Executive Summary

Currently, Mt Ashland LSR is 17% below the expected functioning range. It is in the LSR group that defines functioning range as having between 45–65% of the capable ground maintained in late successional habitat at any given time throughout the LSR. General desired condition objectives from the Late Seral Reserve Analysis (LSRA) indicate moderate severity fire may be desirable, provided openings are 1–5 acres in size and no more than 5–10% of stands that function as suitable habitat are affected. The Mt Ashland LSR assessment has language regarding the possibility of areas up to 200 acres in size in early successional stage as a result of stand replacement fire. Also, according the LSR assessment, 16% of Mt Ashland would incur lethal effects (≥75% mortality in the primary overstory species) and 7% of the LSR was modeled as "cannot contain".

Mangement direction for this project is given by applicable portions of the Clean Water Act, and the Klamath National Forest Land and Resource Mangement Plan (LRMP).

Forest Management Activities must be consistent with the Federal Clean Water Act, and the California Porter-Cologne Water Quality Act, as given addressed in the Water Quality Control Plan for the North Coast Region. This Plan contains water quality standards that include water qualityobjectives and protection of applicable beneficial uses.

Table H-1: Alternative Comparison

	Alt. 2	**Alt.4**	**Alt. 5**
Total Acres Treated	4706	4185	4612
Acres Thinned >9"	3875	3361	3781
Cable	1602	1552	1471
Helicopter	1071	861	1245
Tractor	428	220	376
Com. Grd. Base	555	541	494
Mech. Harv.	219	187	195
Fuels Treatment	4706	4202	4612
Handpile/Underburn	1959	1801	1964
Underburn	1502	1438	1528
Masticate	1245	963	1120
Road Segments	22	16	9
Miles	6.8	4.9	2.3
Clearing	21.5	20.1	9.5
Landings	40	34	31
Clearing	25	22.5	22

The project interdisciplinary team identified issues because of their extent, duration of effects, or intensity of resource conflicts. The issue relevant to soil, water, and geologic resources is the following.

Project activities may advesely affect water quality in the 5th and 7th field watersheds within the project area. Water quality is directly related to aquatic species habitat needs and domestic water use.

The measure to track this issue is the output and interpretation of the Klamath National Forest's cumulative watershed effects (CWE) model. A synopsis of the watershed effects are given in a table in the Environmental Cosequences portion of the watershed report.

The Long John and Grouse Creeks are the two primary tributaries to Beaver Creek that have proposed actions planned. They are both 4th Order streams at their confluence. From that point, to the confluence of Beaver Creek and the Klamath River, Beaver Creek is a 5th Order stream.

Water quality of streams within the area is very good. Turbidity is very low, 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.

Resource Protection Measures for this project include Best Management Practices (BMP's) and Wet Weather Operating Standards (WWO's).

BMP's are measures designed to protect water quality. A description of each applicable BMP is included in the Appendix to this report. Monitoring of implementation and effectiveness will ensure that water quality objectives are being met.

WWO's will be applied to this project if project activities are scheduled to occur between 15 April and 15 October.

Water drafting sites will be located away from sensitive sites with turbid water prevented from entering the streamcourse (BMP 2.21)

Other resource protection measures are listed in the Project Design Measures section of the report. The report also includes, in the Appendix, Applicable BMP's and a description of how the elements of theAquatic Conservation Strategy objectives are being met.

Watershed Report
Mt. Ashland LSR Habitat Restoration Project
(Final 10 April 2007)

I. Introduction

This report has been prepared for the Mt. Ashland LSR Habitat Restoration Project on the Oak Knoll portion of the Scott River Ranger District, Klamath National Forest. The purpose of this project is to implement steps to attain the Desired Future Condition as given by the Beaver Creek Watershed Analysis, for the Mt. Ashland Late Seral Reserve.

This report includes the Cumulative Watershed Effect Analysis; the Aquatic Conservation Strategy goals met; the Best Management Practices recommended for this project, as well as their objectives and implementation methods; and the erosion control plan for the sale. A Unit description will be appended to this report after layout is complete.

A. Proposed Action

The proposed action would mechanically treat approximately **3875** acres of land. These treatments would include cable yarding (**1602** acres), helicopter yarding (**1071** acres), tractor yarding (**428** acres) and mechanical harvester (**219** acres). A combination ground-based system will treat **555** acres. Existing fuel and project generated fuel will be treated on approximately **4706** acres using a variety of treatments including handpile/underburning (**1959** acres), underburning (**1502** acres), and a masticator (**1245** acres). In addition approximately **733** acres will be pr-commercially thinned.

No new system roads will be constructed. Thirteen short temporary roads totalling **6.8** miles are proposed to be constructed to facilitate conventional logging opportunities. Road construction will require about **21.5** acres of clearing The temporary roads will be decomissioned after project needs are met.

Approximately **40** log landings will be used for helicopter (**11** new helicopter landings with 4 associated service landings), cable (**14** new cable landings), and tractor logging (**15** new tractor landings). This will result in about **25** acres of clearing for the new landing construction. The **14** new cable landings will be parallel settings with a mobile yarder on roads.

Five water drafting sites, to control fugitive dust on haul roads and landings will be used.

B. Purpose and Need

Acceleration of wildlife habitat. Currently, Mt Ashland is 17% below the expected functioning range. It is in the LSR group that defines functioning range as having

between 45–65% of the capable ground maintained in late successional habitat at any given time throughout the LSR.

