salmon from Washington, Oregon, and California. U.S. Dep. Commer., NOAA Tech Memo. NMFS-NWFSC-24, Northwest Fisheries Science Center, Seattle, Washington. 258 pages.

APPENDIX A1: CWE Model Tables (USLE, GEO and ERA for Alternatives 2, 4, and 5)

Table A-1: Model-Estimated Risk of Sediment Delivery [USLE – Surface Erosion] Alt 2			
7th-field Drainage	**Risk Ratio relative to inference point** (Current)	**Risk Ratio Post Action**	With Future Actions
Beaver/Grouse Creek	0.94	0.98	0.98
Long John Creek	0.88	0.97	0.97
Upper Cow Creek	0.66	0.67	0.67
Deer-Beaver Creek	0.94	0.96	0.96
5th field – Beaver Creek with proposed action	1.17	1.18	1.18
Entire analysis area [1]	1.12	1.13	1.13

Table A-2: Model-Estimated Risk of Sediment Delivery [USLE – Surface Erosion] Alt 4			
7th-field Drainage	**Risk Ratio relative to inference point** (Current)	**Risk Ratio Post Action**	With Future Actions
Beaver/Grouse Creek	0.94	0.99	0.99
Long John Creek	0.88	0.97	0.97
Upper Cow Creek	0.66	0.67	0.67
Deer-Beaver Creek	0.94	0.96	0.96
5th field – Beaver Creek with proposed action	1.17	1.18	1.18
Entire analysis area [1]	1.12	1.13	1.13

Table A-3: Model-Estimated Risk of Sediment Delivery [USLE – Surface Erosion] Alt 5			
7th-field Drainage	**Risk Ratio relative to inference point** (Current)	**Risk Ratio Post Action**	With Future Actions
Beaver/Grouse Creek	0.94	0.99	0.99
Long John Creek	0.88	0.96	0.96
Upper Cow Creek	0.66	0.66	0.66
Deer-Beaver Creek	0.94	0.95	0.95

1 Entire Analysis Area equals the Beaver Creek 5th field watershed, Headwaters Cottonwood Creek 7th field watershed and the all 7th fields in the Beaver Creek 5th field outside of the project area boundary.

Table A-3: Model-Estimated Risk of Sediment Delivery [USLE – Surface Erosion] Alt 5			
5th field – Beaver Creek with proposed action	1.17	1.18	1.18
Entire analysis area [1]	1.12	1.13	1.13

Table A-4: Model-Estimated Risk of Sediment Delivery [GEO – Mass Wasting] – Alt 2			
7th-field Watershed	**Risk Ratio relative to inference point** (Current)	**Risk Ratio Post Action**	With Future Actions
Beaver/Grouse Creek	1.50	1.48	1.48
Long John Creek	1.45	1.39	1.39
Upper Cow Creek	0.50	0.50	0.50
Deer-Beaver Creek	0.87	0.87	0.87
5th field – Beaver Creek with proposed action	0.91	0.90	0.90
Entire analysis area [1]	0.91	0.90	0.90

Table A-5: Model-Estimated Risk of Sediment Delivery [GEO – Mass Wasting] – Alt 4			
7th-field Watershed	**Risk Ratio relative to inference point** (Current)	**Risk Ratio Post Action**	With Future Actions
Beaver/Grouse Creek	1.50	1.49	1.49
Long John Creek	1.45	1.39	1.39
Upper Cow Creek	0.50	0.50	0.50
Deer-Beaver Creek	0.87	0.87	0.87
5th field – Beaver Creek with proposed action	0.91	0.91	0.91
Entire analysis area [1]	0.91	0.90	0.90

Table A-6: Model-Estimated Risk of Sediment Delivery [GEO – Mass Wasting] – Alt 5			
7th-field Watershed	**Risk Ratio relative to inference point** (Current)	**Risk Ratio Post Action**	With Future Actions
Beaver/Grouse Creek	1.50	1.48	1.48
Long John Creek	1.45	1.39	1.39
Upper Cow Creek	0.50	0.50	0.50
Deer-Beaver Creek	0.87	0.87	0.87
5th field – Beaver Creek with proposed action	0.91	0.90	0.90
Entire analysis area [1]	0.91	0.90	0.90

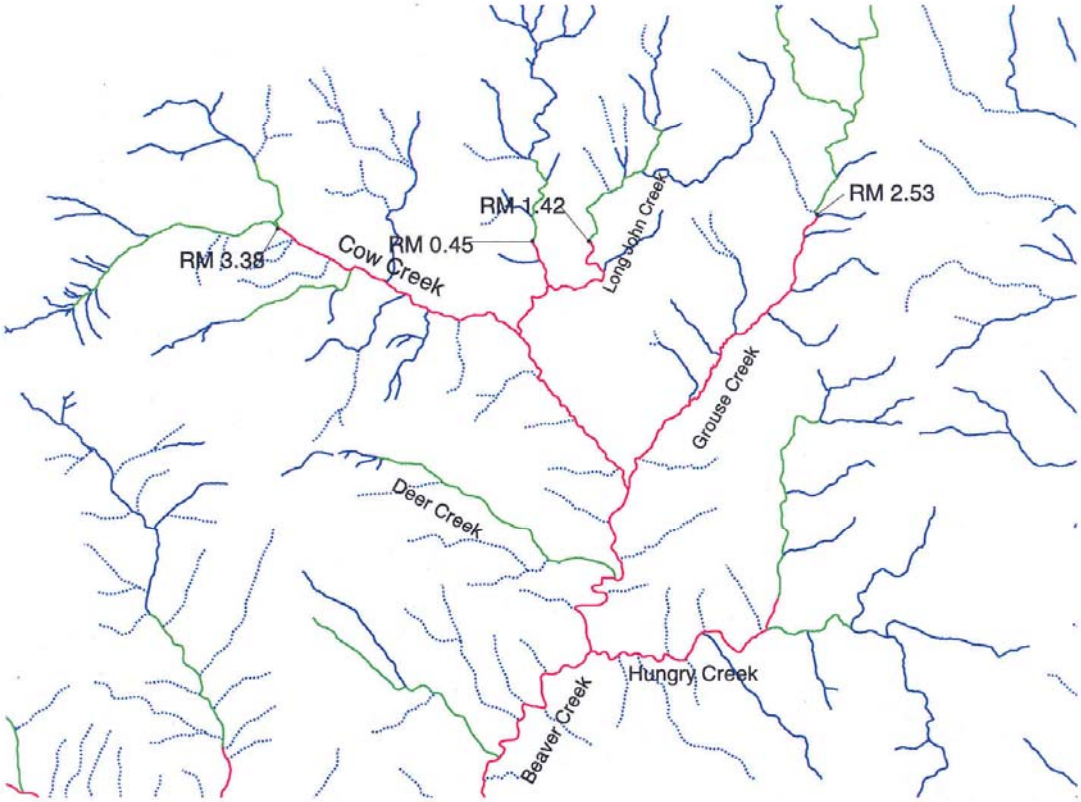
Table A-7: Model-Estimated Risk of changes in flow [ERA- Equivalent Roaded Acres] – Alt 2			
7th-field Drainage	**Risk Ratio relative to inference point** (Current)	**Risk Ratio Post Action**	With Future Actions
Beaver/Grouse Creek	0.55	0.80	0.80
Long John Creek	0.40	0.76	0.76
Upper Cow Creek	0.32	0.35	0.35
Deer-Beaver Creek	0.71	0.83	0.83
5th field – Beaver Creek	0.79	0.86	0.86

Table A-8: Model-Estimated Risk of changes in flow [ERA- Equivalent Roaded Acres] – Alt 4			
7th-field Drainage	**Risk Ratio relative to inference point** (Current)	**Risk Ratio Post Action**	With Future Actions
Beaver/Grouse Creek	0.55	0.77	0.77
Long John Creek	0.40	0.70	0.70
Upper Cow Creek	0.32	0.35	0.35
Deer-Beaver Creek	0.71	0.83	0.83
5th field – Beaver Creek	0.79	0.85	0.85

Table A-9: Model-Estimated Risk of changes in flow [ERA- Equivalent Roaded Acres] – Alt 5			
7th-field Drainage	**Risk Ratio relative to inference point** (Current)	**Risk Ratio Post Action**	With Future Actions
Beaver/Grouse Creek	0.55	0.78	0.78
Long John Creek	0.40	0.74	0.74
Upper Cow Creek	0.32	0.35	0.35
Deer-Beaver Creek	0.71	0.83	0.83
5th field – Beaver Creek	0.79	0.86	0.86

Appendix A2: CH/EFH Distribution Map for Project Area

CH/EFH Distribution Map



Legend

CH-EFH

Resident Trout

Perennial Stream

Intermittent Stream

Appendix B. Best Management Practices

Best Management Practices2 (BMPs) were developed to comply with Section 208 of the Clean Water Act. BMPs have been certified by the State Water Quality Resources Control Board and approved by the Environmental Protection Agency (EPA) as the most effective way of protecting water quality from impacts stemming from non-point sources of pollution. These practices have been applied to forest activities and have been found to be effective in protecting water quality within the Klamath National Forest. Specifically, effective application of the R-5 USFS BMPs has been found to maintain water quality that is in conformance with the Water Quality Objectives in the North Coast Regional Water Quality Control Board's (NCRWQCB) Basin Plan (www.swrcb.ca.gov/agendas/2005/march/0302-06.doc).

Region 5 Forest Service BMPs have been monitored and modified since their original implementation in 1979 to make them more effective. Numerous on-site evaluations by the NCRWQCB have found the practices to be effective in maintaining water quality and protecting beneficial uses. The Forest monitors the implementation and effectiveness of BMPs on randomly selected projects each year. BMP effectiveness requirements were met on 90-100% of the sites sampled in 2002-2006. The average BMP effectiveness was 97%. Results of this monitoring can be found on the Klamath National Forest Web page (USDA Forest Service 2006. Best Management Practices Report).

The following list of BMPs will be implemented in the Project. A description of the objective of each BMP is included, as well as how each practice will be specifically implemented within the Project. For additional information on the BMPs and their objectives, see Water Quality Management for Forest System Lands in California[1].

BMP 1.1 – Timber Sale Planning Process: Requires the Interdisciplinary Team (IDT) to consider methods of reducing water quality impacts during the planning phase of a project. This is accomplished during the planning process of the Timber Sale project.

- For determining Riparian Reserve (RR) buffer widths, one site potential tree height was designated as 170' for the Project.
- Stream shading will not be reduced below 80% to maintain water temperature.
- Masticating equipment may operate on slopes up to 45%.
- Tractor yarding equipment is generally limited to slopes < 35%.
- Existing skid trails will be reused whenever possible.
- Existing landings will be reused whenever possible.
- Tractor skidding will occur on designated skid trails. Tractors may leave skid trails to access isolated logs if ground conditions permit. End lining will be employed on slopes greater than 35% (see also BMP 5.2).
- The temporary roads will be outsloped and blocked after the harvest season (prior to the first winter after use). The temporary roads will be decommissioned (hydrologically restored) at project completion.
- Water drafting sites are existing sites and rocking of approaches will be used as required; all boards and plastic will be removed after use.

2 USDA Forest Service. 2000. Water quality Management for Forest System Lands in California. Best Management Practices. September 2000.

- Watershed personnel reviewed all proposed landings and new roads in the field to determine if unstable areas or other watershed issues were present and documented findings in project reports.
- Unstable areas will be reviewed by an earth scientist prior to actual landing construction and mitigated or avoided.
- Swing Boom Yarding (SBY) will be required within the timber sale contract to help alleviate the need to enlarge existing landings or construct additional landings.
-

BMP 1.2 – Timber Harvest Unit Design: Requires the IDT to consider methods of reducing water quality impacts due to changes in unit design. This is accomplished during the planning phase of a project. Examples of design changes are restricting timing of tree removal and utilizing less impacting yarding systems.

- The IDT reviewed all units to select harvest methods appropriate to site conditions.
    - Helicopter logging was selected as the most appropriate method to minimize soil disturbance in selected units.
    - Tractor yarding equipment is generally limited to slopes $\leq$ 35%. This is incorporated into the unit layout.
- Equipment will be kept approximately 50 feet from the break in slope to the wetted channel or inner gorge of intermittent streams channels.

BMP 1.3 – Use of Erosion Hazard Rating for Unit Design: Identifies high or very high erosion hazard areas and adjust management activities to prevent downstream water quality impacts; and to increase soil cover for those areas that have a high risk of contributing sediment into streams. This is done during the planning and layout phase of the project.

- Based on field review and site data (% slope distribution, soil texture), the Forest Soil Scientist determined the surface erosion hazard rating for each treatment unit and prescribed logging systems and soil cover needs based on the erosion hazard rating.
- Some unit boundaries were defined by equipment slope limitations for skidders at 35%.

