United States Department of Agriculture

Hwy 46 Project

Draft Environmental Impact Statement

Forest Service   Willamette National Forest   Detroit Ranger District   October 2017

Draft Environmental Impact Statement

Hwy 46 Project

Willamette National Forest Service

Marion County, Oregon

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Abstract: This Draft Environmental Impact Statement (DEIS) contains the Detroit Ranger District's proposal to improve stand growth, diversity and structure; move stand structure from an overabundance of mid seral stands to increase both early and late seral stand structure within the watershed; reduce hazardous fuels; restore sugar pine and encourage sugar pine regeneration; treat powerline visuals; restore riparian and meadow habitats; restore hydrologic processes in the Short Lake area; and provide a sustainable yield of timber for commercial products to local and regional economies. The proposed project is located approximately 6 miles northeast of the town of Detroit, Oregon, in Marion County. Three alternatives were analyzed in this DEIS; a no action alternative (Alternative 1) and two action alternatives (Alternative 2 and 3). Alternative 2 proposes 4,060 acres of treatment (including skips), Alternative 3 proposes 3,075 acres of treatment (including skips). Alternative 2 is the Forest Service preferred alternative.

Comments: This DEIS is made available for a 45-day public comment period, under the provisions of the National Environmental Policy Act (40 CFR 1500-1508) and 36 CFR Part 218, which replaced Notice, Comment, and Appeal procedures at 36 CFR 215. The Forest Service will accept comments beginning on the day following the date of publication of the Notice of Availability (NOA) in the Federal Register. The official comment period timelines will be posted in a legal notice in Statesman Journal, and on the Willamette National Forest's Web site: http://www.fs.usda.gov/project/?project=47109

It is important that reviewers provide their comments at such times and in such a way that they are useful to the Agency's preparation of the EIS. Therefore, comments should be provided prior to the close of the comment period and should clearly articulate the reviewer's concerns and contentions. The submission of timely and specific comments can affect a reviewer's ability to participate in subsequent administrative review or judicial review. Comments received in response to this solicitation, including names and addresses of those who comment, will be part of the public record for this proposed action. Comments submitted anonymously will be accepted and considered; however, anonymous comments will not provide the respondent with standing to participate in subsequent administrative or judicial reviews.

Submit comments electronically via the Forest Service online commenting system at:
https://cara.ecosystem-management.org/Public/Commentinput?project=47109

Or send comments to:
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Reader's Guide

The Forest Service has prepared this Draft Environmental Impact Statement in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Draft Environmental Impact Statement discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed actions and alternatives. The document is organized as outlined below:

- *Summary*
- *Chapter 1. Purpose and Need:* This chapter describes the scope and objectives of the proposal as well as defines why the proposal is being made at this location and at this time.
- *Chapter 2.* This section describes the alternative methods for achieving the project's purpose. Alternatives are designed to meet the project's purpose and need and to address one or more significant issues related to the proposed actions. This chapter also includes mitigation measures and a summary table of the environmental consequences associated with each alternative.
- *Chapter 3. Affected Environment and Environmental Consequences:* This chapter describes the environment that would be affected by the proposed actions as well as the environmental consequences of implementing the alternatives. The analysis is organized by resource area.
- *Chapter 4. List of Preparers:* This section lists the names, together with their qualifications (expertise, experience, professional disciplines), of the persons who were primarily responsible for preparing the environmental impact statement.
- *Chapter 5. List of Agencies, Organizations, and persons to whom copies of the statement are sent*
- *Appendices:* The appendices provide more detailed information to support the analyses presented in the draft environmental impact statement.
- *References*
- *Glossary*
- *Index*

Additional documentation, including more detailed analysis of project area resources, can be found in the project planning record located at the Detroit Ranger District Office on the Willamette National Forest.

List of Acronyms

ACS..................Aquatic Conservation Strategy
ACSO...............Aquatic Conservation Strategy Objectives
ARP..................Aggregate Recovery Percentage
B/C Ratio ....Benefit / Cost Ratio
B.E. ....Biological Evaluation
BLM.................Bureau Of land Management
BPA..................Bonneville Power Administration
BMP.................Best Management Practices
B.O...................Biological Opinion
CFR..................Code of Federal Regulations
CHU.................Critical Habitat Unit
CVS..................Current Vegetation Survey
dB.....................Decibel
dbh ....Diameter Breast Height (4.5 feet above ground)
DDE ....Dietary Digestible Energy
DEIS.................Draft Environmental Impact Statement
DEQ ....Department of Environmental Quality
DTR ....Dominant Tree Release
EFH..................Essential Fish Habitat
EIS ....Environmental Impact Statement
ESA..................Endangered Species Act
FEIS ....Final Environmental Impact Statement
FM....................Fuel Model
FR.....................Fire Regime
FRCC ....Fire Regime Condition Class
FS ....Forest Service
FSH..................Forest Service Handbook
FSM ....Forest Service Manual
FSVeg...............Forest Service Vegetation database
GIS...................Geographic Information System
GPS..................Global Positioning System
HE....................Habitat Effectiveness
IRA...................Inventoried Roadless Area
LAA ....Likely to Adversely Affect
LFH..................Listed Fish Habitat

LRMP...............Land and Resource Management Plan
LSR ....Late Successional Reserve
MA ....Management Allocation
MBF ....Thousand Board Feet
MIS ....Management Indicator Species
MMBF ....Million Board Feet
MVUM.............Motor Vehicle Use Map
NEPA ....National Environmental Policy Act
NF ....National Forest
NFF ....National Forest Fund
NHPA...............National Historic Preservation Act
NLAA ....Not Likely to Adversely Affect
NMFS...............National Marine Fisheries Service
NPV ....Net Present Value
NRHP...............National Register of Historic Places
NRIS ....Natural Resource Information System
NRT..................National Recreation Trail
NSO ....Northern Spotted Owl
NWFP ....Northwest Forest Plan
ODF ....Oregon Department of Forestry
OFRI ....Oregon Forest Resources Institute
OHV.................Off-Highway Vehicle
ORV ....Outstanding Remarkable Values
PGE..................Pacific Gas and Electric
PNW.................Pacific Northwest
Q100.................100 Year Flood Flows
RA32................Recovery Action 32
RIS ....Road Investment Strategy
ROD ....Record of Decision
ROS..................Recreation Opportunity Spectrum
SDI ....Stand Density Index
SDI max ....Maximum Stand Density Index
SHPO ....State Historic Preservation Officer
SIA ....Special Interest Area
TMDL ....Total Maximum Daily Load
Tpa ....Trees per acre
USDA..............United States Department of Agriculture

USDI ....United States Department of Interior
USFWS ....United States Fish and Wildlife Service
VMS.................Visual Management System
VQO.................Visual Quality Standard
WEPP...............Watershed Erosion Prediction Project model
WMU ....Wildlife Management Unit
WUI Wildland-Urban Interface

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Summary

The Detroit Ranger District is proposing to improve stand growth, diversity and structure; move stand structure from an overabundance of mid-seral stands to increase both early and late seral stand structure within the watershed; reduce hazardous fuels; restore sugar pine and encourage sugar pine regeneration; treat powerline visuals; restore riparian, understory and meadow habitats; and restore hydrologic processes in the Short Lake area. This project would also provide a sustainable yield of timber for commercial products to local and regional economies. Treatments would occur on about 4,060 acres on the Willamette National Forest.

Purpose and Need

Improve Stand Growth, Diversity and Structure and Move Stand Structure from an Overabundance of Mid-seral Stands

The proposed project is needed to improve stand conditions, diversity, density, and structure in the project area, providing benefits to vegetation, wildlife, and overall health of the forest.

Increase Stand Health and Vigor: All of the stands in which overstory management is proposed have a high continuous overstory canopy cover, most averaging 80% or more. The trees are competing for sunlight, water, and nutrients causing reduced tree growth and vigor as well as limiting understory vegetation. The understory is mostly limited to shrubs with few small trees scattered throughout resulting in single-storied stands in the plantations. The fire regenerated stands are similar to the plantations in that there is high competition between the overstory trees and suppression in the regeneration.

The proposed project would help improve stand conditions, diversity, density and structure with thinning, gaps, and dominant tree release. Thinning the overstocked stands would make more growing space and resources available to the remaining trees, resulting in decreased tree stress and development towards larger diameter stands. Stand vigor would also be increased as released trees develop into larger trees sooner, accelerating the development of some late successional characteristics. Tree species, age, and structure diversity would be maintained or enhanced.

Plantations are generally characterized by dense monocultures of Douglas-fir. Competition is high with mortality occurring in many of the stands. Crown ratios are small, leading to reduced diameter growth. Although fairly well established on some of the northerly slopes, regeneration is suppressed by the overstory and growing slowly. Fire regenerated stands are older than the plantations in this project, and tend to have larger trees. Species composition in the overstory varies for pure Douglas-fir to mixed Douglas-fir with noble fir, western white pine, western hemlock, western redcedar, pacific silver fir, and sugar pine. Understory regeneration is variable and is predominantly western hemlock with western redcedar, grand fir, pacific yew, and mountain hemlock at the higher elevations. These stands are similar to the plantations in that there is high competition between the overstory trees and suppression in the regeneration.

Increase the Amount of Early Seral Habitat: Age class diversity in forest stands is important as some species of animals and plants depend on younger stages of forests for their feeding, nesting, and breeding requirements. Early seral habitat (defined as less than 20 years old) is of key importance to an estimated 156 species of wildlife in the central Oregon Cascades (O’Neil et al 2001).

With the cessation of clear-cut logging twenty years ago and continued fire suppression, early seral habitat has been substantially reduced within the project area. The powerline corridor contains most of the early seral habitat, and it encompasses less than 1% of the acreage in the project area. Historically, the Breitenbush watershed maintained about 9% early seral due to wildfire (USDA 1996, 2014). Patches of early seral habitat contribute to landscape heterogeneity and provide habitat for large herbivores, song birds, cavity nesters, and pollinators.

Increase the Amount of Late Seral Habitat: Age class diversity in forest stands is important as some species of animals and plants depend on older stages of forest development for their feeding, nesting, breeding and cover requirements such as flying squirrels, spotted owls, and many lichens and mosses.

Historically, the Breitenbush watershed maintained about 60% of closed canopy late seral stands. Currently, the watershed has about 48% closed canopy late seral stands. There is currently a need to enhance, create, and maintain stands of trees in the Breitenbush watershed with late seral characteristics.

Late-Successional Reserves (LSR) are to be managed to protect and enhance conditions of late-successional and old-growth forest ecosystems. Silviculture treatments are to benefit the creation and maintenance of late-successional forest conditions and are subject to review by the Regional Ecosystem Office (REO). In the Hwy 46 Project, there are 38 units that are either completely within or have a portion within the LSR, totaling 1,018 acres. Of this, 35 units encompassing 808 acres are prescribed for commercial thinning. These stands are previously managed, densely stocked plantations, less than 80 years old.

Increase the Potential for Riparian Reserves to Function as Late Successional Habitat: Treatment of stands in Riparian Reserves would maintain adequate shade and accelerate the ability of Riparian Reserves to provide adequate root strength and bank stability, sediment filtration and nutrient cycling, large wood supply to waterbodies and floodplains, organic matter input, and habitat for riparian-dependent wildlife.

Strategically Reduce Hazardous Fuels

The project area surrounds both the Breitenbush Hot Springs Retreat and Conference Center and the Breitenbush and Devils Creek summer home tracts. These areas have been identified as communities at risk in the Marion County Community Wildfire Protection Plan. Much of the area that surrounds the structures within these communities is dense older forest with heavy fuel loadings and narrow road access that could inhibit fire suppression activities in the event of a wildfire.