Protection of habitat from loss due to wildfire**.** General desired condition objectives from the LSRA indicate moderate severity fire may be desirable, provided openings are 1–5 acres in size and no more than 5–10% of stands that function as suitable habitat are affected. The Mt Ashland LSR assessment has language regarding the possibility of areas up to 200 acres in size in early successional stage as a result of stand replacement fire.

Also, according the LSR assessment, 16% of Mt Ashland would incur lethal effects (≥75% mortality in the primary overstory species) and 7% of the LSR was modeled as "cannot contain".

C. Management Direction

Mangement direction for this project is given by applicable portions of the Clean Water Act, and the Klamath National Forest Land and Resource Mangement Plan (LRMP).

Forest Management Activities must be consistent with the Federal Clean Water Act, and the California Porter-Cologne Water Quality Act, as given addressed in the Water Quality Control Plan for the North Coast Region. This Plan contains water quality standards that include water qualityobjectives and protection of applicable beneficial uses.

Clean Water Act

The Environmental Protection Agency (EPA) delegated Clean Water Act (CWA) authority to the states. The State of California enacted the Porter Cologne Act to promulgate its CWA responsibilities, and delegated authority for regulation of water quality on Federal Lands to the State Water Resources Control Board (WRCB) with its Regional Boards. For management actions on National Forest lands, the Forest Service Pacific Southwest Region (R5) entered into a 1981 management agency agreement with the WRCB. This requires the Forest Service to institute a water quality management program to meet applicable water quality objectives, and protect beneficial uses in accordance with Regional Basin Plans. The agreement allows the FS to use its State-approved and EPA-certified BMPs to protect water quality from non-point sources of pollution and thereby meet applicable Basin Plan objectives. The agreement also requires the FS to monitor BMP effectiveness in meeting Basin Plan requirements.

The role BMPs play in meeting the CWA and State water quality standards has been described by EPA in a guidance document titled SAM-32 (1987). This guidance was subsequently incorporated into EPA's Water Quality Standards Handbook (EPA, 1994, Water Quality Standards Handbook, Second Edition, Government Printing Office EPA-823-B-94-005a). That guidance established the policy that Best Management Practices are the primary method for controlling non-point pollution and achieving water quality

standards. The Water Quality Standards Handbook has since been revised and the BMP policy is again a stand alone document (SAM-32). In part, it says:

> Once BMPs have been approved by the State, the BMPs become the primary mechanism for meeting water quality standards. Proper installation, operation and maintenance of State approved BMPs are presumed to meet a landowner's or manager's obligation for compliance with applicable water quality standards…Applicable water quality standards along with water quality monitoring should be used to measure the effectiveness of BMPs.

It is important to note that the BMP process is iterative in nature, reflecting the complex nature of nonpoint pollution control. Site-specific prescriptions are applied to identified problems iteratively, until water quality standards are achieved. By agreement, use of the BMP process constitutes compliance with the CWA even in circumstances where water quality standards are not yet achieved. The Best Management Practice Evaluation Program is used by Forests in R5 to evaluate implementation and effectiveness of specific BMP prescriptions, and initiate adaptive changes to BMP prescriptions (or general BMPs) based on those results. In this way, BMPs are designed to achieve full compliance with water quality standards over time.

D. Watershed Issues and Concerns

The project interdisciplinary team identified issues because of their extent, duration of effects, or intensity of resource conflicts. The issue relevant to soil, water, and geologic resources is the following.

Project activities may advesely affect water quality in the 5th and 7th field watersheds within the project area. Water quality is directly related to aquatic species habitat needs and domestic water use.

The measure to track this issue is the output and interpretation of the Klamath National Forest's cumulative watershed effects (CWE) model.

There are three elements to the Forest CWE model that evaluate the difference between estimated current watershed conditions and post-action watershed conditions: Surface erosion and sediment delivery (USLE); Sediment delivery from mass wasting (GEO); and the Disturbance index (ERA). The USLE Model is an index of predicted sediment delivery for the first year following project completion. The GEO Model estimates sediment delivery for the first decade after project completion. The ERA Model provides an accounting system for tracking disturbances that affect watershed processes, in particular changes in peak runoff flows influenced by ground disturbing activities.

These models estimate sediment delivery by considering various factors such as disturbance type and land sensitivity. 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. The model elements each have inference points (or thresholds of concern;TOC) 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 serve as "yellow flag" indicators of increasing susceptibility for significant adverse cumulative watershed effects.

Each model element expresses results as risk ratios. The risk ratios are calculated by dividing increased sediment delivery values (or equivalent roaded acres) by an inference point value. Thus, 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.

What is the balance between the amount of watershed impact from the proposed treatments and the potential impact from future wildfire? Should the TOC be exceeded in the short term (and if so by how far) to ensure we don't incur even greater watershed impacts later as a result of wildfire? Conversely if the fire behavior can be sufficiently moderated with a lesser amount of treatment, would we propose to only move a portion of the stands forward in this entry to maintain the balance between wildlife habitat development and watershed concerns?

II. Alternatives

Alternative 1

This is the "no action" alternative. The analysis of this alternative serves as a baseline to compare action alternative environmental effects.