BMP 1.4 – Use of Sale Area Maps for Designating Water Quality Protection: Identifies sensitive areas and water uses as part of the Timber Sale contract to assist operators in locating water concerns and applying protection methods. This is accomplished during contract preparation and implemented during layout of the sale.

- All protected stream courses will be illustrated on the Sale Area Map.
- Helicopter landings will be designated on the Sale Area Map.
- Water drafting will be from existing drafting sites and will be identified on the Sale Area Map.
- Units that use tractor yarding will be designated on the Sale Area Map.

BMP 1.5 – Limiting Operating Period of Timber Sale: To prevent soil compaction and erosion from operations during wet weather; and to ensure placement of erosion control structures prior to the onset of winter to reduce water quality impacts. This is accomplished during the timber sale operations.

- The Project is proposed to take place during the normal operating season (NOS) that is defined as April 15 to October 15 and in dry periods outside the NOS with Line Officer approval. Activities will be restricted during periods of wet weather during the NOS.
- When stormy weather is predicted, the TSA will be on site to insure that winterization or erosion control procedures are implemented in a timely fashion and to initiate shutdown or resume operations. Operations will not resume until suitable weather, soil, and forecast conditions exist.
- Forecast periods will be of a suitable length to allow completion or winterization of the task undertaken before precipitation events occur.
- The WWO Guidelines will be used to guide operations, especially haul, during periods of wet weather. The TSA will examine field conditions to determine when the soil and/or road has dried out enough to enable operations to resume without risk of watershed impacts. The project earth scientist may be called on to make recommendations to the TSA who will provide direction to the Contractor as to when operations may resume to insure that BMPs will be met and adverse impacts will be avoided.

BMP 1.6 – Protection of Unstable Lands: Provides for special treatment of unstable areas to avoid triggering mass slope failure with resultant erosion and sedimentation.

- Project watershed personnel conducted field reviews of all proposed harvest units, identified unstable areas observed in the field, reviewed the marking prescription, and documented findings in project reports.
- Unstable lands will be identified on the Unit Information Cards, and equipment will be excluded from them.
- Project watershed personnel will be available for consultation during project implementation when activities occur in or adjacent to unstable areas.

BMP 1.8 – Streamside Management Zone (SMZ) Designation: Designates zones adjacent to water and/or riparian areas as zones of special management. This is accomplished during the planning and layout phase of the project.

- Riparian Reserves within the project area have been designated; the IDT identified one site- potential tree height as 170'.
- Existing landings within 50 feet of the slope break to a stream channel or inner gorge will not be used.
- Sites for water drafting for dust abatement will be designated by the Forest Service and agreed to by the purchaser. Water drafting will meet the NOAA 2001 design standards when drafting from anadromous fish bearing stream reaches.
- There will be no yarding of trees or logs, through, in, or across stream channels.
- For all units where thinning is prescribed in RRs associated with intermittent stream channels, equipment will not operate within 50 feet of the break in slope to the wetted channel or inner gorge of intermittent streams.
- Where a clear break in slope is not evident, equipment will not operate within 50 feet of the wetted channel of any intermittent stream.

BMP 1.9 – Determining Tractor Loggable Ground: Minimize erosion and sedimentation resulting from ground disturbance of tractor logging systems.

- The Forest soil scientist field reviewed the tractor log units to verify that they were reasonable to tractor log from a soil resource perspective based upon the combination of % slope distribution, soil properties and erosion hazard rating.
- Project design features, such as restricting skidding equipment to slopes generally <35% and using endlining on slopes >35% will minimize disturbance to the steeper slopes in tractor units.

BMP 1.10 – Tractor Skidding Design: Designates a tractor skid pattern to avoid oversteepened areas, designates tractor crossings, and reduces skid patterns in sensitive areas to reduce erosion and compaction. This is accomplished during the sale layout and operations phase of the project.

- Existing skid trails will be reused whenever possible.
- Skidding occurs generally on slopes less than 35%
    - If sections of skid trails have slopes exceeding 35%, slash or certified straw will be placed on them as determined necessary by the TSA.
- The location of operating slopes for ground based harvest systems will have a Forest Service representative design and approve areas for logging equipment to work and an earth scientist will provide recommendations if needed.
- Skid trails that intersect Forest Roads will be obliterated at the intersection.
- The location of new skid trails within RRs associated intermittent streams will be by agreement between the Timber Sale Contractor and the TSA. Perennial streams will not be crossed by skid trails. Intermittent channels may be crossed when dry and at locations designated by the Forest Service.
- Limit equipment disturbance within 20 feet on either side of swales, minimize equipment crossings, and avoid running trails up the axis of swales.

BMP 1.11 – Suspended Log Yarding in Timber Harvesting: Protect the soil mantle from excessive disturbance, maintain the integrity of the SMZ and other sensitive watershed areas, and to control erosion on cable corridors.

- All skyline yarding units will require one end suspension. Full suspension will be required for any yarding across or over streams.
- Ground-based skidding will require front-end suspension of logs on skid trails.

BMP 1.12 – Log Landing Location: Locate new landings or reuse existing landings in such a way as to avoid watershed impacts and associated water quality degradation.

- New and old landings would be selected for use that involves the least amount of excavation, and the least erosion potential.
- Landing design standards:
    a. Existing landings will be used to the extent possible.
    b. Do not use existing landings within 50 feet of the slope break to a stream channel or inner gorge.

BMP 1.13 – Erosion Prevention and Control Measures During Timber Sale Operations: Ensures that Purchasers operations shall be conducted reasonably to minimize soil erosion. This is accomplished during the pre-operations meeting with the

purchaser, and throughout the operations phase of the timber sale.

- Erosion control measures are discussed during the pre-operations meeting with the purchaser and the Forest Service. They are updated throughout the operations phase of the timber sale.
- During project implementation, final locations and design characteristics for landings and new roads will be reviewed by watershed personnel prior to construction as needed.
- The project earth scientist will make periodic inspections of the sale to insure that the erosion control measures are having the desired effect and are in compliance with BMP's. The earth scientist will make recommendations to the FSR as to any action needed to comply with BMP's.
- The Klamath WWOS (USDA Forest Service 2002) will be used.
- Storms may temporarily suspend operations to insure BMP compliance and to avoid adverse impacts to T & E species or species of concern (R5 sensitive).
- When stormy weather is predicted, the TSA will be on site to insure that winterization procedures are implemented in a timely fashion and to initiate shutdown or resume operations. Operations will not resume until suitable weather, soil, and forecast conditions exist.
- Also see BMP 1.5 and 1.11

BMP 1.16 – Log Landing Erosion Prevention and Control: Works to reduce erosion and subsequent impacts sedimentation from log landings. Timber Sale Contract provide for erosion prevention and control measures on all landings. This is best done by design of landing drainage measures during the planning phase of the project, and implemented during the operations phase.

- Proposed landings were identified on the Project planning map and were evaluated by earth scientists.
- Landings are shaped to disperse drainage and direct runoff away from watercourses at the time of construction. Rock armoring and silt fences with straw bales may be used as necessary to direct water to areas of suitable drainage and to capture sediment. All new landing cut and fill slopes will be mulched and the mulch will be maintained throughout the life of the project.
- The Project will utilize existing landings whenever possible. Swing Boom Yarding (SBY) will be required within the timber sale contract to minimize the need to construct new landings.
- New landings need to be constructed will not be located within RRs and will be kept as small as feasible, while meeting safe working standards.

BMP 1.17 – Erosion Control on Skid Trails: Employs preventive measures such as drainage structures to reduce water concentration and erosion. This is accomplished during the operations phase of the project. Because of the timing of this project, pre-staging of straw bales for timely construction of water bars will be called for.

- No full bench skid trails will be constructed. (Full bench skid trails have the entire skid trail cut into the hill slope).
- Each skid trail will be water-barred before the sale is completed.

- Skid trails that intersect Forest Roads will be obliterated at the intersection.
- Skid trails that cross dry swales (i.e. depressions in the landscape that do not meet definition for a designation as an RR) will be restored before any storm (with reasonable chance of causing offsite sediment movement), or after use is complete. This generally consists of removing excess soil, reshaping and waterbarring former approaches, and spreading slash on the former crossing.
- Tractor skidding will be done when soil moisture conditions are dry within 4" of the surface on existing skid trails and dry to 10" of the ground surface off skid trails.
- Cable yarding corridors will be water barred.

BMP 1.19 – Streamcourse Protection: Protects the natural flow of streams and reduces the entry of sediment and any other pollutants into streams. The location of stream crossings must be agreed to by the Sale Administrator and the Hydrologist. The accomplishment of the objective of this measure is during the operations phase of the project.

- Service landings are located away from channels. Fuel containment systems will be used at all landings.
- Skid trails will be a minimum of 50 feet from the break in slope to the wetted stream channels or the inner gorge.
- Straw bales, rock, and containment dikes will be used as needed at water drafting sites and service landings to capture any spilled water and prevent runoff to streams.
- There will be no yarding of trees or logs below the break in slope or in inner gorge areas.

BMP 1.20 – Erosion Control Structure Maintenance: Requires periodic inspection of erosion control structures to assess maintenance needs and effectiveness. This is accomplished during the operations and post-operations phase of the project; this ensures the adequacy of erosion control measures.

- When stormy weather is predicted, the TSA will be on site to insure that winterization procedures are implemented in a timely fashion and to initiate shutdown or resume operations. Operations will not resume until suitable weather, soil, and forecast conditions exist.
- The TSA will examine field conditions to determine when the soil and/or road have dried out enough to enable operations to resume without risk of watershed impacts. The project earth scientist may be called on to make recommendations to the TSA who will provide direction to the Contractor as to when operations may resume to insure that BMPs will be met and adverse impacts will be avoided.
- Temporary roads will be graded to outslope.
- A barrier to prevent vehicle traffic and use will be placed at all temporary road takeoffs at the end of the operating season.
- Temporary roads will be water-barred after use and then will be decommissioned at the end of the project.
- Klamath WWOS guidelines will be followed. Spot rocking will used as necessary if small and isolated portions of the road system do not adequately dry

to allow haul when most of the road is capable of haul, provided haul over the newly rocked areas will not create adverse impacts, such as sediment moving off site towards channels.

BMP 1.21 – Acceptance of Erosion Control Measures Before Timber Sale Closure: Erosion control measures are inspected for adequacy to ensure erosion control as planned. This is accomplished during the post-operations phase of the project during the contract final inspection.

- Landings will be shaped for drainage.
- Landings that will not be used again will be contour ripped and covered with slash or weed free straw if necessary.
- At project completion, permanent operating water bars will be installed and-or repaired as necessary on all skid trails, and slash scattered on all skid trails if necessary available.
- Temporary roads will be graded to outslope and covered with slash if needed at termination of activities during the season of use.
- A barrier will be placed at the takeoff of the temporary roads.

BMP 1.25 – Modification of the Timber Sale Contract (as needed): Allows Contract language to be modified to add or increase protection of water quality not identified in the planning process.

- Modifications are not expected at this time but this BMP is retained to illustrate that contract alteration will occur if needed to insure maintenance of water quality, especially if unforeseen circumstances and impacts occur.

BMP 2.1 – General Guidelines of the Location and Design of Roads: To locate and design roads with minimal resource damage.

- Road construction will be designed:
  - For minimal cut and fill
  - On or near ridges
  - On gently sloping ground
  - Outside RRs
- Temporary roads were identified on the Project planning map and were evaluated by earth scientists.

BMP 2.2 - Erosion Control Plan: The objective is to limit and control sedimentation through effective planning prior to the initiation of construction activities and through effective contract administration. This is accomplished during the pre-operations and operations phase of the project.

- Resource protection measures are incorporated into the proposed action by the IDT and these actions are then incorporated into the contract specifications and provisions. Examples are most of the actions described above and include such items as: shaping landings, temporary roads and skid roads for drainage and use of rock as necessary to obtain suitable haul bases on FS roads.
- When stormy weather is predicted, the TSA will be in contact with the sale administrator to insure winterization procedures are implemented in a timely

fashion and to initiate shutdown or resume operations. Operations will not resume until suitable weather, soil, and forecast conditions exist.

- The WWO Guidelines will be used to guide operations, especially haul, during periods of wet weather. The TSA will examine field conditions to determine when the soil and/or road has dried out enough to enable operations to resume without risk of watershed impacts. The project earth scientist may be called on to make recommendations to the TSA who will provide direction to the Contractor as to when operations may resume to insure that BMPs will be met and adverse impacts will be avoided.

BMP 2.3 - Timing of Construction Activities: The objective is to minimize erosion by conducting operations during minimal runoff periods. This is accomplished during the operations phase of the project by the contract administrator and the project earth scientist.