Restore Sugar Pine

The primary range of sugar pine extends from northern Mexico, through the Sierra Nevada, Northern California, and Southern Oregon. The very northern extent of its range is in the Hwy 46 project area. Sugar pines are moderately shade tolerant, particularly when they are young, needing some protection from the sun as they establish. As they get older their tolerance for competition decreases, and other species can out-compete them if lower intensity disturbances, primarily wildfire, do not thin stand densities. Fire suppression in the watershed has limited natural sugar pine regeneration, and the population has declined over time.

Treat Powerline Visuals

The Hwy 46 project area encompasses the Breitenbush viewshed corridor. This viewshed is an important scenic asset as it surrounds the Breitenbush Hot Springs Retreat and Conference Center and includes travel corridors that are considered sensitive to scenic quality. A powerline corridor bisects the watershed and the straight lines of the powerline corridor do not appear natural on the landscape.

Restore Riparian and Understory Habitats, Meadows and Hydrologic Processes

The previously managed stands in the Hwy 46 Project Area were harvested and replanted using direction that pre-dates the Willamette Land and Resource Management Plan (1990) and prior to the Northwest Forest Plan (1994). As a result, the majority of these forest stands were set on a management-induced trajectory that has led to artificially dense, conifer-dominated stands, with tree densities above the range of natural variability expected in this area, suppressing shrub and forb diversity in the understory. Analysis found that 4.6% of the Riparian Reserves in the Hwy 46 project area had a deciduous and deciduous/shrub component. Deciduous leaves have a higher nutritional quality than coniferous needles with regard to contributions to the aquatic food web.

With the exclusion of fire, meadow habitat within the project area has been declining. A high elevation meadow has been encroached upon by conifers, resulting in a decline in plant diversity, pollinator habitat, and wildlife forage.

The current alignment of FS road 46-059 has disrupted the hydrology of the Short Lake Area. This road accesses Short Lake, a popular destination for dispersed recreation camping, as well as fishing, birding, boating and wildlife viewing. Rerouting the road would reduce sediment delivery to streams in the project area, improve water quality, and reduce road maintenance.

Provide Forest Products to the Local Economy

The proposed project is needed to ensure the Willamette National Forest continues to supply a reliable supply of timber products as directed by the laws and guidance and in doing so contributes to the stability of local, regional, and national economies and achieves the annual Probable Sale Quantity (PSQ) target for the Forest.

Alternatives

Three alternatives were analyzed in this DEIS; a no action alternative (Alternative 1) and two action alternatives (Alternative 2 and 3). The alternatives vary by the amount of treatment (Table 1). Alternative 2 is the proposed action and preferred alternative.

Table 1 Comparison of the Alternatives

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3
Timber Harvest Treatments				
Thinning outside Riparian Reserves	Acres	0	1801.45	1373.95
Thinning in Riparian Reserves	Acres	0	716	514
Quality Early Seral Creation	Acres	0	45	16
Sugar Pine Shelterwood	Acres	0	94	9
Gaps	Acres	0	47.8	34.8
Dominant Tree Release	Acres	0	72.75	58.25
Skips	Acres	0	877	671
Meadow Restoration	Acres	0	8	0
Total	Acres	0	3662	2677
Estimated Volume	MMBF	0	~40	~24
Non-commercial treatments				
Understory Habitat Enhancements	Acres	0	155	155
Streamside treatments	Acres	0	20	20
Hazardous Fuels Treatment	Acres	0	223	223
Total	Acres	0	398	398
Post-Harvest Fuels Treatments[1] in Timber Harvest Units				
Pile and Burn (mechanical and/or hand treatments)[2]	Acres	0	897	805
Post-Harvest Underburn [3]	Acres	0	1113	655
Connected Actions				
Harvest System				
Helicopter	Acres	0	317	54
Skyline	Acres	0	1532	1155
Ground	Acres	0	936	797
Transportation				
Temporary Roads Reconstruction	Miles	0	4.01	3.3
Temporary Roads Construction	Miles	0	5.11	3
Road Maintenance/Haul Route	Miles	0	108	98
Road Realignment	Miles	0	1	1
Road Decommissioning	Miles	0	1.99	1.99
Road Storage	Miles	0	1.37	1.37

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3
Rock Pit Management	Each	0	10	10
Post-Harvest Planting				
Early Seral Planting	Acres	0	45	16
Shelterwood Planting	Acres	0	94	9
Gap Planting	Acres	0	47.8	34.8
Dominant Tree Release Planting	Acres	0	Up to 72.75	Up to 58.25
Key Issues				
Fire regenerated stands harvested	Acres	0	988	0

1: Post-harvest fuels treatments methods may change depending on feasibility and funding. Post-harvest fuels treatments would occur in timber harvest units; therefore the acreage of post-harvest fuels treatments are not included in the total acres of treated units.

2: Mechanical treatment may include: grapple piling in slash concentrations, yarding tops attached, mastication, or any other mechanical device).

3: These acres are possible underburn acres due to dbh and location, not all acreage may be underburned. Acreage not underburned may have other post-harvest fuels treatments assigned before implementation.

Summary of Environmental Consequences

Table 2 Summary of Direct Effects on Resources for Alternative 2 and Alternative 3

Resource	Alternative 1	Alternative 2	Alternative 3
Forest and Stand Structure	High stocking density and canopy covers would continue to restrict regeneration and slow tree growth. Sugar pine presence would decline on the landscape as would early seral habitat.	3515 acres would be treated by thinning, skips, and gap creation. Inter-tree competition within the thinned portions of the stands would be reduced. This would increase vigor, allowing the remaining trees to grow in diameter at a faster rate than without thinning. Shade tolerant tree species such as western hemlock and western redcedar would be released to grow further into the mid and overstory. Skips, clumps, and the creation of dominant tree release gaps would add to the structural heterogeneity of the stands as well as increase species diversity. One to three acre wildlife gaps would increase the amount of grass-forb stage habitat within the project area.	2652 acres would be treated by thinning, skips, and gap creation. Inter-tree competition within the thinned portions of the stands would be reduced. This would increase vigor, allowing the remaining trees to grow in diameter at a faster rate than without thinning. Shade tolerant tree species such as western hemlock and western redcedar would be released to grow further into the mid and overstory. Skips, clumps, and the creation of dominant tree release gaps would add to the structural heterogeneity of the stands as well as increase species diversity. One to three acre wildlife gaps would increase the amount of grass-forb stage habitat within the project area.

Resource	Alternative 1	Alternative 2	Alternative 3
Sugar Pine	Sugar pine on the landscape would continue to decline.	94 acres of sugar pine habitat would be restored The existing sugar pine population would benefit from reduced competition was well as the establishment of a new rust resistant cohort, ensuring the continued presence of the species.	9 acres of sugar pine habitat would be restored. The opportunity to restore sugar pine habitat on 85 acres would be missed.
Early seral habitat	No acres of quality early seral habitat would be created, the amount of grass-forb stage in the project area would decline.	45 acres of quality early seral habitat would be created, increasing the amount of grass-forb stage habitat within the project area. A wide variety of species would benefit, including deer, elk, songbirds, and numerous pollinators.	16 acres of quality early seral habitat would be created, benefitting several wildlife species.
Late Successional Reserves	Stands within the Late Successional Reserve would continue to develop at the current rate.	Structural and species diversity would be increased on 808 acres, resulting in these stands attaining late seral characteristics sooner than if left untreated.	Structural and species diversity would be increased on 808 acres, resulting in these stands attaining late seral characteristics sooner than if left untreated.
Meadow restoration	Conifers would continue to encroach upon the high elevation meadow.	8 acres of conifers would be removed from the high elevation meadow, promoting both wet site plants and early seral obligate species.	Conifers would continue to encroach upon the high elevation meadow.
Fire and Fuels	Effects of fire suppression and past management activities would continue. Lack of fire disturbance would prevent the creation of new early seral conditions and inhibit the establishment of new sugar pine. Fuels would continue to accumulate in the Breitenbush Summer Homes and Hot Springs Resort area.	Hazardous fuels on 223 acres in the Breitenbush WUI would be reduced. Timber harvest slash would follow Forest Plan standards and guidelines FW-212 and FW-252 guidance. Returning fire would increase stand diversity and structure.	Hazardous fuels on 223 acres in Breitenbush WUI would be reduced. Timber harvest slash would follow Forest Plan standards and guidelines FW-212 and FW-252 guidance. Returning fire would increase stand diversity and structure.
Soil Productivity	No effect	Nutrient availability and compaction would remain within the limits outlined in the standard and guidelines of the forest plan.	Nutrient availability and compaction would remain within the limits outlined in the standard and guidelines of the forest plan.
Water Quality and Quantity	No effect	Water quality would be protected. Treatment of riparian vegetation would meet TMDL requirements for temperature and sediment. No increased flood flows are anticipated due to this project.	Water quality would be protected. Treatment of riparian vegetation would meet TMDL requirements for temperature and sediment. No increased flood flows are anticipated due to this project.

Resource	Alternative 1	Alternative 2	Alternative 3
Upper Willamette River ChinookSalmon (Evolutionarily Significant Unit-ESU)	No effect	May affect, likely to adversely affect	May affect, likely to adversely affect
Upper Willamette River Chinook Salmon (Critical Habitat)	No effect	No effect	No effect
Upper Willamette River ChinookSalmon (Essential Habitat)	No effect	No effect	No effect
Caddisflies - *Rhyacophila chandleri, Rhyacophila leechi, Namamyia plutonis* (R6 Sensitive)	No effect	Beneficial effect	Beneficial effect
Northern Spotted Owl (ESA Threatened and Management Indicator Species)	No effect	May affect and is likely to adversely affect spotted owls by habitat modification. May affect and is not likely to adversely affect spotted owls by disturbance.	May affect and is likely to adversely affect spotted owls by habitat modification. May affect and is not likely to adversely affect spotted owls by disturbance.
American Peregrine Falcon (R6 Sensitive and Management Indicator Species)	No impact	No impact	No impact
Harlequin Duck (R6 Sensitive)	No impact	No impact. All project activities with potential to impact harlequin ducks are restricted from March 15 to July 15 to avoid disturbance to nesting harlequin ducks.	No impact. All project activities with potential to impact harlequin ducks are restricted from March 15 to July 15 to avoid disturbance to nesting harlequin ducks.