Alternative 2

This alternative is the proposed action. The proposed action would mechanically treat approximately **3875** acres of land. These treatments would include cable yarding (1602 acres), helicopter yarding (**1071** acres), tractor yarding (**428** acres) and mechanical harvester (219 acres). A combination ground-based system will treat **555** acres. Existing fuel and project generated fuel will be treated on approximately **4706** acres using a variety of treatments including handpile/underburning (1959 acres), underburning (**1502** acres), and a masticator (**1245** acres). In addition approximately 733 acres will be pre-commercially thinned.

No new system roads will be constructed. **22** short temporary roads totalling 6.8 miles are proposed to be constructed to facilitate conventional logging opportunities. Road construction will require about **28.5** acres of clearing The temporary roads will be

decomissioned after project needs are met.

Approximately **40** log landings will be used for helicopter (**11** new helicopter landings with **4** associated service landings), cable (**14** new cable landings), and tractor logging (**15** new tractor landings). This will result in about **25** acres of clearing for the new landing construction. The **14** new cable landings will be parallel settings with a mobile yarder on roads.

Five water drafting sites, to control fugitive dust on haul roads and landings will be used.

Alternative 3

This alternative would mechanically treat approximately **4607** acres of land. These treatments would include cable yarding (**1336** acres), helicopter yarding (**1393** acres), tractor yarding (**1212** acres) and mechanical harvester (**195** acres). A conbination ground-based system will treat **471** acres. Existing fuel and project generated fuel will be treated on approximately 4607 acres using a variety of treatments including handpile/underburning (2073 acres), underburning (**1495** acres), and a masticator (**1039** acres). In addition approximately 711 acres will be pre-commercially thinned.

No new system or temporary roads will be constructed

Approximately **25** log landings will be used for helicopter (**10** new helicopter landings with **4** associated service landings), cable (**2** new cable landings), and tractor logging (**13** new tractor landings). This will result in about **17.5** acres of clearing for the new landing construction. The **2** new cable landings will be parallel settings with a mobile yarder on roads.

Five water drafting sites, to control fugitive dust on haul roads and landings will be used.

Alternative 4

This alternative would mechanically treat approximately **3361** acres of land. These treatments would include cable yarding (**1552** acres), helicopter yarding (**861** acres), tractor yarding (**220** acres) and mechanical harvester (**187** acres). A conbination ground-based system will treat **541** acres. Existing fuel and project generated fuel will be treated on approximately **4202** acres using a variety of treatments including handpile/underburning (**2073** acres), underburning (**1438** acres), and a masticator (**963** acres). In addition approximately **733** acres will be pre-commercially thinned.

No new system roads will be constructed. **16** short temporary roads totalling **4.9** miles are proposed to be constructed to facilitate conventional logging opportunities. Road construction will require about **20.1** acres of clearing The temporary roads will be decomissioned after project needs are met.

Approximately **34** log landings will be used for helicopter (**11** new helicopter landings with 4 associated service landings), cable (**11** new cable landings), and tractor logging (12 new tractor landings). This will result in about **22.5** acres of clearing for the new landing construction. The **11** new cable landings will be parallel settings with a mobile yarder on roads.

Five water drafting sites, to control fugitive dust on haul roads and landings will be used.

Alternative 5

The proposed action would mechanically treat approximately **3781** acres of land. These treatments would include cable yarding (**1471** acres), helicopter yarding (**1245** acres), tractor yarding (376acres) and mechanical harvester (**195** acres). A conbination ground-based system will treat **494** acres. Existing fuel and project generated fuel will be treated on approximately **4612** acres using a variety of treatments including handpile/underburning (**1964** acres), underburning (**1528** acres), and a masticator (**1120** acres). In addition approximately 733 acres will be pr-commercially thinned.

No new system roads will be constructed. **9** short temporary roads totalling **2.3** miles are proposed to be constructed to facilitate conventional logging opportunities. Road construction will require about **9.5** acres of clearing The temporary roads will be decomissioned after project needs are met.

Approximately **31** log landings will be used for helicopter (**11** new helicopter landings with **4** associated service landings), cable (**7** new cable landings), and tractor logging (**13** new tractor landings). This will result in about **22** acres of clearing for the new landing construction. The **7** new cable landings will be parallel settings with a mobile yarder on roads.

Five water drafting sites, to control fugitive dust on haul roads and landings will be used.

Table H-1: Alternative Comparison.

	Alt. 2	Alt.3	Alt.4	Alt. 5
Acres Treated	3875	4607	3361	3781
Cable	1602	1336	1552	1471
Helicopter	1071	1393	861	1245
Tractor	428	1212	220	376
Com. Grd. Base	555	471	541	494
Mech. Harv.	219	195	187	195
Fuels Treatment	4706	4607	4202	4612
Handpile/Underburn	1959	2073	2073	1964
Underburn	1502	1495	1438	1528
Masticate	1245	1039	963	1120
Road Segments	22	0	16	9
Miles	6.8	0	4.9	2.3
Clearing	28.5	0	20.1	9.5

Landings	40	25	34	31
Clearing	25	17.5	22.5	22

C. Project Design Measures

Best Management Practices (BMP's) are measures designed to protect water quality. A description of each applicable BMP is included in the Appendix to this report. Monitoring of implementation and effectiveness will ensure that water quality objectives are being met.