- All landing, temporary road and skid road construction, and all existing temporary road skid road reconstruction, will be conducted during appropriate periods of weather and soil moisture to insure BMP attainment and the avoidance of adverse impacts to listed species. Forecast periods will also be of a suitable length to allow completion or winterization of the task undertaken before precipitation events occur.
- When stormy weather is predicted, TSA will be on site to insure that winterization procedures are implemented in a timely fashion and to initiate shutdown or resume operations. Operations will not resume until suitable weather, soil, and forecast conditions exist.
- The WWO Guidelines will be used to guide operations, especially haul, during periods of wet weather. The TSA will examine field conditions to determine when the soil and/or road has dried out enough to enable operations to resume without risk of watershed impacts. The project earth scientist may be called on to make recommendations to the TSA who will provide direction to the Timber Sale Contractor as to when operations may resume to insure that BMPs will be met and adverse impacts will be avoided.

BMP 2.4 - Road Slope Stabilization (Preventive Practices): The objective is to improve road slope stabilization by applying mechanical and vegetative measures. This is accomplished during the operations phase of the Project.

- All landings, temporary road, and skid trail construction, and road re-conditioning will be conducted during appropriate periods of weather and soil moisture to insure BMP attainment and the avoidance of adverse effects to listed species. Favorable forecast periods will also be of a suitable length to allow completion or winterization of the task undertaken before precipitation events occur.
- Landings will be shaped for drainage at the time of construction. Rock armoring and silt fences with straw bales will be used as necessary to direct water to suitable areas of drainage and to capture sediment. All landing cut and fill slopes will be straw mulched and the mulch is maintained throughout the life of the Project.

- WWOS will be followed. Rocking will be used as necessary.
- Temporary roads will be closed and storm-proofed when not in use (steeper segments will be mulched as needed). Temporary roads will be decommissioned within one year following completion of timber sale activities.

BMP 2.5 - Road Slope Stabilization (Administrative Practices): The objective is to reduce sedimentation by minimizing erosion from road slopes and by minimizing the chances of slope failures along roads. This is accomplished by road design measures during the planning phase of the project.

- Klamath WWOS guidelines will be followed.
- When stormy weather is predicted, the TSA will be on site to insure that winterization procedures are implemented in a timely fashion and to initiate shutdown or resume operations. Operations will not resume until suitable weather, soil and forecast conditions exist.
- The WWO Guidelines will be used to guide operations, especially haul, during periods of wet weather. The TSA will examine field conditions to determine when the soil and/or road has dried out enough to enable operations to resume without risk of watershed impacts. The project earth scientist may be called on to make recommendations to the TSA who will provide direction to the Contractor as to when operations may resume to insure that BMPs will be met and adverse impacts will be avoided.

BMP 2.11 - Minimization of Sidecast Material: The objective is to minimize sediment production originating from material sidecast during road construction or maintenance. This is accomplished during the design phase of the project by the contract inspector.

- Minor blading will occur on temporary roads used by the project. Side-casting of soil during blading operations will be minimal due to the low gradient slopes on which the temporary roads are located.
- During reconstruction of any landings, material will not be sidecast where it can enter a stream channel.

BMP 2.12 - Servicing and Refueling of Equipment: The objective is to prevent pollutants such as fuels, lubricants, bitumens, raw sewage, wash water, and other harmful materials from being discharged into or near rivers, streams, impoundments, or natural and man-made channels which lead into them. This is accomplished through the use of designed and designate refueling areas.

- Fuel containment systems will be in place on landings as necessary.
- Refueling and maintenance of Project motorized equipment will occur at least 200 feet away from any channel.

BMP 2.16 – Stream Crossings on Temporary Roads: The objective is to ensure that temporary roads do not unduly damage stream channels and to insure that fish passage is unimpeded by stream crossing structures.

- The number of crossings is kept to a minimum needed for access.
- Temporary crossings will be removed and the site stabilized prior to any storm (i.e., when there is significant potential for offsite sediment movement) or when

the facility is no longer needed, whichever is earliest.

BMP 2.21 - Water Source Development Consistent with Water Quality Protection: The objective is to limit and mitigate the effects of water source development through the planning of impoundments and withdrawals.

- Drafting sites are existing sites and rocking of approaches will be used as required. All boards and plastic will be removed after use. Straw bales, rock surfacing and containment dikes will be used at all locations where the possibility of water spill or overflow will result in sediment being moved toward the creek.
- Drafting sites and methods will follow NOAA-Fisheries 2001direction including screen size and the amount of flow withdrawal guidelines when drafting from anadromous fish bearing stream reaches.
- Water trucks will be required to remain on existing, rocked roads.

BMP 2.22 – Maintenance of Roads: The objective is to limit sedimentation and erosion by road drainage maintenance and road surface protection. This is accomplished during the operations phase of the project and the post-operations final inspection.

- The Klamath WWOS guidelines will be followed. Spot rocking will used as necessary if small and isolated portions of the road system do not adequately dry to allow haul when most of the road is capable of haul, provided haul over the newly rocked areas will not create adverse impacts, such as sediment moving offsite towards channels.
- When stormy weather is predicted, the TSA will be on site to insure that winterization procedures are implemented in a timely fashion and to initiate shutdown or resume operations. Operations will not resume until suitable weather, soil, and forecast conditions exist.
- The WWO Guidelines will be used to guide operations, especially haul, during periods of wet weather. The TSA will examine field conditions to determine when the soil and/or road has dried out enough to enable operations to resume without risk of watershed impacts. The project earth scientist may be called on to make recommendations to the TSA who will provide direction to the Contractor as to when operations may resume to insure that BMPs will be met and adverse impacts will be avoided.
- Appropriate road watering will occur as roads dry to maintain road fines on site.

BMP 2.23 – Road Surface Treatment to Prevent Loss of Materials: The objective is to reduce road related erosion through treatment of the road surface, usually through spot rocking and dust abatement. This is accomplished during the operations phase of the project.

- The Klamath WWOS will be used for all Project activities (harvest, hauling, planting). The public uses many roads within the analysis area throughout the year and control of this use is outside the scope of the Project or the KNF's jurisdiction.
- Spot rocking will used as necessary if small and isolated portions of the road system do not adequately dry to allow haul when most of the road is capable of haul, provided haul over the newly rocked areas will not create adverse impacts,

such as sediment moving offsite towards channels.

- Landings will be outsloped and rocked if necessary to improve drainage away from existing channels.
- The WWOS dictate conditions that control ground-disturbing operations. For example, if more than 10% of a road segment is rutted 2 inches in depth, road use will be suspended.
- TSAs will be on site daily when new locations and conditions are encountered and to insure that appropriate winterization procedures are implemented in a timely fashion and to initiate shutdown or resume operations. Operations will not resume until suitable weather, soil and forecast conditions exist.
- A Dust Abatement Plan is required under the Timber Sale Contract, Specification CT5.4, under road maintanence. Roads to be dust abated with water will be specified in the contract by project engineer.
- Appropriate road watering on other project roads will occur as roads dry to maintain road fines on site.

BMP 2.24 – Traffic Control During Wet Periods: The objective is to reduce damage to road drainage and limit sedimentation from roads during wet periods. This is generally achieved by increased surfacing and/or road closures during the operations phase of the project.

- The Klamath WWOS Guidelines will be used for all project activities (hauling, fuel treatment, road opening and decommissioning), but the public uses many roads within the project area throughout the year.
- The WWOS Guidelines dictate conditions that control ground-disturbing operations. For example, if more than 10% of a road segment is rutted 2 inches in depth road use will be suspended.

BMP 2.26 – Obliteration or Decommissioning of Roads: The objective is to reduce sediment generated from temporary roads, unneeded system (classified) and non-system (unclassified) roads by obliterating or decommissioning them at the completion of the intended use.

- This BMP applies to all temporary roads
- Roads are to be drained by measures such as re-contouring or outsloping to return the road prism to near natural hydrologic function.
- Road prisms requiring more sediment reduction would be stabilized through appropriate treatment such as tillage, ripping, fertilization, and/or revegetation.
- Road take-offs would be obliterated or effectively blocked to vehicle access.

BMP 5.2 – Slope Limitations for Mechanized Equipment Operations: The objective is to reduce gully and sheet erosion and associated sediment production by limiting tractor use.

- Skidding equipment (track or rubber tired) would be generally restricted to slopes $\leq$35%.
- Masticating equipment may operate on slopes up to 45%.

BMP 5.4 - Revegetation of Surface Disturbed Areas: The objective is to protect water quality by minimizing soil erosion through the stabilizing influence of vegetation. This is

accomplished during the operations and post-operations phase of the project.

- Temporary roads that are decommissioned will be mulched and seeded in areas that have high erosion potential.
- Steep (>35%) portions of skid trails will be covered with slash as needed.

BMP 5.5 – Disposal of Organic Debris: The objective is to prevent gully and surface erosion with associated reduction if sediment production and turbidity during and after treatment.

- Hand pile and pile burning, underburning and mastication would be used to reduce the fine fuel component. Specified soil cover recommendations would be used to maintain sufficient soil cover for erosion prevention.

BMP 5.6 – Soil Moisture Limitations for Tractor Operations: The objective is to prevent soil compaction, rutting, and gulling that may result in increased sedimentation and turbidity.

- This is accomplished during the operations phase of the Project by periodic monitoring performed by the Project's earth scientist.
- Tractor skidding will only be permitted when soil moisture is dry within the top 4" of the soil surface on main skid rails, and 10" when skidding off skid trails.
- Tractor operations will geneally occur where slopes average <35% in slope. Some end lining will occur on steeper slopes, but these areas will be very limited in size and extent. Tractor operations will be restricted to designated skid trails and utilize end lining, which will limit the amount of area impacted.
- When stormy weather is predicted, the TSA will be in contact with the sale administrator to insure winterization procedures are implemented in a timely fashion and to initiate shutdown or resume operations. Operations will not resume until suitable weather, soil and forecast conditions exist.
- The WWOS will be used to guide operations, especially haul, during periods of wet weather. Earth scientists will examine field conditions to determine when the soil and/or road have dried out enough to enable operations to resume without risk of adverse watershed effects. The earth scientist and/or fisheries biologist will make recommendations to the TSA and to the District Ranger, who will provide direction to the Timber Sale Contractor as to when operations may resume to insure that BMPs will be met and adverse effects will be avoided.
- Mastication will occur when the soil is dry down to 10 inches.

BMP 6.1 – Fire and Fuels Management Activities: The objective is to reduce the effects of wildfires on water quality by informing the public, and the development of access plans, fuel breaks, and fuel reduction programs. This done through ongoing fire management program work.

- The District Fuel/Fire department helped determined acceptable levels of slash to retain on the site following harvest activities and also to identify areas and methods to remove standing slash of a sub merchantable size, that otherwise would create an unacceptable fire risk.

- On-going fire management work maintains fire access plans and restricts public activities, such as woodcutting, on days when fire weather predictions indicate significant risk from such activities in the Project Area.

BMP 6.2 – Consideration of Water Quality in Formulating Fire Prescriptions: The objective is to provide for water quality while achieving management objectives of prescribed fire. This is done during the planning phase of the project.

- The different fuel reduction treatments are being used because of soil and water quality considerations.
- All burning will be done under an approved Burn Plan that specifies a burn prescription for each area. These prescriptions will account for fuel loading, fuel moisture, soil moisture, slope, aspect, etc., and will result in the desired quantity of fuel consumed for each prescribed burn. A fuel management specialist, who may utilize recommendations from a soil or earth scientist, will prepare prescriptions.
- Hand piles will burn under controlled settings to contain fire spread.
- Underburning will occur under prescription, occurring in conditions that allow safe burning. Fire crews, equipped to control fire spread, will monitor underburning.
- Fire prescriptions will be reviewed by the IDT and will be approved by the line officer.

BMP 6.3 – Protection of Water Quality From Prescribed Fire Burning Effects: The objective is to minimize surface erosion, protect soil productivity, and to prevent soil and debris from entering streams. This is achieved by a combination of methods appropriate for the site specific conditions including requiring adequate ground cover to reduce surface erosion and impedance of overland flow, avoiding high intensity burns, and maintaining the integrity of SMZ's

- Retain recommended ground cover to keep soil erosion in the burned site within the limits of the burn plan and LRMP guidelines for soil cover (LRMP Table 4-2).
- Maintain the integrity of the riparian reserve.
- If it is determined necessary for a handline to be constructed as a control point within a Riparian Reserve, it should be constructed no closer than 30 feet to a watercourse. Handline construction in riparian vegetation shall be avoided where practical.

BMP 7.7 -- Management by Closure to Use: Exclude activities that could result in damages to either resources or improvements, such as roads and trails, resulting in impaired water quality.

- The Mt. Ashland project is proposed to take place during the NOS that is defined as April 15 to October 15 and in dry periods outside the NOS with Line Officer approval. Activities will be restricted during periods of wet weather during the NOS.
- The Klamath WWO Standards will be used, however, public use of most roads within the Project Area occurs throughout the year. The *Wet Weather Operations Standards and Field Guide*, revised May 16, 2002, is incorporated by reference

and on file in the Project record.