Resource	Alternative 1	Alternative 2	Alternative 3
Fisher (Proposed Threatened)	No effect	Unlikely to occur in the project area and not expected to be affected by proposed activities.	Unlikely to occur in the project area and not expected to be affected by proposed activities.
Fringed Myotis and Townsend's Big-eared Bat (R6 Sensitive)	No impact	May be affected if trees which have potential to be used for nursery colonies are felled as hazards during harvest operations Subsequent snag creation may offset this impact.	May be affected if trees which have potential to be used for nursery colonies are felled as hazards during harvest operations Subsequent snag creation may offset this impact.
Johnson's Hairstreak (R6 Sensitive)	No impact	Minimal effect	Minimal effect
Western Bumble Bee	No impact	Beneficial effect, due to meadow restoration	No effect
Crater Lake Tightcoil (R6 Sensitive and Survey and Manage Species)	No impact	No effect	No effect
Oregon Megomphix (Survey and Manage Species)	No impact	No effect	No effect

Resource	Alternative 1	Alternative 2	Alternative 3
Red Tree Vole (Survey and Manage Species)	No impact	No effect	No effect
Great Gray Owl (Survey and Manage Species)	No impact	No effect	No effect
Cavity Excavators (Management Indicator Species)	No impact	Snag abundance may initially decline on 3515 acres, then increase with post-harvest mitigation and enhancement.	Snag abundance may initially decline on 2652 acres, then increase with post-harvest mitigation and enhancement.
Elk and Deer (Management Indicator Species)	No impact	About 1,747 acres of poor quality foraging areas would be converted to low-marginal (1,575 acres), high-marginal (164 acres) or good (8 acres) foraging habitat.	About 1,179 acres of poor quality foraging areas would be converted to low-marginal (1,096 acres) or high-marginal (83 acres) foraging habitat.
Pileated Woodpecker (Management Indicator Species)	No impact	No effect	No Effect

Resource	Alternative 1	Alternative 2	Alternative 3
Marten (Management Indicator Species	No impact	About 4.5% to 12.5% of the habitat in three potential marten home ranges would be degraded. This level of impact is not expected to result in a loss of functional home ranges for marten, but shifting of use within territories and minor changes to the size of the territory to compensate for the impacts on the habitat would likely occur. Understory habitat enhancement in older stands may slightly benefit marten habitat in two potential home ranges.	About 4.5% to 7.9% of the habitat in two potential marten home ranges would be degraded. This level of impact is not expected to result in a loss of functional home ranges for marten, but shifting of use within territories and minor changes to the size of the territory to compensate for the impacts on the habitat would likely occur. Understory habitat enhancement in older stands may slightly benefit marten habitat in two potential home ranges.
Bald Eagle (Management Indicator Species	No impact	No effect	No effect
Sensitive Botanical Species	No effect	No direct or indirect effect on sensitive vascular plants, lichens or bryophytes. However, since single year surveys were deemed infeasible for fungi, there could be effects to these species.	No direct or indirect effect on sensitive vascular plants, lichens or bryophytes. However, since single year surveys were deemed infeasible for fungi, there could be effects to these species.
Survey and Manage Botanical Species	No effect	Direct effects may include compaction and loss of host trees in timber harvest treatment areas	Direct effects may include compaction and loss of host trees in timber harvest treatment areas
Special Habitats	No effect	Restoration of high elevation meadow habitat. All other special habitats will be protected by buffers or avoidance.	No effect due to buffers and avoidance
Invasive Plants	No effect	A 9% increase in habitat for invasive plant species are expected. Project design elements would be used to mitigate some increases in populations of invasive plants due to ground disturbance; weed increases will be minimized to the extent possible.	A 6% increase in habitat for invasive plant species are expected. Project design elements would be used to mitigate some increases in populations of invasive plants due to ground disturbance; weed increases will be minimized to the extent possible.
Roads	Continued decline in road conditions on the 108 miles of roads associated with the project.	Would improve declining road conditions on an estimated 108 miles of road. 1.99 miles of road would be decommissioned.1.37 miles of road would be closed or stored. The Short Lake road	Would improve declining road conditions on an estimated 98 miles of road. 1.99 miles of road would be decommissioned.1.37 miles of road would be closed or stored. The Short Lake road

Resource	Alternative 1	Alternative 2	Alternative 3
		would be realigned, restoring hydrologic processes and decreasing road generated sediment deliver to streams in the project area.	would be realigned, restoring hydrologic processes and decreasing road generated sediment deliver to streams in the project area.
Heritage	No effect	Not likely to affect	Not likely to affect
Scenic Quality	No effect	The proposed actions would provide benefits to visuals along the powerline corridor and would enhance the view of Mt. Jefferson from the West Cascades National Scenic Byway. The proposed actions would not have any long term adverse effects to visually sensitive management areas, and proposed treatments would be consistent with standards and guidelines set by the Forest Plan.	The proposed actions would provide benefits to visuals along the powerline corridor and would enhance the view of Mt. Jefferson from the West Cascades National Scenic Byway. The proposed actions would not have any long term adverse effects to visually sensitive management areas, and proposed treatments would be consistent with standards and guidelines set by the Forest Plan.
Recreation	No effect	Temporary adverse effects due to trail closures, increased noise and dust and log truck traffic during harvest activity. Benefits of timber harvest activity would include improved access to dispersed recreation areas due to road maintenance, improved scenery from secondary forest roads and an enlarged and improved trailhead parking area at the South Breitenbush Trail.	Temporary adverse effects due to trail closures, increased noise and dust and log truck traffic during harvest activity. Benefits of timber harvest activity would include improved access to dispersed recreation areas due to road maintenance, improved scenery from secondary forest roads and an enlarged and improved trailhead parking area at the South Breitenbush Trail.
Eligible Wild and Scenic Rivers	There will be no impact to the free flowing status or the ORVs of each river and their eligibility for inclusion in the national Wild and Scenic River system will be maintained.	The actions proposed will not affect the eligibility of either the Breitenbush River or South Fork Breitenbush River for inclusion in the national Wild and Scenic River System.	The actions proposed will not affect the eligibility of either the Breitenbush River or South Fork Breitenbush River for inclusion in the national Wild and Scenic River System.
Wilderness	No effect	Temporary adverse effects to wilderness character due to increased noise during harvest activity.	Temporary adverse effects to wilderness character due to increased noise during harvest activity.
Inventoried Roadless Area (IRA)	No effect	Approximately 14 acres would be thinned. Roadless characteristics would continue to be met in the IRA.	Approximately 14 acres would be thinned. Roadless characteristics would continue to be met in the IRA.

Resource	Alternative 1	Alternative 2	Alternative 3
Air Quality	No effect	Impacts on air quality from smoke emissions would not exceed state mandated policy.	Impacts on air quality from smoke emissions would not exceed state mandated policy.
Economics	No contribution to local economy, forest sector jobs, or the National Forest Fund (NFF) would result. If not replaced by another project, Alternative 1 could contribute to a continued decline in forestry and milling related jobs.	Approximately 40 million board feet of timber would be contributed to local economy, forest sector jobs, and county governments via timber revenue and the National Forest Fund (NFF) would result. Jobs associated with timber harvest and production would contribute to the local economy with direct and indirect jobs and increased tax revenue to the government from those jobs.	Approximately 24 million board feet of timber would be contributed to local economy, forest sector jobs, and county governments via timber revenue and the National Forest Fund (NFF) would result. Jobs associated with timber harvest and production would contribute to the local economy with direct and indirect jobs and increased tax revenue to the government from those jobs.

Chapter 1 - Purpose and Need

1.1 Introduction

The Detroit Ranger District is proposing to improve stand growth, diversity and structure; move stand structure from an overabundance of mid-seral stands to increase both early and late seral stand structure within the watershed; reduce hazardous fuels; restore sugar pine and encourage sugar pine regeneration; treat powerline visuals; restore riparian and meadow habitats; and restore hydrologic processes in the Short Lake area. This project would also provide a sustainable yield of timber for commercial products to local and regional economies. Treatments would occur on about 4,060 acres on the Willamette National Forest.

The Hwy 46 project area is approximately 31,295 acres, located in the Breitenbush Watershed. Forest Road 46 (Hwy 46), the Breitenbush River and a powerline bisect the project area. The Hwy 46 project area is located approximately 6 miles northeast of the town of Detroit, Oregon, in Marion County. The legal description of the area is T 9 S, R 6 E, sections 1, 11 – 15, 21 – 28, 35 and 36, T 9 S, R 7 E, sections 3 – 36, T 9 S, R 8 E, sections 7, 18, 19, 30 and 31, T 10 S, R7 E, sections 1 – 6 and 8 – 12, T 10 S, R 8 E, section 6.

Within the project area trees are competing for sunlight, water and nutrients causing reduced tree growth and vigor. There is an oversupply of mid-seral stands, moving the seral distribution away from historic levels and limiting stand structure and species diversity across the landscape. This is the northern most extent of sugar pine, and past management and the exclusion of fire on the landscape has threatened this population of sugar pine. The Breitenbush Resort and Conference Center is located within the project area, and the watershed is popular with recreationists.

31,136 acres in the project area are managed by the Willamette National Forest with the remaining 159 acres belonging to private land holders. The project area is composed mostly of a Douglas-fir and western hemlock overstory, with an understory shrub component of vine maple, salal, dwarf Oregon grape, sword fern and Pacific rhododendron. Historically, large scale disturbances have been from infrequent, high intensity fires. Approximately 40% of the stands within the project area were initiated between 1600 and 1800. Another round of fires burned portions of the landscape around the turn of the twentieth century, particularly in the northern part of the project area, with approximately 21% of the area in this age class. Although commercial logging started in the watershed shortly after that, it did not ramp up until the 1960s with even-aged management. Since the mid-1990s, there has been virtually no stand replacing disturbance. However, as of August 31, 2017 there are fires actively burning within the project area. The effects from these fires is unknown at this time, and will be addressed in the final Environmental Impact Statement.

The project area is popular for recreation activities including: camping, hiking, hunting, fishing, bicycling, picnicking, target shooting, berry picking, viewing scenery, and driving for pleasure. Portions of the West Cascades National Scenic Byway and Cascading Rivers Scenic Bikeway are within the project area. The forested slopes along the Breitenbush River form an important scenic backdrop for the byway and river corridor. Several campgrounds along Forest Road 46 provide access opportunities to explore the area, enjoy a picnic or go for a short hike on a developed trail. Trailheads along the eastern project boundary provide entry to the Mt. Jefferson Wilderness. There are four special use permits for utilities within the project area as well as 71 recreation residences (summer homes).