The Forest's Wet Weather Operating Standards (WWO's) will be applied to this project. Project activities are scheduled to occur between 15 April and 15 October. All landing, temporary road, and skid trail construction, and road reconditioning will be conducted during appropriate periods of weather and soil moisture (BMP's 1.5 and 5.6).

No new system roads will be constructed. Thirteen short temporary roads totalling 8.8 miles are proposed to be constructed to facilitate conventional logging opportunities. Road construction will require about 14 acres of clearing The temporary roads will be decomissioned after project needs are met (BMP 1.3).

Landing design standards should incorporate the following measures: 1)Existing landings will be used to the extent possible; 2) Existing landings within 30 feet of the slope break to a stream channel or inner gorge will not be used;3) Landings will be graded and outsloped so that slopes are free draining; 4) If necessary to protect water quality, landings that will not be used again will be subsoiled and covered with slash. Subsoiling depth will not exceed 12 inches

Water drafting sites will be located away from sensitive sites. Turbid water will be prevented from entering the streamcourse (BMP 2.21)

Fire will be allowed to back into streamside RR's. Fire handlines or tractor lines will be constructed where needed on perimeters of underburns (BMP's 1.17, 6.2, and 6.3). No timber harvest. landing construction, or underburn ignition will occur in riparian reserves.

Riparian Reserves buffering around perennial streams will be 150' from edge of stream. This distance will be a de facto equipment exclusion area to protect soil cover and protect the natural filtering function of the riparian reserve. For intermittent and ephemeral watercourses, the buffer will be 50' each side of centerline of the draw. There will be an understood equipment exclusion zone no closer than that 50', or past the last slope break into the channel (whichever is greater). Around the perennial buffers, stream shading from canopy cover will be of prime importance in selection of trees for removal. All trees selected for removal will be end-lined out of the riparian reserves, intermittent or perennial.

Within the confines of the riparian reserves trees can be cut and end-lined, if:

- Roots are not integral to bank stability.
- Felling does not decrease bank stability, and felling is away from the channel.
- Yarding of the felled material does not cause bank gouging that creates a trough for overland water flow to enter the channel.
- No landings will be constructed within 100' of an intermittent or perennial stream.
- Landings within 200' will require dedicated erosion control, i.e. silt fences or straw bale berms.

The inner gorges and debris flow scars are to be buffered in the field, along the likely limit of root support from upslope or adjacent trees. There is a no-cut prescription within the scars.

Along the debris flow scar sidewalls, for a distance 15 ft. lateral, there is to be no more than 10 ft. spacing for leave trees, selecting healthy hardwoods or conifers to remain. Beyond the 10 ft. lateral distance out to 25 ft. lateral distance, there will be no less than a 15 ft. spacing for leave trees.

Above the headwall area of the debris flow scars; there will be no less than a 15 ft. spacing throughout the extent of the precipitation catchment basin, of the debris flow scar.

These guidelines were developed using the level one stability analysis (LISA) model and varying the cohesive root strength parameter, by varying the basal area to be removed. The model runs yielded the following information. For unfailed hill slopes (harvested and unharvested). Existing situation shows a Factor of Safety FOS 1.39; a reduction in basal area of 50% shows an FOS 1.26. A reduction in basal area of 30% shows an FOS 1.31.

Within draws and debris flow scars the FOS is below 1.29, a reduction of basal area by 30% yields an FOS of 1.2

In headwall areas and side slopes to draws there is an existing FOS 1.15: reduction by 30% basal area lowers this to an FOS of 1.09.

III. Affected Environment

The proposed action would occur mainly in Big John and Grouse Creek drainages which are the two primary tributaries to Beaver Creek and have the highest potential for sedimentation from the proposed project. They are both 4th Order streams at their confluence and their gradients are displayed in Table H-2. From that point, to the confluence of Beaver Creek and the Klamath River, Beaver Creek is a 5th Order stream. The other watersheds in the project area; Cottonwood, Dutch, Buckhorn, Deer, Hungry, Jaynes, the Upper and Lower West Fork of Beaver, Soda, Upper Cow, and Bear Creeks, will have minor ridgetop treatments. These activities are reflected in the Cumulative Watershed Effects model run.

Table H-2 Description of Beaver Creek Tributaries

Stream	Reach Order	Approximate Drop (feet)	Gradient (percent)
Long John Creek	All	3040	12
	1st	160	26
	2nd	800	16
	3rd	1200	12
	4th	720	6
Grouse Creek	All	3280	11
	1st	320	19
	2nd	640	13
	3rd	320	16
	4th	2320	9

Water quality of streams within the area is generally very good. Based on professional opinion and direct observations turbidity is low and water clarity is good. During times of intense precipitation surface erosion and mass wasting activity may be accelerated and accompanied by increased levels of turbidity. In general, this type of precipitation can occur during the winter precipitation season (November through March), with landslide producing storm events occurring with storms of a 10 year or greater return interval.. Exceptions to this generality occur during high intensity, short duration summer thunderstorm events.

The current condition, as reflected by Cumulative Watershed Effects risk ratios, of the 7th field watersheds in the analysis area are displayed in Table H3 (below). Watersheds with currently elevated risk levels (denoted by **bold** font) are susceptible to experiencing significant adverse cumulative watershed effects. For example, the "Headwaters Cottonwood" watershed has no model elements with a current risk of 1.0 or greater. It is less likely that this watershed will experience adverse cumulative watershed effects from storm events than Jaynes Canyon watershed where both the USLE and ERA current risk ratios are greater than 1.0. Further, where all three model elements have a current risk ratio greater than or equal to 1.0, there is a higher possibility of adverse cumulative effects than where only one model element has a risk ratio exceeding 1.0.