- Storms may make it necessary to temporarily suspend operations to insure BMP compliance and to avoid adverse effects to Threatened, Endangered, or Sensitive species. When stormy weather is predicted, THE TSA will be on site to insure that winterization or erosion control procedures are implemented in a timely fashion and to initiate shutdown or resume operations. Operations will not resume until suitable weather, soil and forecast conditions exist.
- In riparian reserves, prescribed fire effects will mimic a low intensity backing fire, except for burning handpiles where higher intensity may occur to consume pile material.

BMP 7.8 – Cumulative Off-Site Watershed Effects: Maintain soil productivity, minimize erosion and minimize ash, sediment, nutrients, and debris from entering water bodies.

- A cumulative watershed effects analysis was completed for the Project. Project design standards including Resource Protection Measures have been incorporated into the proposed action to minimize cumulative off-site watershed effect

APPENDIX C: Table of Population and Habitat Indicators For Use on the Klamath National Forest In The Northwest Forest Plan Area

The Table shows criteria used to determine baseline conditions in 7th and 5th field watersheds within the KNF boundaries. The existing conditions and effects to Indicators are discussed in the narrative within this BA (Section V) and are summarized in the Table-Checklist format in Appendix D.

Last Level 1 review: updated October 26, 2005

Klamath National Forest Tributaries Matrix of Pathways and Indicators:				
Pathways	Indicators	Properly Functioning	At Risk	Not Properly Functioning
Water Quality:	Temperature (1)			
	1st - 3rd Order Streams [instantaneous]	69 F degrees or less	> 69 to 70.5 degrees F	> 70.5 degrees F
	4th-5th Order Streams [7 Day Maximum]	70.5 degrees F or less ~ 21.4 C	> 70.5 to 73.5 degrees F	> 73.5 degrees F ~ 23.0 C
	Suspended Sediment/Turbidity (2)	Low	Medium	High
		Compliance with Clean Water Act requirements for suspended sediment and turbidity at the site and project scale is achieved through application of appropriate Best Management Practices and other measures as specific by permits from relevant State Water Quality Control Board.		
	Chemical/Nutrient Contamination (3)	Low levels of contamination from agriculture, industrial, and other sources; no excess nutrients. No CWA 303d designated reaches.	Moderate levels of contamination from agriculture, industrial, and other sources; some excess nutrients. One CWA 303d designated reach.	High levels of contamination from agriculture, industrial, and other sources; high levels of nutrients. More than one CWA 303d designated reach.
Habitat Access:	Physical Barriers (3)	Any man-made barriers present in watershed allow upstream and downstream passage at all flows.	One or more human -made barriers present in watershed do not allow upstream and/or downstream passage at base/low flows.	Human-made barriers present in watershed do not allow upstream and/or downstream passage at a range of flows for at least one life history stage.
Habitat Elements:	Substrate character (4)	Less than 15% fines (<2 mm) in spawning habitat (pool tail-outs, low gradient riffles, and glides) and cobble embeddedness less than 20%.	15% or greater fines (<2 mm) in spawning habitat (pool tail-outs, low gradient riffles, and glides) and/or cobble embeddedness is 20% or greater.	Greater than 20% fines (<2 mm) in spawning habitat (pool tail-outs, low gradient riffles, and glides) and cobble embeddedness greater than 25%.
	Large Woody Debris (3)	More than 20 pieces of large wood	Current levels are being maintained at	Current levels are not at those desired

		(>12 inches in diameter and > 50 feet in length) per mile; also adequate source of woody debris are available for both long- and short-term recruitment.	minimum levels desired for "properly functioning" but potential sources for long term woody debris recruitment are lacking to maintain these minimum values.	levels for "properly functioning" and potential sources of woody debris for short and/or long term recruitment are lacking.
	Pool Quality (Pool = 1meter deep) and Frequency (4)	At least 1 pool every 3 to 7 bankfull channel widths. These pools should occupy at least 50% of the low-flow channel width and all have a maximum depth of at least 36 inches.	At least 1 pool every 3 to 7 bankfull channel widths. These pools should occupy at least 50% of the low-flow channel width. At least half of the pools have a maximum depth of at least 36 inches.	Less than 1 pool every 7 bankfull channel widths and/or less than half of the pools have a maximum depth of at least 36 inches.
	Off-channel Habitat (3)	Watershed has many ponds, oxbows, backwaters and other off channel areas with cover; and side channels are low energy areas.	Watershed has some ponds, oxbows, backwaters and other off channel areas with cover; but side channels are generally high energy areas.	Watershed has few or no ponds, oxbows, backwaters or other off-channel areas.
	Refugia (important remnant habitat for sensitive aquatic species) (3)	Habitat capable of supporting strong and significant populations are protected (e.g. by intact riparian reserves or conservation areas, ground water upwelling areas and seeps); and are well distributed and connected for all life stages and forms of the species.	Habitat capable of supporting strong and significant populations are insufficient in size, number, and connectivity to maintain all life stages and forms of the species	Adequate habitat refugia do not exist.

Klamath National Forest Tributaries Matrix of Pathways and Indicators:				
Pathways	Indicators	Properly Functioning	At Risk	Not Properly Functioning
Channel Condition and Dynamics:	Width/Depth Ratio (5)	Width-to-Depth ratio < 12 on all reaches that could otherwise best be described as 'A', 'G', and 'E' channel types. Width-to-Depth ratio > 12 on all reaches that could otherwise best be described as 'B', 'F', and 'C' channel types. No braided streams formed due to excessive sediment loads	More than 10% of the reaches are outside of the ranges given for Width/Depth ratios for the channel types specified in "Properly Functioning" block. Braiding has occurred in some alluvial reaches as a result of excessive aggradation due to high sediment loads.	M ore than 25% of the reaches are outside of the ranges given for Width/Depth ratios for the channel types specified in "Properly Functioning" block. Braiding has occurred in many alluvial reaches as a result of excessive aggradation due to high sediment loads
	Streambank Condition (3)	> 80% of any stream reach has ≥ 90% stability	50-80%of any stream reach has ≥ 90% stability	< 50% of any stream reach has ≥90% stability
	Floodplain Connectivity (3)	Off-channel areas are frequently hydrologically linked to main channel; overbank flows occur and maintain wetland functions, riparian vegetation, and succession.	Reduced linkage of wetland, floodplains, and riparian areas to main channel; overbank flows are reduced relative to historic frequency, as evidenced by moderate degradation of wetland function, riparian vegetation/succession.	Severe reduction in hydrologic connectivity between off-channel, wetland, floodplain, and riparian areas; wetland area drastically reduced and riparian vegetation/succession altered significantly.
Flow / Hydrology:	Change in Peak/Base Flows (6)	Use ERA model to estimate risk of change in flow. Watershed hydrograph indicates peak flow, base flow, and flow timing characteristics comparable to an undisturbed watershed of similar size, geology, and geography. Clarify and verify conditions and risk through field reviews and/or other available info, as available.	Use ERA model to estimate risk of change in flow. Some evidence of altered peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology, and geography. Clarify and verify conditions and risk through field reviews and/or other available info, as available.	Use ERA model to estimate risk of change in flow. Pronounced changes in peak flow, baseflow and/or flow timing relative to an undisturbed watershed of similar size, geology, and geography. Clarify and verify conditions and risk through field reviews and/or other available info, as available.
	Increase in Drainage Network (3)	Zero or minimum increases in active channel length correlated with human caused disturbance (e.g., trails, ditches, compaction, impervious surface, etc).	Low to Moderate increases in active channel length correlated with human caused disturbance (e.g., trails ditches, compaction, impervious surface, etc).	Greater than moderate increase in active channel length correlated with human caused disturbance (e.g., trails ditches, compaction, impervious surface, etc).
Watershed Conditions:	Road Density and Location (3)	Less than 2 miles per square mile.	Two to three miles per square mile.	Over 3 miles per square mile.
	Disturbance History (7)	CWE model indicator values (USLE, Mass-Wasting, and ERA) are not above 1.0. Clarify and verify conditions and risk through field reviews and/or other available info, as available.	One or two of the CWE model indicator values are above threshold of 1.0. Clarify and verify conditions and risk through field reviews and/or other available info, as available.	Three of the CWE model indicator values are above threshold of 1.0. Clarify and verify conditions and risk through field reviews and/or other available info, as available.
	Riparian Reserves – NW Forest Plan (3)	The riparian reserve system provides adequate shade, large woody debris recruitment, and habitat protection and connectivity in all subwatersheds, and buffers or includes known refugia for sensitive aquatic species (> 80% intact), and/or for grazing impacts; percent similarity of riparian vegetation to the potential natural community/composition > 50%.	Moderate loss of connectivity or function (shade, LWD recruitment, etc) of riparian reserve system, or incomplete protection of habitat and refugia for sensitive aquatic species (approx. 70-80% intact), and/or for grazing impacts; percent similarity of riparian vegetation to the potential natural community/composition 25-50% or better.	Riparian reserve system is fragmented, poorly connected, or provides inadequate protection of habitat and refugia for sensitive aquatic species (approx. less than 70% intact), and/or for grazing impacts; percent similarity of riparian vegetation to the potential natural community/composition is 25% or less.
	Disturbance Regime (7)	Environmental Disturbance is short lived; predictable hydrograph, high quality habitat and watershed complexity providing refuge and rearing space for all life stages or multiple life-history forms. Natural processes are stable. This is best quantified through the CWE modeling described for Disturbance History.	Scour events, debris torrents or catastrophic fire are localized events that occur in several minor parts of the watershed. Resiliency of habitat to recover from environmental disturbances is moderate. This is best quantified through the CWE modeling described for Disturbance History	Frequent flood or drought producing highly variable and unpredictable flows, scour events, or high probability of catastrophic fire exists throughout a major part of the watershed. The channel is simplified, providing little hydraulic complexity in the form of pools or side channels. Natural processes are unstable. This is best quantified through the CWE modeling described for Disturbance History

Footnotes to Table of Population and Habitat Indicators For Use on the Klamath National Forest In The Northwest Forest Plan Area, as adjusted from the Appendix A in the AP

The Table, as designed in the 2004 Analytical Process, and in earlier versions (1997 NMFS BO for the LRMP), suggests values to determine a level of functioning for anadromous fish bearing streams. A note about rigid values to assess level of functioning: In addition to fixed habitat parameters not allowing for natural variability, they set standards that may be geomorphically inappropriate (Bisson et al. 1997). Variability is an inherent property of aquatic ecosystems in the Pacific Northwest and habitats at any given location will change from year to year, decade to decade, and century to century (Bisson et al. 1997). Healthy lotic ecosystems require different parts of the channel system to exhibit very different in-channel conditions and that those conditions change through time (Reid and Furniss 1998). Therefore, a conclusion of function must be evaluated with professional judgment recognizing the streams capability to perform within rigid values. In some cases, a stream's morphology, aspect or size may not support "Properly Functioning" criteria values for one or more habitat Indicators. If an Indicator for a particular stream is determined to be functioning at its capability (due to morphology, aspect, or size), it is rated as Properly Functioning even if it doesn't meet Appendix C Table criteria values. The Table serves to identify values to determine the quality of baseline conditions; the Checklists (Appendix D) serve to summarize the baseline conditions and effects by watershed.

(1) Proper Functioning criteria for 4th -5th Order streams is derived from temperature monitoring near the mouth of streams considered to be pristine or nearly pristine (Clear, Dillon, and Wooley Creeks – 7 day maximum temperatures as high as 70.5 degrees F have been recorded on these streams (EA Engineering, 1998 Salmon River and Dillon Creek Watershed Fish Habitat and Channel Type Analysis, Appendix 2)). At-Risk criteria for 4th/5th order streams is derived from monitoring in streams that support populations of anadromous fish, although temperatures in this range (70.5 to 73.5 degrees F) are considered sub-optimal. A not Properly Functioning criterion is sustained temperatures above 73.5 degrees F that cause cessation of growth and approach lethal temperatures for salmon and steelhead. Properly Functioning criteria for 1st - 3rd order streams is derived from Desired Future Conditions (DFC) values given in the LRMP EIS p 3-68. At Risk and Not Properly Functioning are assigned on a temperature continuum with values given for 4th/5th order streams, with the maximum instantaneous temperature of At Risk of 1st - 3rd order streams coinciding with the minimum 7 day maximum of 4th/5th order At Risk streams. Stream Order according to Strahler (1957).

(2) Turbidity: NTU data for streams in the Klamath River system on the Klamath National Forest are not available. Professional judgment on how fast a stream clears after a peak flow, stream surveys data for substrate conditions, and/or the CWE modeling are used to estimate the existing condition and post-action condition for this Indicator. The AP Table suggests using fine sediment as a surrogate. The risk of sediment delivery to streams is evaluated through the CWE modeling as described below in (4). Also, compliance with Clean Water Act requirements for suspended sediment and turbidity at the site and project scale is achieved through application of appropriate Best Management Practices and other measures as specific by permits from relevant State Water Quality Control Board**.**

1. Properly Functioning: Water clarity returns quickly (within several days) following peak flows. ("Low")
2. At Risk: Water clarity slow to return following peak flows. ("Medium")
3. Not Properly Functioning: Water clarity poor for long periods of time following peak flows. Some suspended sediments occur even at low flows or base flow. ("High")

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(3) Criteria unchanged from AP Table.