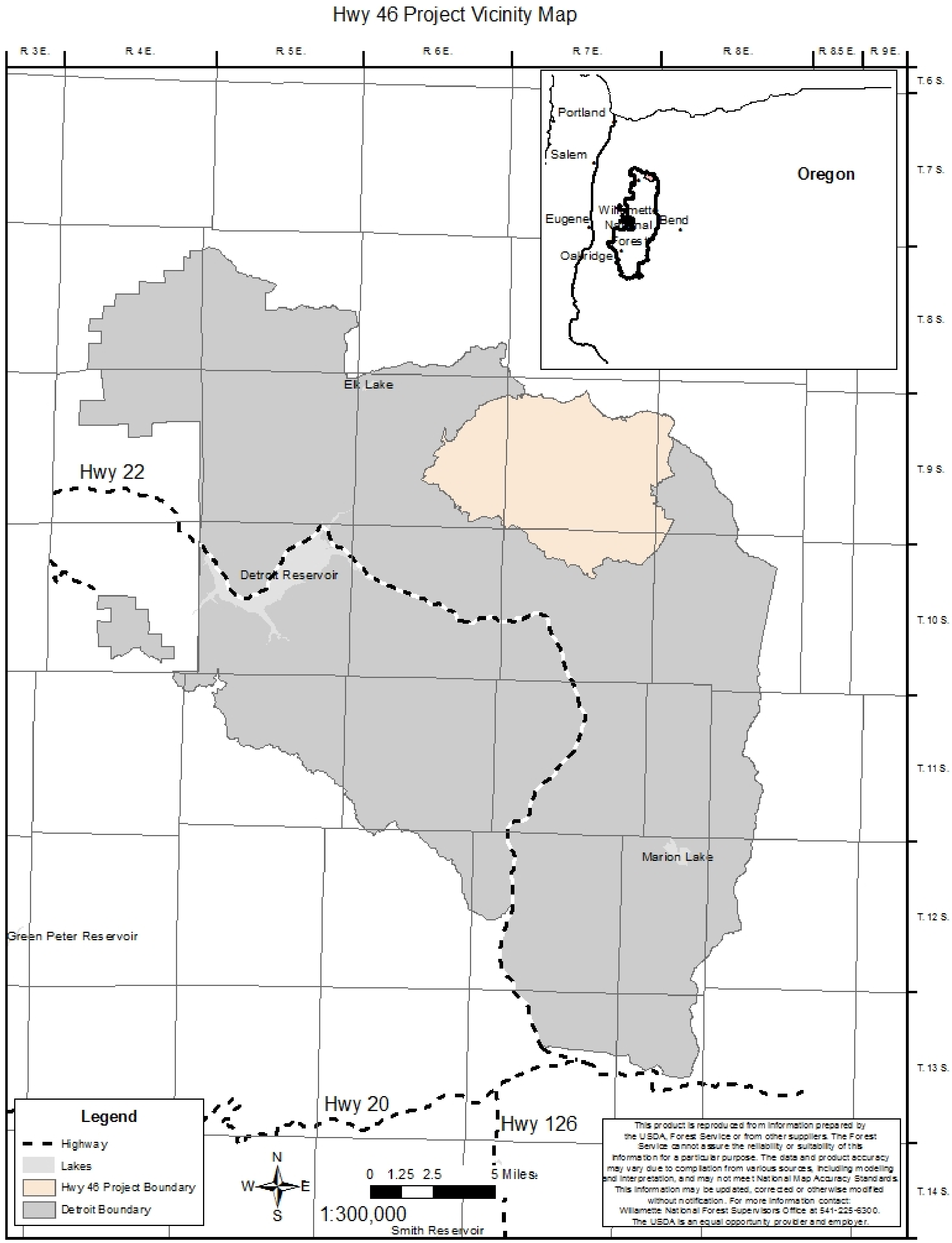

Figure 1 Project Vicinity Map

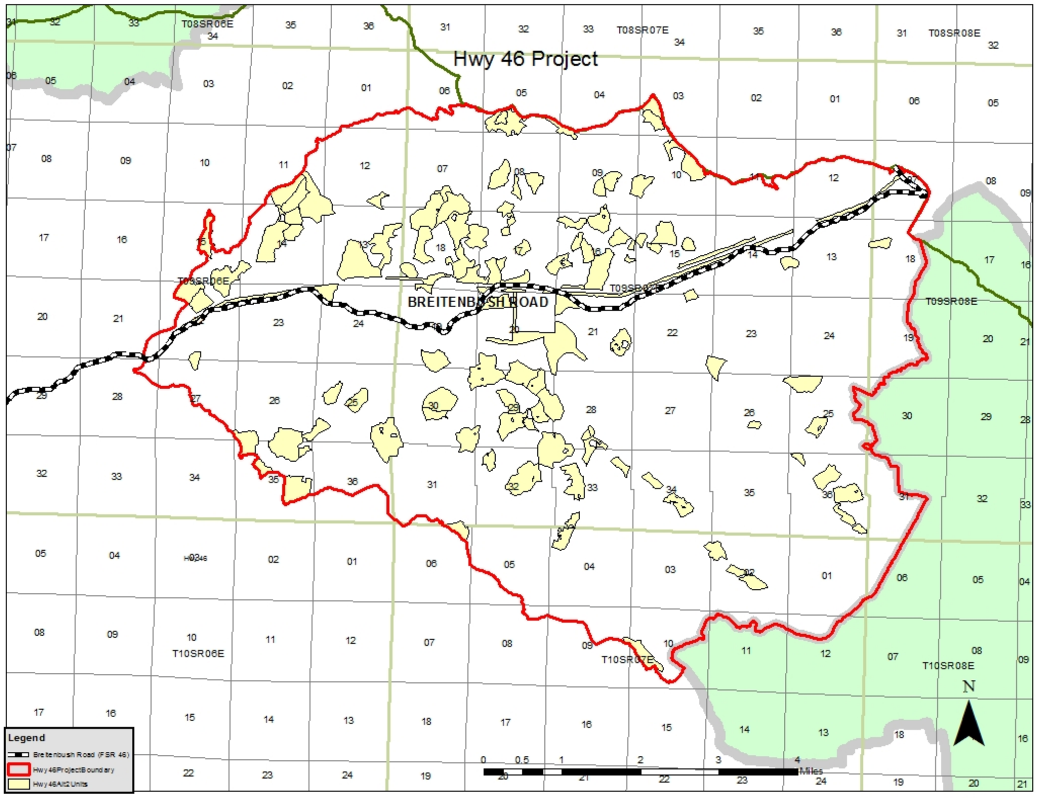

Figure 2 Hwy 46 Project Area

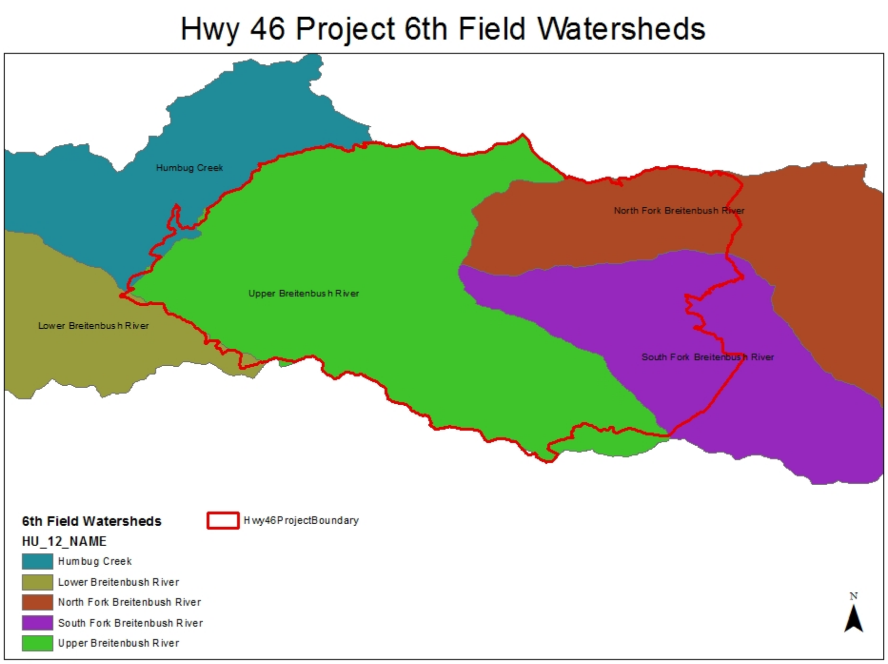

Figure 3 6th Field Watersheds within the Project Area

1.2 Purpose and Need for Action

The purpose of this project is to (1) improve stand growth, diversity and structure and move stand structure from an overabundance of mid-seral stands to increase early and late seral stand structure in the watershed, and to diversify wildlife habitat in the watershed; (2) strategically reduce hazardous fuels; (3) restore sugar pine stands to encourage sugar pine regeneration; (4) treat powerline visuals; (5) restore riparian habitats, meadows, and hydrologic processes in the project area; and (6) provide forest products to the local economy.

Improve Stand Growth, Diversity and Structure and Move Stand Structure from an Overabundance of Mid-seral Stands

The proposed project is needed to improve stand conditions, diversity, density, and structure in the project area, providing benefits to vegetation, wildlife, and overall health of the forest.

Increase Stand Health and Vigor

Why Consider Taking Action: All of the stands in which overstory management is proposed have a high continuous overstory canopy cover, most averaging 80% or more. The trees are competing for sunlight, water, and nutrients causing reduced tree growth and vigor as well as limiting understory vegetation. The understory is mostly limited to shrubs with few small trees scattered throughout resulting in single-storied stands in the plantations. The fire regenerated stands are similar to the plantations in that there is high competition between the overstory trees and suppression in the regeneration.

The proposed project would help improve stand conditions, diversity, density and structure with thinning, gaps, and dominant tree release. Thinning the overstocked stands would make more growing space and resources available to the remaining trees, resulting in decreased tree stress and development towards larger diameter stands. Stand vigor would also be increased as released trees develop into larger trees sooner, accelerating the development of some late successional characteristics. Tree species, age, and structural diversity would be maintained or enhanced.

The Stand Density Index (SDI), which is a qualitative measure of tree competition within a stand, ranges from 143 to 522 and averages 322 for all stands being considered for treatment in the Hwy 46 project area. In Douglas-fir, the maximum SDI (SDImax) is 595 (Reineke 1933). As a stand reaches an SDI of about 149, or approximately 25% of SDImax, trees within the stand start to compete with each other. As SDI increases to around 357, or 60% SDImax, trees reach a point at which they start dying due to competition, or self-thinning (Long, 1985).

Existing Condition: Plantations are generally characterized by dense monocultures of Douglas-fir. Competition is high with mortality occurring in many of the stands. Crown ratios are small, leading to reduced diameter growth. Although fairly well established on some of the northerly slopes, regeneration is suppressed by the overstory and growing slowly. Fire regenerated stands are older than the plantations in this project, and tend to have larger trees. Species composition in the overstory varies for pure Douglas-fir to mixed Douglas-fir with noble fir, western white pine, western hemlock, western redcedar, pacific silver fir, and sugar pine. Understory regeneration is variable and is predominantly western hemlock with western redcedar, grand fir, pacific yew, and mountain hemlock at the higher elevations. These stands are similar to the plantations in that there is high competition between the overstory trees and suppression in the regeneration.

Desired Condition: The desired future condition is to have healthy, vigorous stands which are diverse in species as well as in vertical and horizontal structure.

Increase the Amount of Early Seral Habitat

Why Consider Taking Action: Age class diversity in forest stands is important as some species of animals and plants depend on younger stages of forests for their feeding, nesting, and breeding requirements. Early seral habitat (defined as less than 20 years old) is of key importance to an estimated 156 species of wildlife in the central Oregon Cascades (O'Neil et al 2001).

With the cessation of clear-cut logging twenty years ago and continued fire suppression, early seral habitat has been substantially reduced within the project area. The powerline corridor contains most of the early seral habitat, and it encompasses less than 1% of the acreage in the project area. Historically, the Breitenbush watershed maintained about 9% early seral due to wildfire (USDA 1996, 2014). Patches of early seral habitat contribute to landscape heterogeneity and provide habitat for large herbivores, song birds, cavity nesters, and pollinators.

There is a need to enhance, create, and maintain diverse quality and structurally rich early seral habitat to support wildlife species that have been documented to depend on early seral habitat, such as elk, black-tailed deer, rufous hummingbirds, olive-sided flycatchers, and a large number of butterfly and moth species.

Existing Condition: Less than 4% of the project area is early seral habitat (defined as less than 20 years old).

Desired Condition: Historically the Breitenbush Watershed maintained about 9% early seral due to wildfire (USDA 1996, 2014). The desired condition would be to increase quality early seral habitat in the project area closer to historic levels.

Increase the Amount of Late Seral Habitat

Why Consider Taking Action: Age class diversity in forest stands is important as some species of animals and plants depend on older stages of forest development for their feeding, nesting, breeding and cover requirements such as flying squirrels, spotted owls, and many lichens and mosses.

Historically, the Breitenbush watershed maintained about 60% of closed canopy late seral stands. Currently, the watershed has about 48% closed canopy late seral stands. There is currently a need to enhance, create, and maintain stands of trees in the Breitenbush watershed with late seral characteristics. Late-Successional Reserves (LSR) are to be managed to protect and enhance conditions of late-successional and old-growth forest ecosystems. Silviculture treatments are to benefit the creation and maintenance of late-successional forest conditions and are subject to review by the Regional Ecosystem Office (REO). In the Hwy 46 Project, there are 38 units that are either completely within or have a portion within the LSR, totaling 1,018 acres. Of this, 35 units encompassing 808 acres are prescribed for commercial thinning. These stands are previously managed, densely stocked plantations, less than 80 years old.

Existing Condition: Approximately 48% of the project area is in closed canopy late seral stands.

Desired Condition: Historically, approximately 60% of the project area was in closed canopy late seral stands. The desired condition would be to move the late seral habitat closer to historical levels.

Increase the Potential for Riparian Reserves to Function as Late Successional Habitat

Why Consider Taking Action: Treatment of stands in Riparian Reserves would accelerate the ability of Riparian Reserves to provide adequate stream shade, root strength and bank stability, sediment filtration and nutrient cycling, large wood supply to waterbodies and floodplains, organic matter input, and habitat for riparian-dependent wildlife.