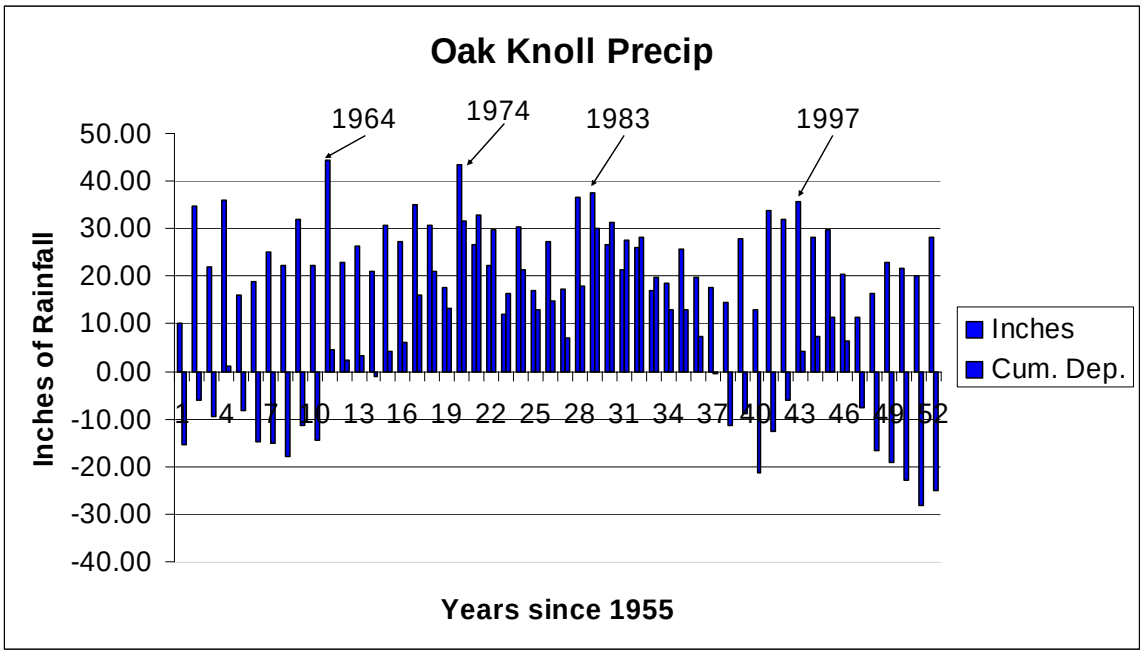
Table H3. Current (2006) cumulative watershed effects conditions of watersheds in the Ashland LSR analysis area.

7th-field Drainage	USLE Yds^3/Year	Current Risk		GEO Yds^3/Decade	Current Risk		ERA	Current Risk
Hdwters Cottonwood	174.2	0.41		19359	0.87		115.5	0.27
Beaver-Dutch	247.7	**1.19**		28073	0.69		188.8	0.58
Beaver-Grouse	482.3	0.94		36296	**1.50**		249.8	0.55
Buckhorn-Beaver	207.5	0.67		42383	0.60		306.3	0.39
Deer-Beaver	166.6	0.94		19980	0.87		144.9	0.71
Hungry	387.0	**1.35**		34369	**1.82**		425.0	0.80
Jaynes Canyon	1086.6	**1.68**		54796	0.76		556.1	**1.06**

Long John	396.4	0.88		32753	**1.45**		203.0	0.40
Lower West Fork Beaver	368.6	**1.57**		30766	0.84		393.6	**1.29**
Soda-Bumblebee	687.5	**1.50**		57612	**1.31**		528.9	0.90
Upper Cow	520.3	0.67		32825	0.50		262.2	0.32
Upper West Fork Beaver	608.3	**1.72**		35100	0.81		384.9	**1.07**
WF Beaver-Bear	352.8	0.86		23971	0.70		221.4	0.70

Domestic water intakes are located outside of the project area generally in 1st and 2nd Order streamcourses.

The chart below shows the annual precipitation and the cumulative departure from the mean annual precipitation (25.39 inches) for the Oak Knoll area. The cumulative departure curve indicates that there was a drying trend from 1959 until 1964. A wetting trend (annual precip. > mean annual precip) until about 1991. A minor drying trend lasted until 1994. The area has been in a drying trend since about 2001



More detailed description of the area is given in the Beaver Creek Watershed Analysis.

IV. Environmental Consequences

Alternative 1

This alternative shows the existing situation for the project area. With no action, this analysis result would continue on into the future. For the CWE model, values for these drainages are displayed in Table H3.

A model fire run in the upper Grouse Creek watershed was made to determine a "worst case scenario" were a a high severity wildfire to occur with adoption of the no action alternative. The model used was the Wateshed Erosion Prediction Project (Disturb WEPP) interface v.2006.01.20. The Fort Jones, CA climate model, was used to simulate 30 years of climate.

Disturbed WEPP Model

Disturbed WEPP is an interface to the Water Erosion Prediction Project soil erosion model (WEPP) to allow users to easily describe numerous disturbed forest and rangeland erosion conditions. The interface presents the results as a summary and extended WEPP outputs, and also presents the probability of a given level of erosion occurring the year following a disturbance.