(4) Properly Functioning criteria for % fines in gravel is taken from LRMP EIS p 3-68 can also be used to assess existing conditions when that information is available. When that information is unavailable, professional judgment is used to describe existing conditions and to estimate effects based upon model output interpretation, research results, or other information. The KNF CWE modeling procedure (Appendix F) describes the risk (probability) of Project-caused sediment production. For Existing and Post Action:

1. Properly Functioning: USLE and GEO values are less than 1.0
2. At Risk: USLE and GEO values are between 1.0-1.20
3. Not Properly Functioning: USLE and GEO values are greater than 1.20

(5) The Width to depth ratio for various channel types is based on delineative criteria of Rosgen (1996). Properly Functioning means that Width-to-Depth ratio falls within expected channel type as determined by the other four delineative factors (entrenchment, sinuosity, slope, and substrate). Aggradation on alluvial flats causing braiding is well known phenomenon that often accompanies changes in Width-to-Depth ratio as watershed condition deteriorates. Stream width is a function of streamflow occurrence and magnitude, size and type of transported sediment, and the bed and bank materials of the channel (Rosgen 1996). Channel widths generally increase downstream as the square root of discharge. Channel widths can be modified by changes in riparian vegetation, changes in streamflow regimes, and changes in sediment supply. Mean depth of channels varies greatly by reach under different discharges due to the sequence of riffle and pool bed features. Width-to-depth ratios vary with the dimensions of the channel cross section for a given slope, boundary roughness as a function of streamflow and sediment regime, bank erodibility, degree of entrenchment and the distribution of energy in the stream channel (Rosgen 1996). The Table in indicates that confined or entrenched channel types (such as A, G, and E types) are Properly Functioning when Width-to-Depth ratios are <12, and wider channel types (such as B, C, and F types) are Properly Functioning when Width-to-Depth ratios are >12. To meet the Properly Functioning criteria channels must also have no or minimal braiding due to excessive sediment.

(6) The Table values in the 2004 Analytical Process suggest using hydrograph information to estimate existing flow conditions and post-project changes in flow. Hydrograph information is not available for most watersheds on the Forest. Forest Service Region 5 uses ERA/TOC to determine the existing risk as well as the risk of adverse effects to flows (Appendix F).

(7) The three components of the KNF CWE model are used to determine conditions and risk to this Indicator (Appendix F). The KNF CWE model components replace the use of ECA because ECA is not

used in Forest Service Region 5. Agreed to by Yip and Perrochet (Level 1) April 8, 2003.

1. Properly Functioning: All 3 model values (USLE, GEO and ERA) are less than 1.0 risk ratio; i.e. below threshold
2. At Risk: One or two model values is 1.0 or greater; i.e. at or exceeding threshold
3. Not Properly Functioning: Values for all three models is greater than 1.0.

Appendix D:

CHECKLISTS FOR DOCUMENTING ENVIRONMENTAL BASELINE AND EFFECTS OF PROPOSED ACTION(S) ON RELEVANT INDICATORS FOR THE Mt. ASHLAND LSR HABITAT RESTORATION AND FUELS REDUCTION PROJECT

Legend For Reference Information Used to Determine Baseline Conditions:

PJ = Professional Judgment
NA = Not Applicable
ND= No Data
CWE98 = Westside CWE Analysis 1998
CWE06 = Mt. Ashland LSR CWE Analysis 2006
96WA = Beaver Creek Ecosystem Analysis (USFS – Scott River RD, 1996)
TEMP99 = Stream temperature surveys conducted in Grouse Creek – 1999.
TEMP02 = Stream Temperature surveys conducted in 2002 in Long John Creek.

DB=Information based on USFS habitat typing, SCI, and thermograph/hobotemp surveys
DB Survey data is housed in runstreams database (USFS 2003).
PFR = Project field review.

INDICATORS	ENVIRONMENTAL BASELINE 7th Field: Upper Cow Creek			EFFECTS OF THE ACTIONS 7th Field: Upper Cow Creek		
	PROPERLY FUNCTIONING	AT RISK	NOT PROP FUNCTIONING	RESTORE	MAINTAIN	DEGRADE
Water Quality Temperature*		CWE06 96WA DB			X	
Sediment/Turbidity	PJ				X	
Chemical Contam	PJ				X	
Habitat Access Physical Barrier		CWE06 96WA DB			X	
Habitat Elements Substrate		DB PJ			X	
LWD		DB PJ 96WA			X	
Pool Frequency		DB PJ 96WA			X	
Pool Quality					X	
Off-channel Habitat N/A	96WA				X	
Refugia	96WA				X	
Channel Cond & Dyn W/D Ratio*	96WA				X	
Streambank Cond.	96WA				X	
Floodplain Cond.	CWE06				X	
Flow /Hydrology Peak/Base Flow	CWE98				X	
Drainage Net Incrs		CWE98			X	
Watershed Cond. Road Dens/Loc	CWE06 96WA				X	
Disturbance History	96WA PJ				X	
Riparian Reserves		CWE06 96WA DB			X	

INDICATORS	ENVIRONMENTAL BASELINE 7th Field: Deer-Beaver Creek			EFFECTS OF THE ACTIONS 7th Field: Deer-Beaver Creek		
	PROPERLY FUNCTIONING	**AT RISK**	**NOT PROP FUNCTIONING**	**RESTORE**	**MAINTAIN**	**DEGRADE**

Water Quality Temperature*	PJ				X	
Sediment/Turbidity		CWE06 96WA			X	
Chemical Contam	PJ				X	
Habitat Access Physical Barrier	96WA				X	
Habitat Elements Substrate		CWE06 96WA			X	
LWD		96WA PJ			X	
Pool Frequency		96WA PJ			X	
Pool Quality		96WA PJ			X	
Off-channel Habitat N/A					X	
Refugia	96WA				X	
Channel Cond & Dyn W/D Ratio*	96WA PJ				X	
Streambank Cond.		96WA PJ			X	
Floodplain Cond.	96WA				X	
Flow /Hydrology Peak/Base Flow	CWE06				X	
Drainage Net Incrs		CWE98			X	
Watershed Cond. Road Dens/Loc		CWE98			X	
Disturbance History	CWE06 96WA				X	
Riparian Reserves	96WA PJ				X	

INDICATORS	ENVIRONMENTAL BASELINE 7th Field: Beaver/Grouse Creek			EFFECTS OF THE ACTIONS 7th Field: Beaver/Grouse Creek		
	PROPERLY FUNCTIONING	**AT RISK**	**NOT PROP FUNCTIONING**	**RESTORE**	**MAINTAIN**	**DEGRADE**
Water Quality Temperature*	TEMP 99				X	
Sediment/Turbidity		CWE06 DB 96WA			X	
Chemical Contam	PJ				X	
Habitat Access Physical Barrier	96WA				X	
Habitat Elements Substrate		CWE06 DB 96WA			X	
LWD		PJ DB 96WA			X	
Pool Frequency		DB 96WA			X	
Pool Quality		DB 96WA			X	
Off-channel Habitat		DB 96WA PJ			X	
Refugia		96WA PJ			X	
Channel Cond & Dyn W/D Ratio*	PJ				X	
Streambank Cond.		96WA PJ			X	
Floodplain Cond.	96WA PJ				X	
Flow /Hydrology Peak/Base Flow	CWE06				X	
Drainage Net Incrs		CWE98			X	
Watershed Cond. Road Dens/Loc		CWE98			X	
Disturbance History		CWE06 96WA			X	
Riparian Reserves	96WA PJ				X	

INDICATORS	ENVIRONMENTAL BASELINE 7th Field: Long John Creek			EFFECTS OF THE ACTIONS 7th Field: Long John Creek		
	PROPERLY FUNCTIONING	AT RISK	NOT PROP FUNCTIONING	RESTORE	MAINTAIN	DEGRADE
Water Quality Temperature*	TEMP 02				X	
Sediment/Turbidity		CWE06 96WA DB			X	
Chemical Contam	PJ				X	
Habitat Access Physical Barrier	96WA				X	
Habitat Elements Substrate		CWE06 96WA DB			X	
LWD		PJ 96WA DB			X	
Pool Frequency			DB 96WA PJ		X	
Pool Quality			DB 96WA PJ		X	
Off-channel Habitat		DB 96WA PJ			X	
Refugia	96WA PJ				X	
Channel Cond & Dyn W/D Ratio*	PJ				X	
Streambank Cond.		96WA			X	
Floodplain Cond.	96WA				X	
Flow /Hydrology Peak/Base Flow	CWE06				X	
Drainage Net Incrs		CWE98			X	
Watershed Cond. Road Dens/Loc		CWE98			X	
Disturbance History		CWE06 96WA			X	
Riparian Reserves	96WA PJ				X	

INDICATORS	ENVIRONMENTAL BASELINE 5th Field: Beaver Creek			EFFECTS OF THE ACTIONS 5th Field: Beaver Creek		
	PROPERLY FUNCTIONING	AT RISK	NOT PROP FUNCTIONING	RESTORE	MAINTAIN	DEGRADE
Water Quality Temperature		96WA DB			X	
Sediment		96WA CWE06 DB			X	
Chemical Contamination	PJ				X	
Habitat Access Physical Barrier	PJ				X	
Habitat Elements Substrate			DB CWE06 96WA		X	
LWD		96WA DB			X	
Pool Frequency			96WA		X	
Pool Quality			96WA		X	
Off-channel Habitat		PJ			X	
Refugia		PJ			X	
Channel Cond & Dyn W/D Ratio		PJ			X	
Streambank Cond.		PJ			X	
Floodplain Cond.		PJ			X	
Flow /Hydrology Peak/Base Flow			PJ CWE06		X	
Drainage Net Increase			PJ CWE98		X	
Watershed Cond. Road Dens/Location			96WA CWE98		X	
Disturbance History		CWE06 96WA			X	
Riparian Reserves		96WA PJ			X	

Appendix E: Life History and Biological Requirements of Pacific Salmonids

Coho Salmon

General life history information and biological requirements of Southern Oregon/Northern California Coastal (SONCC) coho salmon have been described in various documents (Hassler 1987; Sandercock 1991; Weitkamp et al. 1995) as well as NOAA-Fisheries' final rule listing SONCC coho salmon (May 6, 1997; 62 FR 24588). Adult coho salmon typically enter rivers between September and February. However, the National Academy of Sciences, 2002 report offers more specific information for the Klamath River mainstem:

Coho salmon enter the main stem of the Klamath River for spawning typically in their third year, primarily between October and December. Over most of this interval, main-stem flows below Iron Gate Dam often are high (ca. 2500-3000 cfs: NMFS 2001). Thus, standard methods for observing and counting spawning fish are not easily applied, and the size of the spawning population is unknown. Approximations put the entire ESU at about 10,000 spawning coho salmon of non-hatchery origin per year (Weitkamp et al. 1995), of which only a small portion is associated with the Klamath Basin, where several important tributary runs have been reduced to a handful of individuals (NMFS 2001)… Although a minor amount of spawning and growth may occur in the main stem, the main stem serves adults primarily as a migration route (http://www.klamathbasincrisis.org/articles/NAS-Report/nas_chapter3-coho.htm).

Spawning occurs from November to January (Hassler 1987) in the tributaries to the Klamath River, but occasionally as late as February or March (Weitkamp et al. 1995). Coho salmon eggs incubate for 35-50 days between November and March. Successful incubation depends on several factors including dissolved oxygen levels, temperature, substrate size, amount of fine sediment, and water velocity. Fry start emerging from the gravel two to three weeks after hatching and move into shallow areas with vegetative or other cover. As fry grow larger, they disperse up or downstream. In summer, coho salmon fry prefer pools or other slower velocity areas such as alcoves, with woody debris or overhanging vegetation. Juvenile coho salmon over-winter in slow water habitat with cover as well. Juveniles may rear in fresh water for up to 15 months then migrate to the ocean as smolts from March to June (Weitkamp *et al.* 1995). Coho salmon adults typically spend two years in the ocean before returning to their natal streams to spawn as three-year olds.

Available historical and most recent published coho salmon abundance information are summarized in the NOAA-Fisheries coast-wide status review (Good and Waples 2005). The rivers and tributaries in the California portion of this ESU were estimated to have average recent runs of 7,080 natural spawners and 17,156 hatchery returns, with 4,480 identified as native fish occurring in tributaries having little history of supplementation with non-native fish. However, limited information exists regarding coho salmon abundance in the Klamath River basin. What information exists [CDFG unpublished

data; U.S. Fish and Wildlife Service (USFWS) unpublished data] suggests adult populations are small to nonexistent in most years. The decline of SONCC coho salmon across the ESU is not the result of one single factor, but rather a number of natural and anthropogenic factors that include dam construction, instream flow alterations; land use activities coupled with large flood events, fish harvest and hatchery effects.