Existing Condition: Portions of Riparian Reserves within project area units consist of dense, overstocked, conifer-dominant stands with very little structural and species diversity and understory development. This lack of complexity and diversity is outside the natural range of variability and may be limiting nutrient cycling, deciduous organic matter input to waterbodies, and habitat for riparian-dependent wildlife.

Desired Condition: Maintain conditions in currently functioning portions of Riparian Reserves. In overstocked, conifer-dominant portions lacking structural and species diversity, attain Aquatic Conservation Strategy Objectives (Appendix E).

Strategically Reduce Hazardous Fuels

Why Consider Taking Action: The project area surrounds both the Breitenbush Hot Springs Resort and the Breitenbush and Devils Creek summer home tracts. These areas have been identified as communities at risk in the Marion County Community Wildfire Protection Plan. Much of the area that surrounds the structures within these communities is dense older forest with heavy fuel loadings and narrow road access that could inhibit fire suppression activities in the event of a wildfire.

Existing Condition Fire suppression over the past century has resulted in increased fuel loading throughout forest ecosystems. In 2014 51 acres of mastication work was completed within the Breitenbush Hot Springs, and between 2006 and 2012 50 acres of fuels reduction was completed by the US Forest Service within the summer home tracts. While this work has improved defensible space conditions and access for fire suppression resources there is still a substantial risk from wildfire within these communities.

Desired Condition: Reduced horizontal and vertical continuity of fuels in and around the Breitenbush Wildland-Urban Interface to decrease potential impacts and risks to people, structures, and resources in the event of a wildfire.

Restore Sugar Pine

Why Consider Taking Action: The primary range of sugar pine extends from northern Mexico, through the Sierra Nevada, Northern California, and Southern Oregon. The very northern extent of its range is in the Hwy 46 project area. Sugar pines are moderately shade tolerant, particularly when they are young, needing some protection from the sun as they establish. As they get older their tolerance for competition decreases, and other species can out-compete them if lower intensity disturbances, primarily wildfire, do not thin stand densities.

Existing Condition: Fire suppression over the last 100 years, extensive logging, and the introduction of white pine blister rust at the turn of the 20th century have reduced the population across its range (Waring and Angell, 2011). Most of the sugar pine found in the project area are lone big trees surrounded by dense Douglas-fir stands. One area of naturally regenerating sugar pine was found during project reconnaissance. The presence of these trees means that sugar pine has been part of this landscape for a long time and now appears to be losing its place in the ecosystem due to lack of disturbance allowing it to regenerate.

Desired Condition: Sugar pine will be restored closer to historic levels on the landscape with continued regeneration.

Treat Powerline Visuals

Why Consider Taking Action: The Hwy 46 project area encompasses the Breitenbush viewshed corridor. This viewshed is an important scenic asset as it surrounds the Breitenbush Hot Springs Retreat and

Conference Center and includes travel corridors that are considered sensitive to scenic quality. A powerline corridor bisects the watershed and the straight lines of the powerline corridor do not appear natural on the landscape.

Existing Condition: The project area is a high priority viewshed, with the powerline corridor bisecting the project area. The straight lines of the corridor are not natural looking.

Desired Condition: The existing straight line along the powerline corridor will be softened and a more natural appearing landscape will be created.

Restore Riparian Habitats, Meadows and Hydrologic Processes

Why Consider Taking Action: The previously managed stands in the Hwy 46 Project Area were harvested and replanted using direction that pre-dates the Willamette Land and Resource Management Plan (1990) and prior to the Northwest Forest Plan (1994). As a result, the majority of these forest stands were set on a management-induced trajectory that has led to artificially dense, conifer-dominated stands, with tree densities above the range of natural variability expected in this area, suppressing shrub and forb diversity in the understory. Analysis found that 4.6% of the Riparian Reserves in the Hwy 46 project area had a deciduous and deciduous/shrub component. Deciduous leaves have a higher nutritional quality than coniferous needles with regard to contributions to the aquatic food web.

With the exclusion of fire, meadow habitat within the project area has been declining. A high elevation meadow has been encroached upon by conifers, resulting in a decline in plant diversity, pollinator habitat, and wildlife forage.

The current alignment of FS road 46-059 has disrupted the hydrology of the Short Lake Area. This road accesses Short Lake, a popular destination for dispersed recreation camping, as well as fishing, birding, boating and wildlife viewing. Rerouting the road would reduce sediment delivery to streams in the project area, improve water quality, and reduce road maintenance.

Existing Condition: The project area is deficient in hardwoods along streams. Past silvicultural practices harvested timber to the edge of many streams and planted Douglas-fir along the streamside. Foliage from hardwoods provide nutrients for macro-invertebrates which provide food for fish downstream.

A high elevation meadow has been encroached upon by conifers since the last severe fire around the turn of the twentieth century. Historic aerial photos and field surveys indicate that this meadow once contained much more moisture and meadow vegetation, which is now being shaded out.

The current alignment of FS road 46-059 has disrupted the natural hydrology in the Short Lake area, allowing road generated sediment to enter the streams.

Desired Condition: Increase the shrub and deciduous component adjacent to streams. Restore the high elevation meadow to original standards by increasing hydrology, increasing solar exposure and enhancing the ability for native species to re-establish. Reduce the amount of road generated sediment entering streams in the area adjacent to FS road 46-059 (the Short Lake Road) by realigning the road to a more stable terrain.

Provide Forest Products to the Local Economy

Why Consider Taking Action: The proposed project is needed to ensure the Willamette National Forest continues to supply a reliable supply of timber products as directed by the laws and guidance below and in doing so contributes to the stability of local, regional, and national economies and contributes to the annual Probable Sale Quantity (PSQ) target for the Forest.

Several laws direct and allow the Forest Service to provide the sustainable harvest of trees from the Nation's forests including Multiple-Use Sustained-Yield Act of 1960 and the National Forest Management Act of 1976. One of the strategic goals of the Forest Service is to provide and sustain benefits to the people of the United States and the world as a whole. To accomplish this goal, one of the objectives is to provide a reliable supply of forest products over time consistent with achieving the desired conditions on National Forest System (NFS) lands and to maintain or create processing capacity and infrastructure in local communities. (USDA Strategic Plan FY 2014-2018). Additionally, the Willamette National Forest Land and Resource Management Plan as amended by the Northwest Forest Plan, includes goals to produce an optimum and sustainable yield of timber that helps maintain the stability of local and regional economies, and contribute valuable resources to the national economy on a predictable and long-term basis.

Probable Sale Quantity (PSQ) is an estimate of probable harvest levels that could be maintained on a forest annually (Northwest Forest Plan 1994). PSQs represent neither minimum levels that must be met nor maximum levels that cannot be exceeded. Rather, PSQs represent the best assessment of the average annual amount of timber harvest that could occur on a forest without decline, over the long term, if the schedule of harvests and regeneration are followed (Northwest Forest Plan 1994). PSQ can vary and change over time depending on acres available for harvest, expected acre yields and Forest direction.

Existing Condition: The current PSQ annual target for the Willamette National Forest is 111 million board feet (MMBF) as amended by the Approval of PSQ Estimates for Northwest Forest Plan Forests (1998).

Desired Condition: Through implementation of the proposed action, the Detroit Ranger District would contribute approximately 40 MMBF to the Willamette National Forest PSQ target and to the local economy.

1.3 Proposed Action

Proposed Action

The proposed action would treat approximately 4,060 acres in the project area. Harvest treatments proposed include thinning, dominant tree release, gap creation, early seral creation, shelterwood harvest, meadow restoration and skips. Non-commercial treatments include understory enhancements, riparian treatments, and hazardous fuels treatments. A detailed description of proposed treatments and project activities is located in Appendix A.

As stated in Section 1.2, the purpose and need for action includes:

1. improve stand growth, diversity and structure, and move stand structure from an overabundance of mid-seral stands to increase early and late seral stand structure in the watershed, and to diversify wildlife habitat in the watershed;

2. strategically reduce hazardous fuels;

3. restore sugar pine stands to encourage sugar pine regeneration;

4. treat powerline visuals;

5. restore riparian habitats, meadows, and hydrologic processes in the project area; and

6. provide forest products to the local economy

Table 3 illustrates the proposed treatments, connected actions, and the purpose and need they address.

Table 3 Proposed Action Treatments and Connected Actions

Proposed Activity	Unit of Measure	Proposed Action	Purpose – Need Addressed
Timber Harvest Treatments			
Thinning outside Riparian Reserves	Acres	1801.45	1,3,4,5,6
Thinning in Riparian Reserves	Acres	716	1,3,4,5,6
Quality Early Seral Habitat Creation	Acres	45	1,6
Sugar Pine Shelterwood	Acres	94	1,2,3,6
Gaps	Acres	47.8	1,3,4,6
Dominant Tree Release	Acres	72.75	1,3,5,6
Skips	Acres	877	1,5
Meadow Restoration	Acres	8	1,5,6
Total	**Acres**	**3662**	-
Estimated Volume	**MMBF**	**~40**	
Non-Commercial Treatments			
Understory Habitat Enhancements	Acres	155	1,2,5
Streamside Treatments (fall and leave)	Acres	20	1,5
Hazardous Fuels Treatment (WUI)	Acres	223	2
Total Non-Commercial Treatment	**Acres**	**398**	
Post-Harvest Fuels Treatments[1] in Timber Harvest Units			
Pile and Burn (mechanical and/or hand treatments)[2]	Acres	897	2
Post-Harvest Underburn[3]	Acres	1113	2
Connected Actions			
Harvest System			
Helicopter	Acres	317	6
Skyline	Acres	1532	6
Ground	Acres	936	6
Transportation			
Temporary Road Reconstruction	Miles	4.01	6

Proposed Activity	Unit of Measure	Proposed Action	Purpose – Need Addressed
Temporary Road Construction	Miles	5.11	6
Road Maintenance/Haul Route	Miles	108	6
Road Realignment	Miles	1	5, 6
Road Storage	Miles	1.37	5
Road Decommissioning	Miles	1.99	5
Rock Pit Management	Each	10	6
Post-Harvest Planting			
Early Seral Planting	Acres	45	1
Shelterwood Planting	Acres	94	1, 3
Gap Planting	Acres	47.8	1, 3
Dominant Tree Release Planting	Acres	Up to 72.75	1, 3
Key Issues			
Fire regenerated stands harvested	Acres	988	1, 3, 5, 6
Other			
Subsoiling: Subsoiling would occur in harvest units where needed to keep compaction below Forest Standards and Guidelines for high compaction levels Subsoiling would also occur on skid roads located in regeneration harvest units and gaps. **Temporary Road Decommissioning:** All temporary roads used in project activities would be decommissioned upon completion of activities or connected activities. **Scarifying Temporary Roads:** Soils may be scarified to aid in vegetation establishment. **Down Wood and Snag:** At least 240 lineal feet per acre of decay class I and II material greater than 20” diameter and 20 feet in length would be retained within the regeneration harvest units. Where the preferred size of material is not available, 240 lineal feet per acre of the next largest trees proposed to be harvested would be left. On average 4 snags (or live trees for snag creation) per acre would also be left in the regeneration harvest units.			

[1]: Post-harvest fuels treatments methods may change depending on feasibility and funding. Post-harvest fuels treatments would occur in timber harvest units; therefore the acreage of post-harvest fuels treatments are not included in the total acres of treated units.

[2]: Mechanical treatment may include: grapple piling in slash concentrations, yarding tops attached, mastication, or any other mechanical device).