For forest conditions, there are two levels of forest age: 5-year-old and 20-year-old. By the time a forest reaches 20 years of age, the impact of the canopy and residue accumulation is sufficient to provide as much erosion protection as can be achieved from vegetation.

The 5-year-old forest is considered a reasonable condition to describe a forest that has been heavily logged, leaving some side trees and considerable groundcover, or to describe a forest one to two years after a prescribed fire, or two to three years after a wild fire.

A 20 year-old forest is any well-established forest with approximate 6 ft. spacing or greater, and 15ft. or taller. Ground cover is completely covered with duff or litter

The erosion potential of a given soil depends on the vegetation cover, the surface residue cover, the soil texture, and other soil properties that influence soil strength. Soil parameters to be used with the Disturbed WEPP model are shown in the table below.

Soil Type	**Description**	**Universal Soil Classification**
Clay Loam	Derived from shale or other fine-grained sedimentary rock, or lakebed	CH
Silt Loam	Ash cap or loess soils, or soils derived from highly erodible mica-schists	ML, CL
Sandy Loam	Glacial outwash or soils derived from decomposed granitics	GP, GM, SW, SP

Loam	Glacial till, or alluvial deposits	GC, SM, SC, MH

Low severity fire: This condition describes areas that have either had a low-severity fire, or a successful prescribed fire. This catagory may best describe forest conditions the year of a prescribed fire, or conditions 1 year after a wild fire. If there has been a high severity fire, and the soils are NOT hydrophobic, this is probably the best selection, but with a cover reduced to 15 percent, or that observed on the site.

High Severity Fire: This condition describes areas that have experienced a high-severity fire and soils are hydrophobic (or water repellant). Vegetation is assumed to reach a maximum height of 0.15 m with a spacing of 0.15 m.

At best, any predicted runoff or erosion value, by any model, will be within only plus or minus 50 percent of the true value. Erosion rates are highly variable, and most models can predict only a single value.

Model Results

The model used a typical convex slope profile in the Grouse Creek area, running from the ridge crest into the Grouse Creek inner gorge. Model runs simulated the effects of: 1) No Action; 2) No Action, with an escaped wildfire; 3) Action Alternatives; and 4) Action Alternatives, with an escaped wildfire at a future date.

Model parameters were: a three hundred feet slope profile; a sandy loam soil with 20% rock fragments, derived from a granitic bedrock; and, 80% ground cover. Because of the similarities of alternatives only one alternative (the proposed action) was simulated. Model outputs were erosion and sediment delivered predicted for the 30 year period; average of the 30 year period; average yearly storm event: the % chance of erosion; and, the percent chance of sediment delivery.

	No Action	**No Action w/wildfire**	**Action Alternatives**	**Action Alternatives w/wildfire**
30 yr. avg.	0.0089 tons/acre	1.26 tons/acre	0.031 tons/acre	0.067 tons/acre
2 yr. storm	0 tons/acre	0 tons/acre	0 tons/acre	0 tons/acre
Chance of erosion	7%	97%	13%	20%
Chance of sedment delivery	13%	60%	13%	20%

The table above indicates that adoption of a proposed action could lead to an increase in sedimentation, it is much less than the increase expected from an escaped wildfire with adoption of the No Action Alternative.

Action Alternatives

Cumulative Effects

The modeled effects of the project action, and foreseeable future actions are as given below. The numbers are expressed as the risk/ratio, compared to 1.0, the point which represents a "yellow flag" that the watershed is approaching the point of peak flow impacts may be occurring.

7th-field Drainage	**USLE** No Action	Alt 2	Alt 3	Alt. 4	Alt. 5
Hdwters Cottonwood	0.41	0.42	0.42	0.42	0.42
Beaver-Dutch	**1.19**	**1.19**	**1.19**	**1.19**	**1.19**
Beaver-Grouse	0.94	0.98	0.98	0.99	0.99
Buckhorn-Beaver	0.67	0.67	0.67	0.67	0.67
Deer-Beaver	0.94	0.96	0.95	0.96	0.96
Hungry	**1.35**	**1.35**	**1.35**	**1.35**	**1.35**
Jaynes Canyon	**1.68**	**1.68**	**1.68**	**1.68**	**1.68**
Long John	0.88	0.97	0.95	0.97	0.97
Lower West Fork Beaver	**1.57**	**1.57**	**1.57**	**1.57**	**1.57**
Soda-Bumblebee	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**
Upper Cow	0.67	0.67	0.66	0.67	0.67
Upper West Fork Beaver	**1.72**	**1.72**	**1.72**	**1.72**	**1.72**
WF Beaver-Bear	0.86	0.86	0.86	0.86	0.86

7th-field Drainage	**GEO** No Action	Alt 2	Alt 3	Alt. 4	Alt. 5
Hdwters Cottonwood	0.87	0.87	0.87	0.87	0.87
Beaver-Dutch	0.69	0.69	0.69	0.69	0.69
Beaver-Grouse	**1.50**	**1.48**	**1.48**	**1.49**	**1.49**
Buckhorn-Beaver	0.60	0.60	0.60	0.60	0.60
Deer-Beaver	0.87	0.87	0.87	0.87	0.87
Hungry	**1.82**	**1.81**	**1.81**	**1.82**	**1.81**
Jaynes Canyon	0.76	0.76	0.76	0.76	0.76
Long John	**1.45**	**1.39**	**1.39**	**1.41**	**1.39**
Lower West	0.84	0.84	0.84	0.84	0.84