The KNF refined the GIS steelhead trout distribution layer to determine coho salmon habitat CH/EFH, using field observation to determine occupied habitat. Based on the range of steelhead mapped by the KNF, coho salmon designated CH/EFH occurs in the Action Area as shown in Table 4. In the anadromous fish bearing streams that may be affected by PEs, coho salmon occur in the mainstem of Beaver Creek, the lower 2.53 miles of Grouse Creek, the lower 1.42 miles of Long John Creek, and in the lower 1.75 miles of Cow Creek.

Chinook Salmon

The following information was excerpted or summarized from NMFS status review of Chinook salmon (Meyers *et al.* 1998). Chinook salmon mature between 2 and 6+ years of age (Meyers *et al.* 1998). Fall-run Chinook salmon enter freshwater at an advanced stage of maturity, move rapidly to their spawning areas on the mainstem or lower tributaries of the rivers, and spawn within a few days or weeks of freshwater entry (Healey 1991). Post-emergent fry seek out shallow, nearshore areas with slow current and good cover, and begin feeding on small terrestrial and aquatic insects and aquatic crustaceans. The optimum temperature range for rearing Chinook salmon fry is 50°F to 55°F (Rich 1997, Seymour 1956) and for fingerlings is 55°F to 60°F (Rich 1997). In preparation for their entry into a saline environment, juvenile salmon undergo physiological transformations known as smoltification that adapt them for their transition to salt water. The optimal thermal range for Chinook salmon during smoltification and seaward migration is 50°F to 55°F (Rich 1997). Chinook salmon spend between one and four years in the ocean before returning to their natal streams to spawn (Meyers *et al*. 1998). Chinook salmon addressed in this document exhibit an ocean-type life history, and smolts out-migrate predominantly as subyearlings, generally during April through July. Chinook salmon spend between 2 and 5 years in the ocean (Healey 1991), before returning to freshwater to spawn. Some Chinook salmon return from the ocean to spawn one or more years before full-sized adults return.

The UKT ESU includes fall- and spring-run Chinook salmon in the Klamath and Trinity River Basin upstream of the confluence of the Klamath and Trinity rivers. Historically, spring-run Chinook salmon were probably the predominate run. This ESU still retains several distinct spring-run populations, albeit at much reduced abundance levels. Fish from this ESU exhibit an ocean-type life history; however genetically and physically, these fish are quite distinct from coastal and Central Valley Chinook salmon ESUs. Genetic analysis indicated that this ESU form a unique group that is quite distinctive compared to neighboring ESUs. The majority of spring- and fall-run fish emigrate to the marine environment primarily as subyearlings, but have a significant proportion of yearling smolts. Recoveries of coded wire tags indicate that both runs have a coastal distribution off the California and Oregon coasts. The 1999 adult fall-run Chinook

salmon run into the Klamath River system was estimated at 52,538 fish, about 55% of the 1978-1998 average of 95,202 adults. The grilse run was estimated at 17,463 fish, about 91% of the 1978-1998 average of 19,232 fish. Using this figure, NMFS (1999) Projected an in-river harvest of 18,800 fish (including 1,300 unlanded mortalities), leaving 48,600 adults to spawn naturally or in hatcheries.

Fish surveys information is provided for Beaver Creek to show variability in run sizes over the years surveyed (data from CDFG records and KNF records). The number of fish counted are variable (depending on year class, disease, ocean and stream conditions, annual precipitation, and stochastic events) ranging from 6 to 400 redds counted, with no specific trend noted. For example, there were only 48 fish in 1984, but in 1985 there were 400. In 2005 and 2006, fall Chinook surveys were conducted in Beaver Creek: Three fall Chinook redds (& three live Chinooks) were observed in Beaver Creek (KNF surveys records) in 2005. Twenty four fall Chinook redds (& no live Chinooks) were observed in Beaver Creek in 2006.

California Department of Fish and Game (calfish.org)

Begin Date	End Date	Year	Times Surveyed	Count	Sampling Method	Calculation Method	Count Comment
10/1/79	12/15/79	79		6	Ground	Actual Physical Counts	This tributary was examined during the fall spawning season. Spawning was negligible.
8/23/82	8/24/82	82			N/A	N/A	During a snorkeling survey from the West Fk downstream to the mouth (6 Miles) July, 10 chinook were observed and presumed to have been early fall run. Later in the season salmon were observed spawning 12 miles upstream in Cow Creek near the state line.
10/19/1983	11/7/1983	1983	4	103	Ground	Actual Physical Counts	Adult 97, grilse 6.
10/26/1984	11/14/1984	1984	4	48	Ground	Actual Physical Counts	Observed 45 adult and three grilse carcasses. Too few tags were recovered for a valid Schaefer estimate.
10/31/1985	11/21/1985	1985	5	400	Ground	Actual Physical Counts	Adult 347, grilse 53.

KNF Records –Beaver Creek, Fall Chinook Surveys

Year	Week Surveyed	# Adults	# Redds	Miles Surveyed	KM Surveyed	Data Source	Reach Surveyed	# Redds per KM
1981		42	16			YFG-96-01		
1982		562				YFG-96-01		
1983		420				YFG-96-01		
1984		275				YFG-96-01		

KNF Records –Beaver Creek, Fall Chinook Surveys								
Year	Week Surveyed	# Adults	# Redds	Miles Surveyed	KM Surveyed	Data Source	Reach Surveyed	# Redds per KM
1985		1505				YFG-96-01		
1986		1673				YFG-96-01		
1987		1359				YFG-96-01		
1988		538				YFG-96-01		
1989		140				YFG-96-01		
1990		2				YFG-96-01		
1991		2				YFG-96-01		
1992		16				YFG-96-01		
1993		346				YFG-96-01		
1994		260				YFG-96-01		
1995		817				YFG-96-01		
1996	No survey							
1997	No survey							
1998	Oct 28	103	105			SCRD-98-01	Fire house to Hwy 96. Mannhalter to Soda Creek 2 carcasses also seen	
1999	Nov 3	50	42			SCRD-99-01	Soda Springs to mouth 16 carcasses also seen	
2000			84			KNF-00-01	Campground to mouth	

Steelhead

Biologically, steelhead can be divided into two basic run-types, based on the state of sexual maturity at the time of river entry and duration of spawning migration (Burgner *et al*. 1992). The stream-maturing type, or summer steelhead, enters fresh water in a

sexually immature condition and requires several months in freshwater to mature and spawn. The ocean-maturing type, or winter steelhead, enters fresh water with well-developed gonads and spawns shortly after river entry (August 9, 1996, 61 FR 41542; Barnhart 1986). South of Cape Blanco, Oregon, summer steelhead are known to occur in the Rogue, Smith, Klamath, Trinity, Mad, and Eel rivers, and in Redwood Creek (Busby *et al.* 1996).

Winter steelhead enter fresh water between November and April in the Pacific Northwest (Busby *et al*. 1996; Nickelson *et al*. 1992), migrate to spawning areas, and then spawn, generally in April and May (Barnhart 1986). Some adults, however, do not enter some coastal streams until spring, just before spawning (Meehan 1991). Steelhead require a minimum depth of 0.18 m and a maximum velocity of 2.44 m/s for active upstream migration (Smith 1973). Spawning and initial rearing of juvenile steelhead generally take place in small, moderate-gradient (generally 3-5%) tributary streams (Nickelson *et al*. 1992). A minimum depth of 0.18 m, water velocity of 0.30-0.91 m/s (Smith 1973), and clean substrate 0.6-10.2 cm (Nickelson *et al*. 1992) are required for spawning. Steelhead spawn in 3.9-9.4°C water (Bell 1986). Depending on water temperature, steelhead eggs may incubate for 1.5 to 4 months (August 9, 1996, 61 FR 41542) before hatching, generally between February and June (Bell 1986). After two to three weeks, in late spring, and following yolk sac absorption, alevins emerge from the gravel and begin actively feeding. After emerging from the gravel, fry usually inhabit shallow water along banks of perennial streams. Fry occupy stream margins (Nickelson *et al*. 1992). Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small wood. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson *et al*. 1992). Steelhead prefer water temperatures ranging from 12-15°C (Reeves *et al*. 1987). Juveniles live in freshwater from one to four years (usually two years in the California ESUs), then smolt and migrate to the ocean in March and April (Barnhart 1986). Winter steelhead populations generally smolt after two years in fresh water (Busby *et al*. 1996).

The KMP steelhead ESU occurs in coastal river basins between the Elk River in Oregon and the Klamath River in California, inclusive. The KMP steelhead ESU contains populations of both winter and summer steelhead. The Rogue and Klamath River basins are distinctive in that they are two of the few basins producing “half-pounder” steelhead. In 2001, NOAA-Fisheries reconsidered the status of KMP steelhead under the ESA (66 FR 17845, April 4, 2001) and determined that KMP steelhead do not warrant listing as threatened or endangered at this time.

In California, the largest proportions of naturally spawning hatchery fish are believed to occur in the Trinity River, where estimates from 1990s range from 20-70 percent hatchery. These estimates apply to fall-run fish. Because the hatchery program in the Trinity River basin propagates mostly fall-run fish, natural spawners in this basin that return at other times are believed to be predominantly of natural origin. Counts at Willow Creek weir provide an estimate of about 2000 natural origin fall-run spawners per year. The Willow Creek weir samples steelhead only over a period of about 3 months during the fall run and thus provides no information about

other runs in the basin. CDFG biologists estimated natural escapement in the California portion of the ESU to be approximately 30,000-50,000 adults per year.

In Beaver Creek, surveys for steelhead trout are variable, with the number ranging from 0 to 57 and the largest numbers counted in 1989 and 1990. Summer steelhead surveys have been conducted on tributary streams to the middle Klamath River since 1988. Summer steelhead surveys have not been conducted on Beaver Creek since summer steelhead are not present in this stream system.

Begin Date	End Date	Year	Count	Sampling Method	Calculation Method	Count Comment
1/1/1989	12/31/1989	1989	57	Aerial (unspecified aircraft)	Actual Physical Counts	Grouse Cr to Mouth(17.9 Km): Month surveyed: 3, 4, 5
1/1/1990	12/31/1990	1990	57	Aerial (unspecified aircraft)	Actual Physical Counts	Grouse Cr to Mouth(17.9 Km): Month surveyed: 3, 4, 5
1/1/1991	12/31/1991	1991	3	Aerial (unspecified aircraft)	Actual Physical Counts	Grouse Cr to Mouth(17.9 Km): Month surveyed: 3, 4
1/1/1992	12/31/1992	1992	2	Aerial (unspecified aircraft)	Actual Physical Counts	Grouse Cr to Mouth(17.9 Km): Month surveyed: 3, 4, 5
1/1/1993	12/31/1993	1993	0	Aerial (unspecified aircraft)	Actual Physical Counts	Grouse Cr to Mouth(17.9 Km): Month surveyed: 3, 4, 5

Designated Critical Habitat for coho salmon

Designated CH for coho salmon encompasses accessible reaches of all rivers (including estuarine areas and tributaries) between the Mattole River in California and the Elk River in Oregon, inclusive (May 5, 1999, 64 FR 24049). The area described in the final rule represented the current freshwater and estuarine range of coho salmon. Land ownership patterns within the coho salmon ESU analyzed in this document and spanning southern Oregon and northern California are 53% private lands; 36% Federal lands; 10% State and local lands; and 1% Tribal lands. The Forest Service manages about 1,680,000 acres (90.6%) of land within the Forest boundaries and about 200,000 acres (9.4%) of land are within the Forest boundaries but in other ownership (LRMP, Page 3-12).

A hard copy map of Alternative 2 project activities included with this document shows the distribution of anadromous fish within the Action Area. This map is based on steelhead distribution with site-specific changes made per professional fisheries biologist knowledge, stream surveys, or CDFG data, as indicated in the Action Area discussion. The KNF recognizes that coho and Chinook salmon may not occupy the same waters as steelhead because of the difference in jumping abilities. The maximum jumping height for coho is 2.2 meters; Chinook salmon is 2.4 meters; and steelhead is 3.4 meters (Meehan, 1991). Therefore, steelhead can access more habitat than coho or Chinook salmon. The use of the KNF steelhead distribution layer to define coho salmon CH is, therefore, recognized as a conservative approach for assessment of effects to coho salmon CH.