[3]: These acres are possible underburn acres due to dbh and location, not all acreage may be underburned. Acreage not underburned may have other post-harvest fuels treatments assigned before implementation.

1.4 Forest Plan and Management Direction

This draft Environmental Impact Statement (DEIS) is tiered to the following EISs and plans, which are incorporated by reference:

The Willamette National Forest Land and Resource Management Plan Environmental Impact Statement, as amended (USDA Forest Service 1990; referred to as the “Forest Plan”)

The Northwest Forest Plan and Record of Decision and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Related Species with the Range of the Northern Spotted Owl (USDA Forest Service and USDI Bureau of Land Management 1994a; referred to as the “Northwest Forest Plan”)

The Forest Plan as amended by the 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (USDA Forest Service and USDI Bureau of Land Management 2001)

The Environmental Impact Statement and Record of Decision for Preventing and Managing Invasive Plants (USDA Forest Service 2005)

The Willamette National Forest Road Investment Strategy, Travel Analysis Report (TAR) (USDA Forest Service 2015)

The Forest Plan “guides all natural resource management activities and establishes management standards and guidelines for the Willamette National Forest. It describes resource management practices, levels of resource production and management, and the availability and suitability of lands for resources management” (Forest Plan, I-1). The Forest Plan provides management direction through the designation of specific management areas and standards and guidelines specific to these designations.

The Forest Plan was amended by the Northwest Forest Plan (1994), which established additional management areas, standards, and guidelines associated with Matrix, Riparian Reserves, Adaptive Management Areas, and Late-Successional Reserves. When there is overlap of management areas, the more restrictive standards and guidelines apply (Northwest Forest Plan 1994a p. A-6). Figure 4 and 5 illustrate the Forest Plan and Northwest Forest Plan management areas. Table 4 displays Forest Plan management areas, Northwest Forest Plan land management areas and proposed action unit acres for the proposed action.

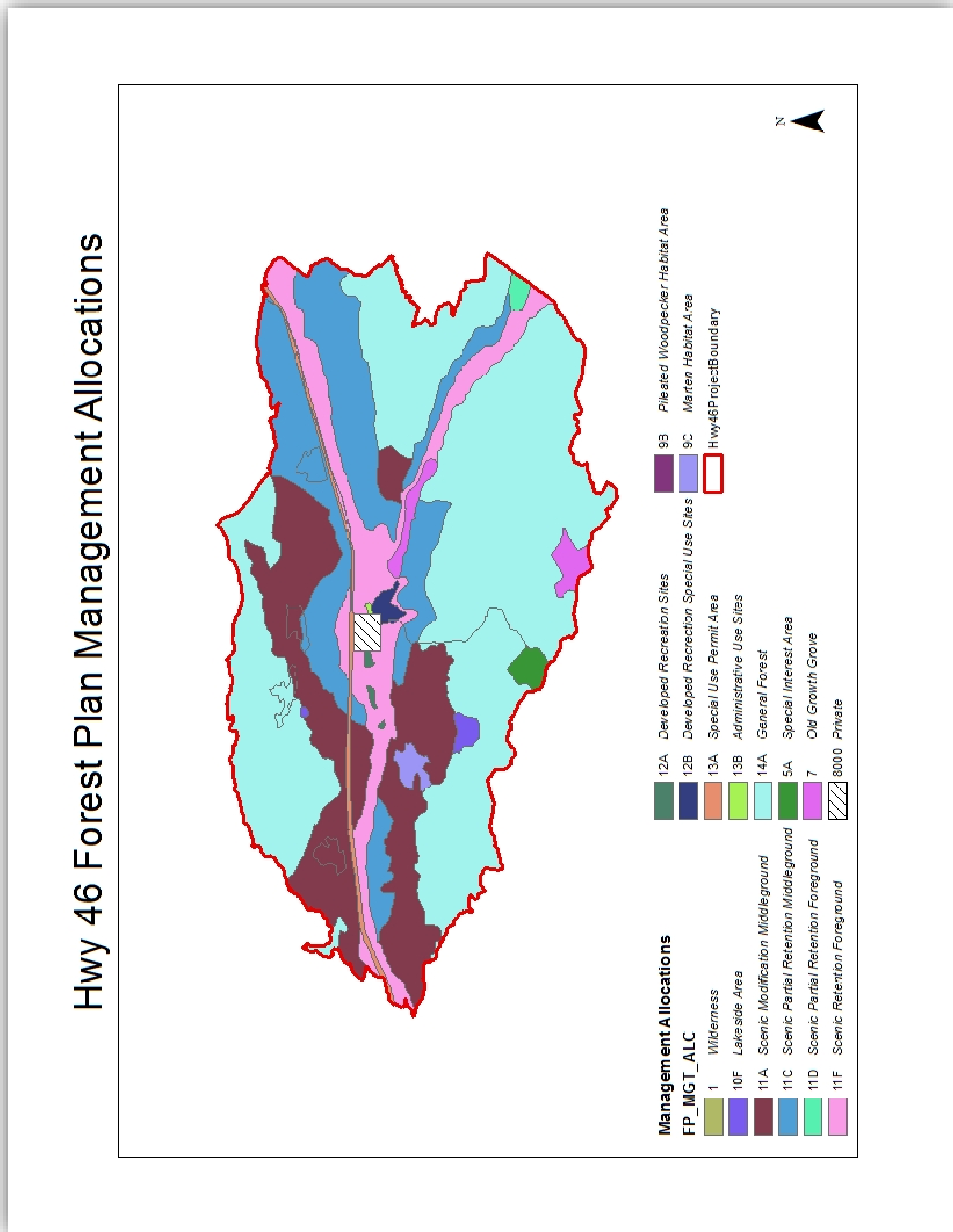

Figure 4 Willamette Forest Plan Management Areas in the Hwy 46 Project Area

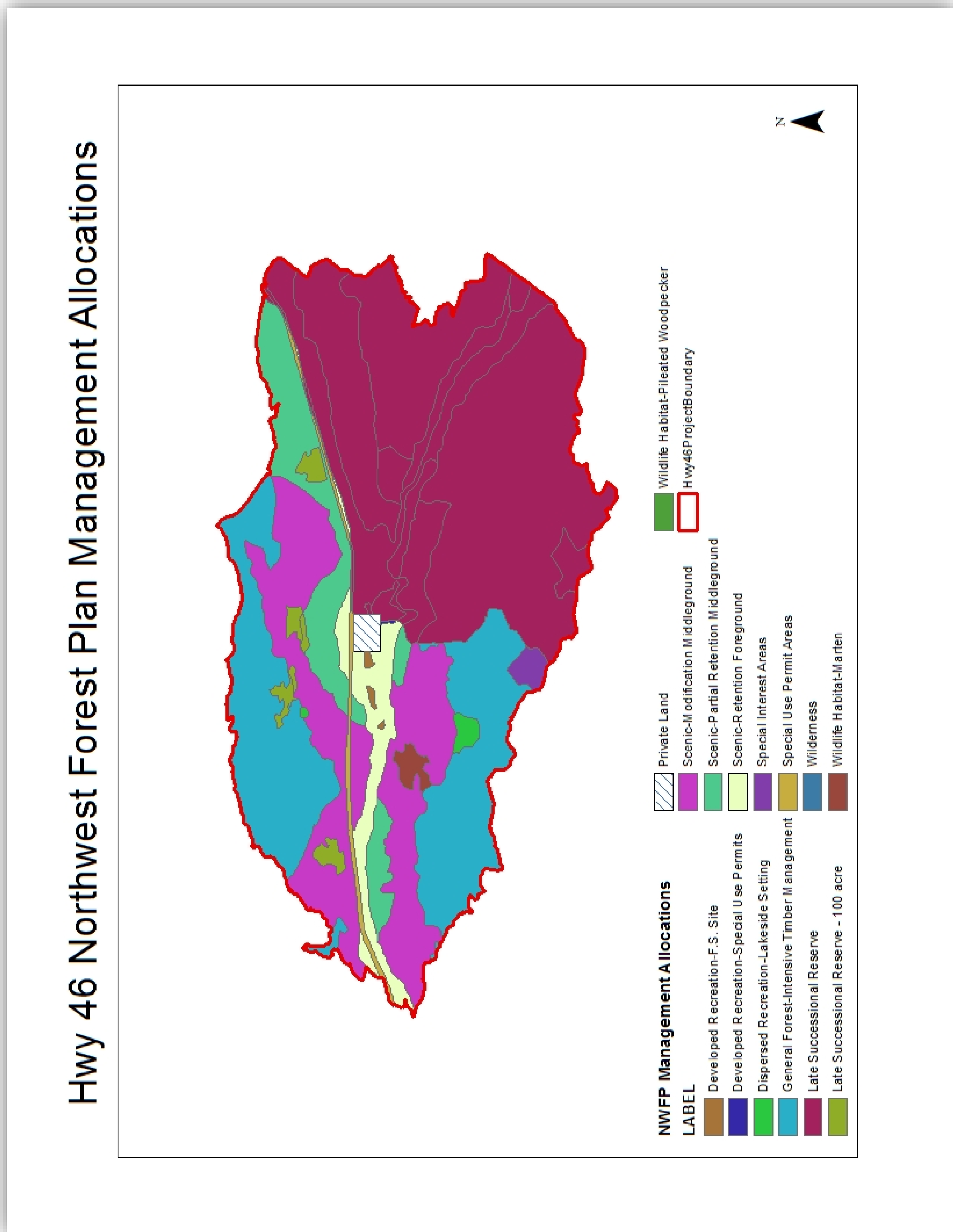

Figure 5 Northwest Forest Plan Management Areas in the Hwy 46 Project Area

Table 4 Land Management Areas in Project Area and Proposed Treatment Acres (Alternative 2)

Forest Plan Management Areas (MA)	Northwest Forest Plan Management Areas (MA)	Acres in Project Area	Proposed Action Acres		
			Timber Harvest	Non Commercial	Total
Special Interest Areas (5A)		182	0	0	0
Old Growth Groves (7)	Late Successional Reserve (16A)	422	0	0	0
Wildlife Habitat – Pileated Woodpecker (9B)		<1	0	0	0
Wildlife Habitat – Marten (9C)		168	0	0	0
Dispersed Recreation – Lakeside Setting (10F)		130	10[1]	0	10
Scenic Modification Middleground (11A)	Matrix (14)	5353	1150	8	1158
Scenic Modification Middleground (11A)	Late Successional Reserve (16A))	215	22	0	22
Scenic Modification Middleground (11A)	100-acre Late Successional Reserve (16B)	193	0	0	0
Scenic Partial Retention Middleground (11C)	Matrix (14)	2385	299	0	299
Scenic Partial Retention Middleground (11C)	Late Successional Reserve (16A)	2790	192	5	197
Scenic Partial Retention Middleground (11C)	100-acre Late Successional Reserve (16B)	137	0	0	0
Scenic Retention Middleground (11D)	Late Successional Reserve (16A)	97	0	0	0
Scenic Retention Foreground (11F)	Matrix (14)	1259	188	52	240
Scenic Retention Foreground (11F)	Late Successional Reserve (16A)	1872	126	448	174
Developed Recreation – FS Site (12A)		45	0	3	3
Developed Recreation – Special Use Permits (12B)		7	0	5	5
Developed Recreation – Special Use Permits (12B)	Late Successional Reserve (16A)	105	0	93	93
Special Use Permit Areas (13A)		335	59	0	59
Special Use Permit Areas (13A)	Late Successional Reserve (16A)	65	27	0	27
Administrative Use Site (13B)	Late Successional Reserve (16A)	6	0	0	0
General Forest (14A)	Matrix (14)	6323	1070	140	1210
General Forest (14A)	Late Successional Reserve (16A)	8965	519	44	563

Forest Plan Management Areas (MA)	Northwest Forest Plan Management Areas (MA)	Acres in Project Area	Proposed Action Acres		
			Timber Harvest	Non Commercial	Total
General Forest (14A)	100-acre Late Successional Reserve (16B)	82	0	0	0
Eligible Wild and Scenic Rivers (6B/6C)		5288	372	132	504
Riparian Areas (15)	Riparian Reserves (15)	13502	761	53	814
Critical Habitat		24552	2692	305	2997
Private Land (not a management allocation)		159	0	0	0
Total Land Allocations[1]		**31295**	**3662**	**398**	**4,060**

[1]: Does not include Eligible Wild and Scenic Rivers, Riparian Reserves or Critical Habitat which overlay other allocations.