Fork Beaver					
Soda-Bumblebee	**1.31**	**1.31**	**1.31**	**1.31**	**1.31**
Upper Cow	0.50	0.50	0.50	0.50	0.50
Upper West Fork Beaver	0.81	0.81	0.81	0.81	0.81
WF Beaver-Bear	0.70	0.70	0.70	0.70	0.70

7th-field Drainage	**ERA** No Action	Alt 2	Alt 3	Alt. 4	Alt. 5
Hdwters Cottonwood	0.27	0.33	0.33	0.33	0.33
Beaver-Dutch	0.58	0.58	0.58	0.58	0.58
Beaver-Grouse	0.55	0.80	0.77	0.77	0.77
Buckhorn-Beaver	0.39	0.39	0.39	0.39	0.39
Deer-Beaver	0.71	0.83	0.83	0.83	0.83
Hungry	0.80	0.80	0.80	0.80	0.80
Jaynes Canyon	**1.06**	**1.06**	**1.06**	**1.06**	**1.06**
Long John	0.40	0.76	0.73	0.70	0.74
Lower West Fork Beaver	**1.29**	**1.29**	**1.29**	**1.29**	**1.29**
Soda-Bumblebee	0.90	0.90	0.90	0.90	0.90
Upper Cow	0.32	0.35	0.34	0.35	0.35
Upper West Fork Beaver	**1.07**	**1.07**	**1.07**	**1.07**	**1.07**
WF Beaver-Bear	0.70	0.70	0.70	0.70	0.70

The Mt. Ashland LSR project would take place in the Beaver Creek 5th field Watershed. Beaver Creek is comprised of 13 7th field Watersheds. Proposed project actions would occur in portions of all of those 7th field watersheds.

Although the above tables indicate that the proposed action could elevate Beaver-Grouse, Deer-Beaver, and Long John watersheds to their inference points. The elevation occurs more as a response to the granitic soils in the area, rather than from existing mass wasting or surface erosion occurrence. Although the models indicate an exceedance of the inference point, this would be largely mitigated in project design measures and implementation of Best Management Practices, as well as strict adherence to ground and soil cover guidelines in the Klamath LRMP. Re-opening of temp spur roads and new construction of temp spurs are the major contributor to the elevation in the USLE model.

There would be no lessening of binding root strength that would lead to mass wasting accelerance in the GEO model. Avoidance of debris-slide prone slopes and swales in the granitic areas would further lessen the risk.

The ERA model shows the greatest degree of proposed action impacts in the Beaver-Grouse and Long John watersheds. None of the 7th field watershed reach their inference points of 1.0 in this model.

5th-field Drainage	Current	Proposed With Future Actions
USLE	1.17	1.17
GEO	0.91	0.91
ERA	0.70	0.70

The model runs for the entire Beaver Creek 5th field watershed show a slight elevation in all areas, with only the soil loss model exceeding the inference point of 1.0. Once again this is because of the amount of non-cohesive granitic soils. This can be largely mitigated by project design measures.

Direct Effects

Direct Effects are those that occur at the same time and place as the proposed action. Hydrologic direst effects include changes to runoff regimes, stream canopy shade, and in-stream turbidity caused by runoff or in-channel work. Direct effects relating to slope stability and surface erosion consist of disturbances to the soil layer. Direct effects of timber harvest can include disturbance of the soil and physical removal of trees, reducing stand density, binding root strength, decreasing evapo-transpiration potential, and creating opening which can increase snow pack buildup.

Stream Shade

The potential to reduce stream canopy shade from harvesting is negligible to non-existent, because there is no commercial thinning in riparian reserves adjacent to flowing or standing water. The effect of under burning on stream shade is negligible to non-existent because fire will be allowed to back into streamside areas from ignition points higher on the hillslopes.

Disturbance

Ground disturbance through mechanical harvest, particularly tractor yarding can be critical. Use of masticators and mechanical harvesters will lessen ground pressure on the project area soils. Compliance with LRMP soil cover guidelines will serve to further protect the watershed beneficial uses.

Indirect Effects

Indirect effects are those impacts which may result after completion of project actions. Hydrologic indirect effects include increased sedimentation from increased surface erosion. Road use also creates suspended sediment during wet weather, and from dust settling during dry periods. Indirect effects relating to slope stability may occur from road fill failures, and loss of binding root strength.

Other indirect effects may include accelerated vigor in trees following thinning of competing vegetation, and reduction of escaped wildfire rates of spread in thinned and underburned areas.

Surface Erosion

As shown above there is a negligible surface erosion increase through out the project area. This could cause some minor short-term increases in turbidity during above average precipitation events. Riparian Reserves associated with streamcourses would not be entered (with the possible exception of Hazard Tree felling), so they would provide an effective sediment filter zone for streams.

Suspended sediment from road use will be controlled and mitigated by wet weather operation guidelines and dry-season dust abatement measures. Project design measures effectively addresses potential water quality impacts potential water quality impacts associated with log haul and construction of temporary roads.

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. The action alternative is designed to be low risk to watershed condition and function compared to risks resulting from high intensity, escaped wildfire.