APPENDIX F: Background information on Analyses related to Sediment, Flow, and Disturbance Indicators

The Forest cumulative watershed effects (CWE) model evaluates the difference between estimated current watershed conditions and predicted post-action watershed conditions. There are three elements to this model: Surface erosion and sediment delivery (USLE); Sediment delivery from mass wasting (GEO); and the Disturbance index (ERA). USLE is an index of predicted sediment delivery for the first year following project completion. GEO estimates sediment delivery for the first decade after project completion. ERA provides an accounting system for tracking disturbances that affect watershed processes, in particular changes in peak runoff flows influenced by clearing and compaction. Together with project specific conditions and research findings, the modeled results are discussed under the Sediment-Turbidity-Substrate character, Change in Peak/Base Flow, and Disturbance Indicators. (See Appendix D for the summary of existing environment and effects, with data sources identified.)

The USLE and GEO models estimate sediment delivery by considering various factors such as disturbance type and land sensitivity. The disturbance index for the watershed (ERA Model) gives and indication of relative risk of channel widening or scour from changes in peak flow magnitude or frequency. As disturbances to the land surfaces and stream channels in a watershed occur over space and time, the risk of initiating or contributing to existing adverse cumulative watershed effects becomes a concern. A continuum exists from lower to higher risk of adverse watershed effects. Each model has inference points that are intended to represent the center of that risk continuum. The inference points do not represent the exact point when cumulative watershed effects will occur, but indicate increasing susceptibility to significant adverse cumulative watershed effects. **Below a risk ratio of 1.0, watershed cumulative effects have been rarely expressed, but as the ratio exceeds 1.0, a cautious approach is taken. This includes a closer field examination to assess the probability of effects from particular actions based on actual watershed conditions and trends.** If a project's expected effect on water quality is above the inference point, the risk ratio will be above 1.0. A comparison of the current modeled risk ratio to the risk ratio that is expected to result after project implementation provides a basis for analyzing the project's risk of adversely effecting watershed conditions. Validation monitoring of the cumulative watershed effects models has been conducted (Elder 2006).

Cumulative Watershed Effects (CWE) for the Project is assessed quantitatively and qualitatively. Recent Past Projects (completed or near completion) are 1) Tennis Thin, and 2) Colestine Fuels Reduction Project. Present Projects besides Mt. Ashland LSR (in early implementation phase, or will soon be) are 1) Mt. Ashland Ski Area Expansion. Foreseeable Future Actions (will be implemented in 2007 or later, does not have signed NEPA) 1) Ashland Forest Resiliency Project. The CWE quantitative analysis also took into account natural events such as the 1987 fires, roadside salvage, changes in road maintenance level, underburning outside RRs, hand grubbing, extracting rock from quarries, chainsaw release around planted seedlings, improving existing water

developments, and pre-commercial thinning and underburning projects were considered qualitatively when rating the baseline condition and effects analyses. These actions are not included in the quantitative analysis because past monitoring has found these types of actions resulted in minute watershed effects that do not extend beyond the treatment areas.

Much of the CWE assessment of sedimentation and hydrologic runoff altercation risk incorporates model-supported information. Three models accumulate disturbances over time and within the analysis area relative to land sensitivity. As disturbances increase (and recover) over time and space, at some point, the risk of initiating or contributing to existing adverse cumulative watershed impacts may become a cause for concern. These model-specific levels are defined as "inference points" (or thresholds of concern" – TOC). These points or range of values 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 risk. 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 indicators of watershed degradation will occur.

Inference point values for each model have been identified at the following levels: (1) surface erosion (USLE) model output value = 800% background, (2) mass-wasting (GEO) model value = 200% over background, and (3) runoff risk (ERA/TOC) model value = watersheds' TOC value. Risk ratio values represent a continuum of, and serve as, indicators of relative watershed condition. Risk ratios are calculated by dividing model values by an inference point value. For the mass wasting (GEO) and surface erosion (USLE) models, existing levels are shown as 'percent over background', which is a measure of accelerated sedimentation above 'recovered' or pristine watershed conditions. The ratio of existing or proposed ERA to TOC is used to assess the risk of altering hydrologic runoff. For example, a watershed with GEO model-estimated sediment delivery from mass wasting of 100% over background would yield a landslide risk ratio of .50 [100% divided by 200%]. "Background" is a watershed's natural sediment production and delivery, or sediment delivery, assuming no disturbance. "Background" includes lands with (1) old timber harvest units (>10 years), (2) old fire (>10 years), (3) young fire (<10 years), low burn intensity, (4) young harvest (<10 years), low impact prescriptions, and (5) "pristine". Land with disturbances that have fully recovered, and completely undisturbed land are not included (Elder 2006).

The effects from Project activities were qualitatively analyzed through map, airphoto, and field review and consideration of the extent and intensity of ground disturbance. The modeled results are discussed under the Sediment/Turbidity/Substrate character, Change in Peak/Base Flow, and Disturbance Indicators, and consider all parts of the proposed action that affect these indicators. The model results are clarified and verified through field and map review in order to make final conclusion of potential effects to anadromous fish and/or their habitat. (See Appendix D for Summary of existing environment and effects, with data sources identified.).

Probability, Magnitude, and Frequency: The sediment rates predicted by the surface erosion model are realized during a six-hour maximum rainfall with a two-year recurrence interval. The probability of this event occurring is 1 in 2 for any given year. For the mass-wasting model, the predicted sediment volumes from landsliding are associated with a flood event with a recurrence interval of 10 – 20 years (or a probability of 10% to 5% in any given year). The index for magnitude of effects on surface runoff is reflected through ERA, which is more difficult to tie to probability of occurrence because it predicts relative changes in average level of watershed disturbance. Runoff risk can be interpreted as increasing, for any given rainfall recurrence interval, with increasing ERA. The Cumulative Watershed Effect Analysis for the Mt Ashland LSR Habitat Restoration and Fuels Reduction Project (Elder 2006) details the modeling process and includes spreadsheets of outputs for each of the models.

Equivalent Roaded Acreage/Threshold of Concern (ERA/TOC) was used to determine current conditions for peak flow in the four 7th field watersheds and Beaver Creek 5th-field watershed. ERA/TOC provides a simplified accounting system for tracking disturbances that affect watershed processes, in particular, estimates in changes of peak runoff flows influenced by disturbance activities. This model is not intended to be a process-based sediment model; however it does provide an indicator of watershed conditions. This model compares the current level of disturbance within a given watershed (expressed as % ERA) with the theoretical maximum disturbance level acceptable (expressed as % TOC).

ERA/TOC (or “risk ratio”) estimates the level of hydrological disturbance or relative risk of increased peak flows and consequent potential for channel alteration and general adverse watershed impacts. TOC is calculated based on channel sensitivity, beneficial uses, soil erodibility, hydrologic response, and slope stability. The TOC does not represent the exact point at which cumulative watershed effects will occur. Rather, it serves as a “yellow flag” indicator of increasing susceptibility for significant adverse cumulative effects occurring in a watershed. Susceptibility of CWE generally increases from low to high as the level of land disturbing activities increase towards or past the TOC (FS Handbook, 2509.22-23.63a).

Appendix G: Proposed Action -Details on Project Elements

Hauling Description:

Logs are hauled on standard log trucks on Forest System roads from landing locations to nearby county roads or state highways where they are transported to various processing mills.

Thinning and Yarding Method Descriptions

Thinning Descriptions:

Thinning is an intermediate harvest treatment applied to overstocked stands to reduce density of trees. Thinning typically harvests current mortality and slower growing conifers that may die before the next logical harvest entry. Tree selection will emphasize retention of healthy, vigorous, disease and damage free trees with live crown ratios greater than 40% and constant or increasing height growth. Post harvest spacing will vary based on species, site quality, aspect and elevation. Generally, pine species will be preferred as original stands in this area were pine dominated and will result in more fire resilient stands for the future.

Variable Density Thinning of Trees Greater than 9 Inches DBH - The silvicultural prescriptions are designed to promote the development of late-successional forest habitat while retaining any late-successional attributes the stands may currently exhibit. All stands would receive an intermediate harvest prescription. A variable density thinning from below would take place with modifications for the stands topographic aspect, slope position, species composition, and relationship to other key habitat features (refer to Table G-1, General Thinning Prescriptions for Trees Greater Than 9 Inches DBH). Trees in the smaller size classes (three to twenty inches in diameter) would be removed; the removal of white fir would be emphasized.

Small Diameter Thinning of Trees Less Than 9 Inches DBH— These treatments would be applied to the 1-9 inch diameter trees found in early-successional stands with natural regeneration (outside of the variable density thinning stands described above). Some stands currently have a young component of overstocked trees that are growing and developing slowly due to inter-tree competition. Thinning these areas would increase growth to provide for larger trees in a shorter period of time (DeBell and others, 1997). Spacing will be somewhat variable depending on species, aspect, site quality and slope position. Thinning is done by crews using chainsaws. Cut material is usually lopped and scattered to decompose, or handpiled and burned.

Weeding and Cleaning of Understory Trees—These treatments would be applied to the 1—9 inch DBH trees found in the lower layer of variable-density thinning stands mentioned above. This is similar to small diameter thinning but there is no implied spacing and pertains more to scattered individuals and clumps of understory trees that are not healthy and thrifty. It involves the removal of small (one to nine inches in diameter)

trees of poor vigor and form, or diseased trees that will not develop into a larger healthy tree in the future. Also small trees of less desired species would be removed. It is not a technique to eliminate disease within a stand but rather to lessen its impacts. This treatment removes small trees from an already disease infected stand, reducing the number of trees getting infected and concentrating growth on the remaining trees in the stand. Ladder fuels are reduced too. This work would usually be done by crews using chainsaws but could be accomplished mechanically in those stands planned for tractor or

	HABITAT RESTORATION/PROMOTION SILVICULTURAL PRESCRIPTIONS					
	Aspen				**Thinning**	
	Ponderosa Pine				**Thinning**	
	Douglas Fir				**Thinning**	
	Aspen/Douglas Fir				**Thinning**	
	Aspen/Ponderosa Pine				**Thinning**	
	DEFENSIBLE FUEL PROFILE ZONE SILVICULTURAL PRESCRIPTION					
	Wildlife				**Thinning**	

mechanized harvesting operations. Cut material would be lopped and scattered, handpiled and burned or removed to a designated disposal area.

Defensible Fuel Profile Zones (DFPZ) - DFPZs are a component of each action alternative. There are five zones identified along major ridges. The average width of the DFPZs is roughly ¼ mile. The objective of the fuel modification within the DFPZ is to create zones that are resistant to crown fires on upper slopes and along prominent ridges. Active crown fires moving into these zones would drop to the round and become surface fires. The DFPZ is a zone where surface fuels are reduced to levels that generate low fireline intensity; ladder fuels are reduced to limit potential for spread into crowns; canopy fuels are reduced to limit potential spread between crowns and to maintain an overstory of large healthy trees, minimizing the potential for competition induced mortality and creation of snags.

Table G-1, General Thinning Prescriptions for Trees Greater Than 9 Inches DBH.

Definitions: SDI=stand density index; BA=Basal Area; DF=Douglas-fir; SP=sugar pine; PP/JP=ponderosa pine/Jeffrey pine; IC=incense cedar; WF=white fir; DBH=diameter at breast height; RF=red fir.

Yarding Descriptions:

Tractor Yarding

Tractor yarding is applied to flat or gently sloping ground. There are practical limitations to slopes that can be tractor-yarded: considered to be about 40 percent slope. The Projects' tractor yarding operations will be limited to slopes less than 35%. Tractors can be either rigid-tracked or flexible-tracked machines, and are used to move logs from felling site to landings.

Tractor Endlining

Logs will be yarded up to the tractor from downslope using a winch and cable on the tractor. The logs will then be transported to landings using tractor yarding.

Skyline Yarding

Skyline yarding/logging utilizes a cableway or skyline, to suspend between two points to serve as a track for a block or carriage. Skylines are used to yard timber from difficult sites with very little soil disturbance and are an improvement over the high-lead method. Appropriately rigged skylines also yard logs laterally to the skyline corridor and logs are then moved along the skyline either completely suspended or with one end on the ground. Logs can be moved either up- or down-hill. Skyline systems cause less soil disturbance on a given site than either ground-based or high-lead systems.

Helicopter Logging

Helicopter logging is an aerial system of moving logs from harvest areas to landings and typically accounts for only a smaller portion of harvest methods used because it is more expensive. Helicopter logging is advantageous in difficult terrain and can move large volumes of timber quickly.

Mechanical Harvester

A mechanical harvester is used to harvest trees from sites that would otherwise be suitable for tractor yarding but the slopes are too steep for a tractor to operate. The slopes of these units are at least 35% but less than 46%. An advantage of a mechanical harvester is that individual fellers are not needed but the machine is limited by the size of the trees in the unit (generally a

maximum of 16” dbh).

Combination Ground Based Systems

These units are a combination of mechanical harvester and tractor. There are flatter areas within these units where the slopes are <35%, which will permit a tractor to operate.

Table G-2. Summary of Forest Restoration Project Activities by 7th and 5th field watershed scales - Alternative 2.