The following management direction is relevant to management allocations with proposed treatments in the project area:

Forest Plan

Scenic – Modification Middleground (11A) areas have an objective to create and maintain desired visual characteristics of the forest landscape through time and space. Visually sensitive landscapes would be managed for a modest level of scenic quality. This area may also be managed for other resource goals including maintenance of wildlife habitats, recreation opportunities, watershed protection, and timber production.

Scenic-Partial Retention Middleground (11C) areas have the objective to create and maintain desired visual characteristics of the forest landscape through time and space. Visually sensitive landscapes would be managed for a moderate level of scenic quality. This area would also be managed for other resource goals including timber production, recreation opportunities, watershed protection, and maintenance of wildlife habitats.

Scenic-Partial Retention Foreground (11D) areas have an objective to create and maintain desired visual characteristics of the forest landscape through time and space. Visually sensitive landscapes would be managed for a moderate level of scenic quality. This area may also be managed for other resource goals including maintenance of wildlife habitats, recreation opportunities, watershed protection, and timber production.

Scenic-Retention Foreground (11F) areas have the objective to create and maintain desired visual characteristics of the forest landscape through time and space. Visually sensitive landscapes would be managed for a high visual quality. This area may also be managed for other resource goals including maintenance of wildlife habitats, recreation opportunities, watershed protection, and timber production.

Developed Recreation Sites (12A) areas have an objective to provide a safe, healthful, aesthetic, nonurban atmosphere for the pursuit of natural resource based recreation, and to provide facilities and improvements, consistent with resource protection needs and anticipated user demand.

Developed Recreation Special Use Permits (12B) areas have an objective to provide a safe, healthful, aesthetic, nonurban atmosphere for the pursuit of natural resource based recreation, and to provide facilities and improvements, consistent with resource protection needs and anticipated user demand.

Special Use Permits (13A) areas have an objective to provide safe and efficient sites for permitted facilities and improvements to promote public welfare in an environmentally sound manner.

General Forest (14 A) consists of areas outside of other Land Management Allocation categories where most of the timber treatments occur to produce an optimum and sustainable yield of timber production that is compatible with multiple use objectives.

Eligible Wild and Scenic Rivers (6B/6C) areas have an objective to maintain or enhance the largely undeveloped character of the shoreline while maintaining and improving the quality of water entering the river. These areas are managed to provide opportunities for a wide range of river oriented recreation activities and to maintain or enhance scenic quality. Management will comply with standards for Recreation or Scenic rivers as specified in FSH 1909.12.

Northwest Forest Plan

General Forest-Matrix Lands (14A) consists of areas outside of other Northwest Forest Plan land allocation categories where intensive timber management takes place and most of the timber treatments occur to produce an optimum and sustainable yield of timber production that is compatible with multiple use objectives.

Riparian Reserves (MA 15) are areas where the conservation of aquatic and riparian-dependent, terrestrial resources receives primary emphasis. In these areas all streams, wetlands, ponds, lakes, and unstable or potentially unstable areas are included and managed for the purpose of protecting the health of the aquatic system and its dependent species.

Late Successional Reserves (MA 16A) are managed to protect and enhance conditions of late-successional and old-growth forest ecosystems. The purpose of silvicultural treatments is to benefit the creation and maintenance of late-successional forest conditions.

1.6 Tribal Consultation

Tribal consultation for the Hwy 46 project began in 2011 during the early planning stages of the project and included field visits with tribal representatives. On July 15, 2011 the Grand Ronde and Warm Springs Tribes participated in a field visit to the project area. Representatives from both tribes have also participated in collaborative meetings. The Siletz Tribes consulted independently with field visits and meetings. The Detroit Ranger District consulted with the Klamath Tribes, the Confederated Tribes of Grand Ronde, the Confederated Tribes of Siletz Indians and the Confederated Tribes of Warm Springs. A consultation package and invitation to comment was sent to the Tribes listed above on January 28, 2016. No comments were received.

1.7 Public Involvement Efforts

Public involvement efforts during the development of the DEIS included collaborative meetings, scoping letters, field trips, meetings with interested parties and landowners, and publication of the project in the

Willamette National Forest Schedule of Proposed Actions and Willamette National Forest website. Below is a timeline illustrating public involvement efforts for the Hwy 46 project.

March 2013: Breitenbush Collaborative begins meeting

March 9, 2016: Notice of Intent (NOI) to prepare an EIS published in the Federal Register

May 25, 2016: Public field trip to view and discuss Hwy 46 project

Members of the public, organizations, and state and federal agencies were invited to provide comments and concerns about the Hwy 46 project during the public scoping comment period from March 9 through April 25, 2016. Over 260 comment letters were received, over 210 of those were form letters. Scoping comments received varied from those that wanted more clarification on proposed activities to specific suggestions for project implementation. Scoping comments were used to help develop planning issues, alternatives, and effects analysis for the DEIS. A complete record of all letters, including names and addresses of individuals, agencies, and organizations that submitted a letter during the scoping period, is available online in the Hwy EIS Public Reading Room at https://cara.ecosystem-management.org/Public//ReadingRoom?Project=47109

All correspondence and comments are available in the Project Record at the Detroit Ranger District office.

1.8 Consultation with other Agencies

United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS)

Upper Willamette River Chinook Salmon

In August 2017, a final Biological Assessment will be submitted to NMFS. Letter of concurrence is expected from NFMS in March or April 2018.

Northern Spotted Owl

Endangered Species Act (ESA) formal consultation with the USFWS for the Northern Spotted Owl was completed in 2017 and evaluated by the USFWS in the 2017 Biological Opinion (FWS reference 01EOFW00-2017-F-0555) signed August 31, 2017.

Oregon State Historic Preservation Office

The 1995 Programmatic Agreement (PA) among the USDA Forest Service PNW, the Advisory Council on Historic Preservation, and the Oregon State Historic Preservation Officer (SHPO) Regarding Cultural Resource Management in the State of Oregon by the USDA Forest Service, (amended in 2004), provides a process by which the Forest Heritage Specialist may certify that the Forest has complied with Section 106 of NHPA for the project. In accordance with this PA, an appropriate inventory was conducted during the summers of 2013, 2014, 2015 and 2016. All known cultural sites in the Area of Potential Effect (project area) were protected by avoidance, resulting in a determination of “No Historic Properties Affected” on December 28, 2016. Documentation was provided by SHPO and copies have been retained in the Forest and District Heritage files.

1.9 Issues Derived from Public Comments

A standardized content analysis process was conducted to analyze the letters received during the public scoping comment period. Content analysis was designed to extract comments from each letter received, evaluate similar comments from different letters, and identify topics or issues of concern. During content analysis, the Interdisciplinary Team (IDT), with involvement and approval from the Responsible Official, identified issues and separated them into three categories: “key” issues, “other” issues, and “out of scope” issues.

Key Issues

Key issues represent an unresolved conflict associated with potential environmental effects of the proposed action that cannot be resolved simply with mitigation or design elements. Key issues are used to formulate alternatives and focus the analysis of environmental effects.

During the public scoping process, two key issues were identified from comments and questions:

> ***Key Issue #1:*** Log truck traffic on the roads into and around the Breitenbush community poses a public safety concern. Issue includes public safety (Breitenbush community, bikeway, scenic byway, motorcyclists, etc.), and associated dust and noise associated with logging.

> ***Key Issue #2:*** Harvest treatments should not occur in fire regenerated stands

In response to Key Issue #1, concern for public safety issues associated with log truck traffic near the Breitenbush community, the haul route has been redesigned to require hauling as much as possible over FS road 2231 to Highway 22. Units located in the southern part of the planning area that are accessed by FS road 2231 will be hauled southeast over Boulder Ridge and down to Highway 22 just west of Idanha. This haul route is for both Alternative 2 and Alternative 3.

In response to Key Issue #2, Alternative 3 was developed, which eliminates harvest in fire regenerated stands. Hazardous fuel and understory treatments would still occur in fire-regenerated stands.

Though two issues are listed above, only one measure of change will be used to compare the alternatives:

> ***Key Issue Measurement:*** Acres of fire-regenerated stands harvested

Other Issues and Out of Scope Issues

Other issues are minor issues that do not result in development of alternatives or focus the analysis of environmental effects. In most cases, the IDT is able to address these issues by refining the design of a project (i.e. dropping a unit from the project) or applying a design feature (i.e. requiring buffers around streams).

Out of Scope issues are those identified as being “out of scope” of this environmental analysis. These issues include those that are not or cannot be addressed or solved in this project-level analysis; issues already decided by law, regulation, or other higher level decisions; issues irrelevant to the decision being made; and/or issues that are conjectural or not supported by scientific evidence.

1.10 Decision Framework

The responsible official for this proposal is the District Ranger of the Detroit Ranger District on the Willamette National Forest. The District Ranger will review the proposed action, alternatives, and the environmental consequences in order to make the following decisions:

- Whether to implement the proposed action or another alternative;
- What specific design elements are needed;
- What specific project monitoring requirements are needed to ensure design elements are implemented and effective; and
- What if any modifications would be made to the proposed action.

The decision will be based on:

- How well the selected alternative achieves the project purpose and need; and
- How well the selected alternative responds to analysis issues.

Chapter 2 - Alternatives

This chapter describes and compares the alternatives considered for the Hwy 46 project. It includes a description and map of each alternative considered. This chapter also presents the alternatives in comparative form, defining the differences between each alternative in order to provide a clear basis for choice by the decision maker.

Three alternatives have been analyzed for this project: Alternative 1 - No-Action; Alternative 2 - Proposed Action and Alternative 3 - No Harvest in Fire Regenerated Stands.

2.1 Alternative 1 – No Action

Alternative 1- No-Action assesses the current management situation of the affected environment as well as the future conditions should an action not be implemented. The No-Action alternative should not be confused with a baseline. Whereas a baseline is essentially a description of the affected environment at a fixed point in time, the No-Action alternative considers what effects would occur to forest ecosystems and resources in the project area if no action is taken.

The purpose and need of the proposed action would not be met under Alternative 1, as no timber harvest or fuels treatments would be implemented.

2.2 Alternative 2 – Proposed Action

Alternative 2 is the proposed action and was developed to fully meet the purpose and need for this project. Alternative 2 proposes to treat approximately 4,060 acres in the project area (Figure 6). Harvest treatments proposed include thinning, gap creation, dominant tree release, quality early seral creation, sugar pine shelterwood harvest, meadow restoration and skips. Harvest treatments would yield approximately 40 million board feet of timber. Post-harvest fuels treatments would include pile and burn and post-harvest underburn. Non-commercial treatments include understory enhancements, riparian treatments, and hazardous fuels treatments. Approximately 9.2 miles of temporary road construction and reconstruction would occur and approximately 108 miles of existing road would be maintained under Alternative 2. The Short Lake reroute would connect FS Rd 040 to FS Rd 045 by using Rd 059 (as signed in the field) with a new construction of a short section to be approximately 1000 feet in length. Road 059 (as signed in the field) is an existing road that is located on a broad flat ridge. Approximately 1 mile of road realignment will occur, including the Short Lake road realignment and 0.3 miles of realignment on FS road 2231 to accommodate hauling over the Boulder Ridge road to Highway 22.