Surface Runoff

The rate of surface runoff would be slightly increased by landings, compacted areas, and by reduction of surface organic cover. Private, domestic water quality would not be affected by project activities. Known domestic water intakes are springs and 1st Order channels outside the influence of project activities.

Application of Project Design Measures, BMP's, and LRMP Standard and Guidelines will ensure the project proposal complies with the Clean Water Act, the Porter-Cologne Water Quality Control Act, applicable water quality control plans, and the Regional Board waiver (Order No. R1-20044-00015).

Appendix I.

Required Best Management Practices (BMP's).

Best Management Practices (BMPs) are measures certified by the State Water Quality 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 in timber sales and road construction projects in this and other watersheds and have been found to be effective in achieving their stated objectives within the Klamath Basin.

Forest Service BMPs have been monitored and modified over several decades to make them more effective. On-site evaluations by State regulatory agencies found the practices were effective in protecting beneficial uses.

Calendar year 2006 was the fifteenth year of the Best Management Practices Evaluation Program (BMPEP) on the Klamath National Forest and the Forest Service Pacific Southwest Region (Region). This program is designed to evaluate how well the Forest and the Region implement BMPs, and how effectively the BMPs control water pollution from National Forest lands. Onsite evaluations have been divided into 28 evaluation categories that reflect related timber, roads, mining, recreation, vegetation management, fire, watershed and range practices. In 2006, BMPs were fully implemented at 93% of the sites evaluated and effective at 100% of the sites evaluated (water quality was protected at some sites even if BMPs were not fully implemented). This represents a slight change in BMP implementation (a 3% decrease) and effectiveness (a 2% increase) compared to 2005.

The following list of BMPs would be required in the Mt, Ashland LSR project area if the Action Alternative is selected for implementation. A description of the objective of each BMP is included, as well as how it is to be accomplished.

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.
- 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 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.

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 150'.
- 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 WWO (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 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.

- 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.

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 WWO 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 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.

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 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 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.
- WWO 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.

- The Klamath NF's WWO 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 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.

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 WWO 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 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.
- 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 WWO 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 WWO 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 WWO 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 WWO 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.

Appendix II.

The LRMP contains the components, objectives and standards and guidelines for the ACS as recommended by the ROD.

The four components of the ACS, as given on pages 4-34 through 4-36 of the LRMP, are: 1) Riparian Reserves, 2) Key Watersheds, 3) Watershed Analysis and 4) Watershed Restoration. None of the treatment areas are within key watersheds. Watershed Restoration, which includes decommissioning and storm damage repair, is an ongoing program on the District and the Forest.

Of the nine ACS objectives on pages 4-6 and 4-7 of the LRMP, the following are applicable to the proposed fuels reduction and thinning project:

Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

Thinning with fuel treatment would occur where wildfire, and resulting fire suppression activities, may altere features to which species are uniquely adapted. Thinning of some of the stands, while Underburning in others, would reduce fuel loading and simultaneously leave material to provide diversity and complexity. Reduced fuel loading would help stands progress to toward conditions where the natural fire regime is restored.

Maintain and restore spatial and temporal connectivity between watersheds.

Within harvest areas, 2–5 snags/acre and 5–20 pieces of Coarse Woody Debris (CWD) would be maintained. Fuel treatment within Riparian Reserves would be designed to create conditions that minimize disturbance of riparian ground cover and vegetation.

Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

Opportunities to deliver key wood to streams would be maintained by leaving at least 5 – 8 snags/acre in upslope riparian reserves. All snags would be left in those riparian reserves well connected to suspected fisheries habitats.

Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems.

This project is consistent with riparian reserve guidelines, which prohibit and regulate activities in the riparian reserves that may prevent or retard attainment of the Aquatic Conservation Strategy. Water quality is expected to remain at pre-fire conditions. Maintenance of water quality would be achieved through minimizing sediment delivery to stream courses.

Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the regime include the timing, volume, rate and character of sediment input, storage, and transport.

Reducing the risk of stand replacing fire and implementing a natural fire regime in the long term would have the most influence on maintenance and restoration of the sediment regime. Soil erosion occurs when soil cover is burned off. In the short term, post-fire soil erosion could show an increase. This is being mitigated to a certain extent by the Project Design Measures presently as proposed. The long term total sediment production is predicted to be lower if areas are thinned and burned under controlled conditions, as compared to another wildfire.

Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats, and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

The proposed project includes the thinning of fire stands, controlled introduction of fire, and post harvest fuel treatment, no activities are planned that would directly divert or reduce stream flows. There may be a short term lessening of evapo-transpiration levels in the area, resulting in an increase in phreatic and vadose flows. This will be countermanded in the long term by increased stand vigor and fire resiliency

Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows.

Since this project only proposes the harvest of thinned timber, any effects to the water table would negligible, because the remaining stand would be more vigouous and efficient as evapo-transpiration mechanism.

Maintain and restore the species composition and structural diversity of plant communities in riparian areas.

Species composition of plant communities in riparian areas would be maintained or restored through reducing the risk of stand replacing fire, in riparian areas. Structural diversity would be maintained or restored by leaving snags in areas connected to the aquatic system.

Maintain and restore habitat to support well distributed populations of native plant and invertebrate riparian dependent species.

A well-distributed mix of riparian habitats would maintain the riparian distributed species. Reducing the risk of a stand replacing fire would increase the likelihood of a well-distributed mix of habitats.