7th and 5th Field **watersheds**	**Watershed Area In Acres**	**Cable Yarding Acres**	**Tractor Yarding Acres**	**Tractor Endline Acres**	**Helicopter Yarding Acres**	**Mechanical Harvester Acres**	**CGB Acres**	**Total Thinning acres**
Summarized by 7th fields								
Long John Creek	**5,679**	**722**	**256**	**38**	**363**	**191**	**205**	**1775**
Beaver/Grouse Creek	**6,497**	**645**	**88**	**3**	**611**	**17**	**139**	**1503**
Upper Cow Creek	**8,127**	**105**	**18**	**0**	**14**	**11**	**51**	**199**
Deer-Beaver Creek	**2,708**	**107**	**23**	**0**	**19**	**0**	**55**	**204**
Headwaters Cottonwood Creek	**4,814**	**23**	**2**	**0**	**64**	**0**	**105**	**194**
TOTALS for 7th fields	**35,197**	**1602**	**387**	**41**	**1071**	**219**	**555**	**3875**
Totals for Beaver Creek and Cottonwood Creek 5th fields								
Beaver Creek	**69,664**	**1579**	**385**	**41**	**1007**	**219**	**450**	**3681**
Cottonwood Creek	**63,563**	**23**	**2**	**0**	**64**	**0**	**105**	**194**
"Entire Analysis Area" (Beaver Creek 5th field watershed, plus Cottonwood Creek 5th field watershed.	**133,227**	**1602**	**387**	**41**	**1071**	**219**	**555**	**3875**

Table G-3. Summary of Forest Restoration Project Activities by 7th & 5th field watersheds - Alternative 4

7th and 5th Field **watersheds**	**Watershed Area In Acres**	**Cable Yarding Acres**	**Tractor Yarding Acres**	**Tractor Endline Acres**	**Helicopter Yarding Acres**	**Mechanical Harvester Acres**	**CGB Acres**	**Total Thinning acres**
Summarized by 7th field watersheds:								
Long John Creek	**5,679**	**692**	**147**	**14**	**241**	**159**	**210**	**1463**
Beaver/Grouse Creek	**6,497**	**648**	**30**	**3**	**503**	**17**	**124**	**1325**
Upper Cow Creek	**8,127**	**82**	**15**	**0**	**36**	**11**	**48**	**192**
Deer-Beaver Creek	**2,708**	**107**	**26**	**0**	**19**	**0**	**55**	**207**
Headwaters Cottonwood Creek	**4,814**	**23**	**2**	**0**	**62**	**0**	**104**	**191**
TOTALS for 7th field watersheds	**35,197**	**1552**	**220**	**17**	**861**	**187**	**541**	**3354**
Summarized for 5th field watersheds:								
Beaver Creek	**69,664**	**1529**	**218**	**17**	**799**	**187**	**437**	**3187**
Cottonwood Creek	**63,563**	**23**	**2**	**0**	**62**	**0**	**104**	**191**
"Entire Analysis Area" (Beaver Creek 5th field watershed, plus Cottonwood Creek 5th field watershed.	**133,227**	**1552**	**220**	**17**	**861**	**187**	**541**	**3378**

Table G-4. Summary of Forest Restoration Project Activities by 7th & 5th field watersheds - Alternative 5								
7th and 5th Field **watersheds**	**Watershed Area In Acres**	**Cable Yarding Acres**	**Tractor Yarding Acres**	**Tractor Endline Acres**	**Helicopter Yarding Acres**	**Mechanical Harvester Acres**	**CGB Acres**	**Total Thinning acres**
Summarized by 7th fields								
Long John Creek	**5,679**	**621**	**252**	**38**	**452**	**178**	**184**	**1725**
Beaver/Grouse Creek	**6,497**	**664**	**42**	**3**	**626**	**17**	**110**	**1462**
Upper Cow Creek	**8,127**	**61**	**15**	**0**	**83**	**0**	**41**	**200**
Deer-Beaver Creek	**2,708**	**102**	**24**	**0**	**19**	**0**	**55**	**200**
Headwaters Cottonwood Creek	**4,814**	**23**	**2**	**0**	**65**	**0**	**104**	**194**
TOTALS for 7th fields	**35,197**	**1471**	**335**	**41**	**1245**	**195**	**494**	**3781**
Totals for 5th field watersheds								
Beaver Creek	**69,664**	**1448**	**333**	**41**	**1180**	**195**	**390**	**3587**
Cottonwood Creek	**63,563**	**23**	**2**	**0**	**65**	**0**	**104**	**194**
"Entire Analysis Area" (Beaver Creek 5th field watershed, plus Cottonwood Creek 5th field watershed.	**133,227**	**1471**	**335**	**41**	**1245**	**195**	**494**	**3781**

Table G-5. Summary of Road Related Project Activities by 7th and 5th field watershed scales - Alternative 4

7th and 5th Field watersheds	Proposed Temporary Road Construction and Decommissioning (miles)	Decomming Existing Roads (miles)	New Landing Construction (acres	Existing Landings (acres)	Water Drafting Sites	Temp Road Stream Crossings to be Decommed	Existing Road Stream Crossings to be Decommed
Summarized by 7th field watersheds							
Long John Creek	**2.44**	**3.75**	**9**	**3**	**2**	**1**	**7**
Beaver/Grouse Creek	**0.84**	**0.86**	**8.5**	**.5**	**2**	**0**	**0**
Upper Cow Creek	**0.90**	**0.38**	**3.5**	**0**	**0**	**0**	**0**
Deer-Beaver Creek	**0.12**	**0.45**	**1.5**	**0**	**1***	**0**	**0**
Headwaters Cottonwood Creek	**0.38**	**0.00**	**0**	**0**	**0**	**0**	**0**
TOTALS for 7th fields	**4.96**	**5.44**	**22.5**	**3.5**	**5**	**1**	**7**
Summarized by 5th field watersheds							
Beaver Creek	**4.58**	**5.44**	**22.5**	**3.5**	**5**	**1**	**7**
Cottonwood Creek	**0.38**	**0.00**	**0**	**0**	**0**	**0**	**0**
"Entire Analysis Area" (Beaver Creek 5th field watershed, plus Cottonwood Creek 5th field watershed.	**4.96**	**5.44**	**22.5**	**3.5**	**5**	**1**	**7**

Table G-6. Summary of Road Related Project Activities by 7th and 5th field watershed scales - Alternative 5

7th and 5th Field **watersheds**	**Proposed Temporary Road Construction and Decommissioning (miles)**	**Decomming Existing Roads (miles)**	**New Landing Construction (acres**	**Existing Landings (acres)**	**Water Drafting Sites**	**Temp Road Stream Crossings to be Decommed**	**Existing Road Stream Crossings to be Decommed**
Summarized by 7th field watersheds							
Long John Creek	**0.86**	**5.52**	**7.5**	**3**	**2**	**1**	**10**
Beaver/Grouse Creek	**2.05**	**1.57**	**8.5**	**.5**	**2**	**0**	**0**
Upper Cow Creek	**0.62**	**0.38**	**3.5**	**0**	**0**	**0**	**0**
Deer-Beaver Creek	**0.79**	**0.45**	**1.5**	**0**	**1***	**0**	**0**
Headwaters Cottonwood Creek	**0.00**	**0.00**	**0**	**0**	**0**	**0**	**0**
TOTALS for 7th fields	**2.27**	**7.92**	**21**	**3.5**	**5**	**1**	**10**
Totals for 5th field watersheds							
Beaver Creek	**2.27**	**7.92**	**21**	**3.5**	**5**	**1**	**10**
Cottonwood Creek	**0.00**	**7.92**	**0**	**0**	**0**	**0**	**0**
"Entire Analysis Area" (Beaver Creek 5th field watershed, plus Cottonwood Creek 5th field watershed.	**2.27**	**7.92**	**21**	**3.5**	**5**	**1**	**10**

Table G-7 Road Miles and Road Density – Alternative 4					
Watershed	**Road Miles Pre-project**	**Road Density Pre-Project (# road miles per watershed miles^2)**	**Road Miles (post-project) short term change**	**Road Density (post-Project) short term change (# road miles per watershed miles^2)**	**Road Miles Post-project, long term change**
Beaver/Grouse Creek (7th Field)	42.1	4.15	41.06	4.05	41.06 (reduction)
Long John Creek (7th field)	38.5	4.34	34.04	3.84	34.04 (reduction)
Upper Cow Creek (7th field)	48.4	3.81	48.02	3.78	48.02 (reduction)
Deer-Beaver Creek (7th field)	20.1	4.75	19.65	4.64	19.65 (reduction)

Table G-8 Road Miles and Road Density – Alternative 5					
Watershed	**Road Miles Pre-project**	**Road Density Pre-Project (# road miles per watershed miles^2)**	**Road Miles (post-project) short term change**	**Road Density (post-Project) short term change (# road miles per watershed miles^2)**	**Road Miles Post-project, long term change**
Beaver/Grouse Creek (7th Field)	42.1	4.15	40.99	4.04	40.99 (reduction)
Long John Creek (7th field)	38.5	4.34	33.1	3.73	33.1 (reduction)
Upper Cow Creek (7th field)	48.4	3.81	48.02	3.78	48.02 (reduction)
Deer-Beaver Creek (7th field)	20.1	4.75	19.65	4.64	19.65 (reduction)

Table G-9. Percent of 7th and 5th Field Watersheds Impacted By Project Activities - Alternative 2.

7th and 5th Field **watersheds**	**Watershed Area In Acres**	**Total Thinning acres**	**Percent Impacted**
Summarized by 7th fields			
Long John Creek	**5,679**	**1775**	**31%**
Beaver/Grouse Creek	**6,497**	**1503**	**23%**
Upper Cow Creek	**8,127**	**199**	**2%**
Deer-Beaver Creek	**2,708**	**204**	**7%**
Headwaters Cottonwood Creek	**4,814**	**194**	**4%**
TOTALS for 7th fields	**35,197**	**3875**	**11%**
Totals for Beaver Creek and Cottonwood Creek 5th fields			
Beaver Creek	**69,664**	**3681**	**5%**
Cottonwood Creek	**63,563**	**194**	**0.3%**
"Entire Analysis Area" (Beaver Creek 5th field watershed, plus Cottonwood Creek 5th field watershed.	**133,227**	**3875**	**3%**

Table G-10: Activities in Riparian Reserves		
UNIT	Watershed	ACTIVITY with NOTES
Water Drafting	From Beaver Creek 5th field, Long John Creek 7th field, and Beaver/Grouse Creek 7th field; following NOAA 2001 guidelines to prevent adverse impacts to anadromous fish and their habitat	For Beaver Creek, Long John Creek, Cow Creek, and Grouse Creek, following NOAA 2001 guidelines to prevent adverse impacts to anadromous fish and their habitat
Landings in RRs	Long John Creek 7th field	Two existing landings in RRs will be used, no effects from their use is expected per BMPs.
Construction of two Temporary road Segments in RRs	Long John Creek 7th field	There are two new temporary roads proposed in Riparian Reserves. One crosses an unnamed perennial tributary to Long John Creek in the SW ¼ of Section 31. This road (T401) begins where road 40S15 crosses this stream and accesses units 401 and 252. The other road (T206B) crosses an RR at the headwaters of an unnamed intermittent tributary to West Branch Long John Creek and connects to the new skyline landing in stand 206. These roads are 2.3 and 1.5 miles upstream of SONCC coho salmon CH, respectively. No adverse impacts to SONCC coho salmon and their CH, steelhead trout, Chinook salmon and their habitat expected since these road segments are not located adjacent to/over fish bearing streams.
Decommissioning of 11 stream crossings.	Long John Creek and Beaver/Grouse Creek 7th fields.	Resource Protection Measures and BMPs will prevent adverse impacts to SONCC coho salmon and their CH, steelhead trout, Chinook salmon and their habitat.
Under burning	Throughout project area	Low intensity in RRs to avoid removal of large woody material, and no fire lines within RRs. Fire can be allowed to back down into RRs from ignition points upslope of RRs.
Variable Density Thinning >9” DBH	Beaver/Grouse Creek, Long John Creek and Deer-Beaver Creek 7th fields.	No adverse impacts to SONCC coho salmon and their CH, steelhead trout, Chinook salmon and their habitat expected since variable density thinning will occur within the second site potential tree height only and no tractor yarding will occur in RRs and the fuels reduction method used with the trees felled will be handpile and pile burn.
Thinning <9” DBH	Beaver/Grouse Creek, Long John Creek and Deer-Beaver Creek 7th fields.	No adverse impacts to SONCC coho salmon and their CH, steelhead trout, Chinook salmon and their habitat expected since no yarding will occur in RRs and the fuels reduction method used with the trees felled will be handpile and pile burn.
Hazard Tree Removal	Throughout project area	Hazard trees (or portions there of) felled in RRs will be left on site to provide for LWD.