Table 5 includes a summary of treatments and connected actions proposed under Alternative 2. A detailed description of proposed treatments and project activities is included in Appendix A. A detailed list of individual unit treatments is listed in Appendix B.

Table 5 Summary of Proposed Treatments and Connected Actions - Alternative 2

Proposed Activity	Unit of Measure	Proposed Action	Purpose – Need Addressed
Timber Harvest Treatments			
Thinning outside Riparian Reserves	Acres	1801.45	1,3,4,5,6
Thinning in Riparian Reserves (outside of no treatment buffers)	Acres	716	1,3,4, 5,6

Proposed Activity	Unit of Measure	Proposed Action	Purpose – Need Addressed
Quality Early Seral Creation	Acres	45	1,6
Sugar Pine Shelterwood	Acres	94	1,2,3,6
Gaps	Acres	47.8	1,3,4,6
Dominant Tree Release	Acres	72.75	1,3,5,6
Skips	Acres	877	1,5
Meadow Restoration	Acres	8	1,5,6
Total	**Acres**	**3662**	-
Estimated Volume	**MMBF**	**~40**	
Non-Commercial Treatments			
Understory Habitat Enhancements	Acres	155	1,2,5
Streamside Treatments (fall and leave)	Acres	20	1, 5
Hazardous Fuels Treatment	Acres	223	2
Total Non-Commercial Treatments	**Acres**	**398**	
Post-Harvest Fuels Treatments[1] in Timber Harvest Units			
Pile and Burn (mechanical and/or hand treatments)[2]	Acres	897	2
Post-Harvest Underburn[3]	Acres	1113	2
Connected Actions			
Harvest System			
Helicopter	Acres	317	6
Skyline	Acres	1532	6
Ground	Acres	936	6
Transportation			
Temporary Roads Reconstruction	Miles	4.01	6
Temporary Roads Construction	Miles	5.11	6
Road Maintenance/Haul Route	Miles	108	6
Road Realignment	Miles	1	5, 6
Road Storage	Miles	1.37	5
Road Decommissioning	Miles	1.99	5
Rock Pit Management	Each	10	6

Proposed Activity	Unit of Measure	Proposed Action	Purpose – Need Addressed
Post-Harvest Planting			
Early Seral Planting	Acres	45	1
Shelterwood Planting	Acres	94	1,3
Gap Planting	Acres	45	1,3
Dominant Tree Release Planting	Acres	Up to 74.25	1,3
Other			
Subsoiling: Subsoiling would occur in harvest units where needed to keep compaction below Forest Standards and Guidelines for high compaction levels Subsoiling would also occur on skid roads located in regeneration harvest units and gaps. **Temporary Road Decommissioning:** All temporary roads used in project activities would be decommissioned upon completion of activities or connected activities. **Scarifying Temporary Roads:** Soils may be scarified to aid in vegetation establishment. **Down Wood and Snag:** At least 240 lineal feet per acre of decay class I and II material greater than 20” diameter and 20 feet in length would be retained within the regeneration harvest units. Where the preferred size of material is not available, 240 lineal feet per acre of the next largest trees proposed to be harvested would be left. On average 4 snags (or live trees for snag creation) per acre would also be left in the regeneration harvest units.			

[1]: Post-harvest fuels treatments methods may change depending on feasibility and funding. Post-harvest fuels treatments would occur in timber harvest units; therefore the acreage of post-harvest fuels treatments are not included in the total acres of treated units.
[2]: Mechanical treatment may include: grapple piling in slash concentrations, yarding tops attached, mastication, or any other mechanical device).
[3]: These acres are possible underburn acres due to dbh and location, not all acreage may be underburned. Acreage not underburned may have other post-harvest fuels treatments assigned before implementation.

Harvest treatments would occur in stands ranging from 26-145 years old. Non-commercial understory habitat and hazardous fuels treatments would occur in stands ranging from 20-450 years old. Table 6 provides a summary of forest age classes and treatment acres for Alternative 2.

Table 6 Summary of Forest Age Classes and Treatment Acres - Alternative 2

	<80 years old	80-120 years old	>120 years old
Acres of Harvest Units (including skips)	2620	880	159
Acres Proposed for Harvest	2005	717	126
Non-Commercial Treatment Acres (including skips)	70	0	308

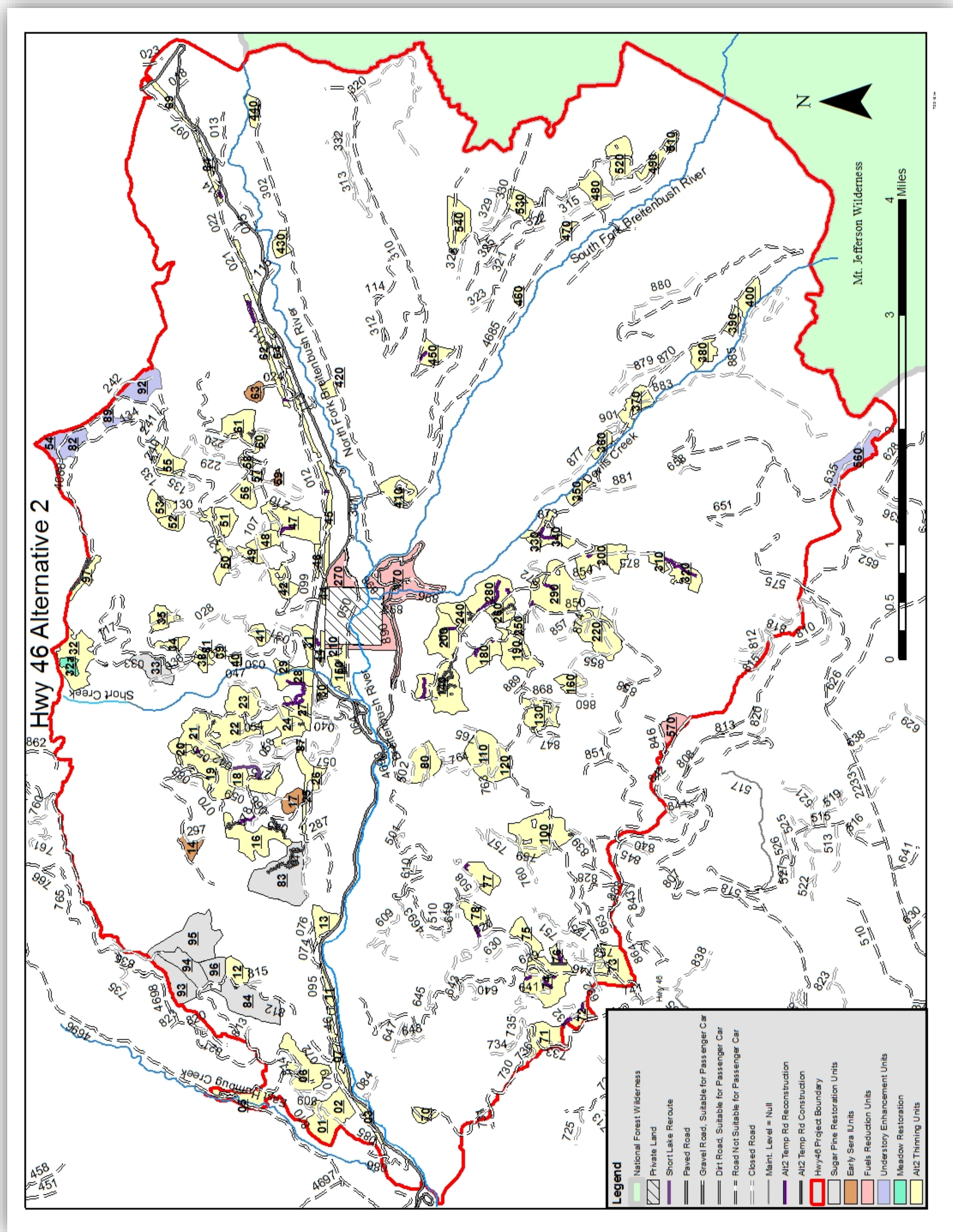

Figure 6 Map of Alternative 2

2.3 Alternative 3 – No Harvest in Fire Regenerated Stands

During the public scoping process, two key issues were identified from comments and questions:

> ***Key Issue #1:*** Log truck traffic on the roads into and around the Breitenbush community poses a public safety concern. Issue includes public safety (Breitenbush community, bikeway, scenic byway, motorcyclists, etc.), and associated dust and noise associated with logging.
>
> ***Key Issue #2:*** Harvest treatments should be restricted to plantations, no harvest in stands over 80 or in fire regenerated stands.

In response to Key Issue #2, Alternative 3 was developed, which commercially harvests in plantations only, eliminating harvest in fire-regenerated stands. Therefore, measuring acres of fire-regenerated stands treated will encompass the stands over 80 years of age. Understory habitat treatments and hazardous fuels (WUI) treatments would still occur in fire-regenerated stands and stands over 80 years of age.

Alternative 3 proposes to treat approximately 3022 acres in the project area (Figure 7). Harvest treatments proposed include thinning, gap creation, dominant tree release, quality early seral creation, sugar pine shelterwood harvest, and skips. Harvest treatments would yield approximately 24 million board feet of timber. Post-harvest fuels treatments would include pile and burn and post-harvest underburn. Non-commercial treatments include understory enhancements, riparian treatments, and hazardous fuels treatments. Approximately 6.3 miles of temporary road construction and reconstruction would occur and approximately 98 miles of existing road would be maintained under Alternative 3. Approximately 1 mile of road realignment will occur, including 0.3 miles of realignment on FS road 2231 to accommodate hauling over the Boulder Ridge road to Highway 22.

Because harvest would occur in plantations only under Alternative 3, proposed acres for harvest treatment decrease by 988 acres from Alternative 2. Alternative 3 proposes 17.5 fewer acres of gap creation; 13 fewer acres of dominant tree release; 640.5 fewer acres of thinning; 195 fewer acres of skips; and 29 fewer acres of regeneration harvest than Alternative 2. Alternative 3 would reduce acres of sugar pine restoration to 9 acres. There would be no meadow restoration in Alternative 3. Post-harvest fuels treatments would include pile and burn and post-harvest underburn. Non-commercial treatments include understory enhancements, riparian treatments, and hazardous fuels treatments.

Table 7 includes a summary of treatments and connected actions proposed under Alternative 3. A detailed comparison of Alternative 2 and Alternative 3 is available in Section 2.4 – Comparison of Alternatives.

Table 7 Summary of Proposed Treatments and Connected Actions - Alternative 3

Proposed Activity	Unit of Measure	Proposed Action	Purpose – Need Addressed
Timber Harvest Treatments			
Thinning outside Riparian Reserves	Acres	1373.95	1,3,4,5,6
Thinning in Riparian Reserves	Acres	514	1,3,4, 5,6
Quality Early Seral Creation	Acres	16	1,6
Sugar Pine Shelterwood	Acres	9	1,2,3,6
Gaps	Acres	34.8	1,3,4,6
Dominant Tree Release	Acres	58.25	1,3,5,6

Proposed Activity	Unit of Measure	Proposed Action	Purpose – Need Addressed
Skips	Acres	671	1,5
Meadow Restoration	Acres	0	
Total	**Acres**	**2677**	-
Estimated Volume	**MMBF**	**~24**	
Non-Commercial Treatments			
Understory Habitat Enhancements	Acres	155	1,2,5
Streamside Treatments (fall and leave)	Acres	20	1,5
Hazardous Fuels Treatment	Acres	223	2
Total Non-Commercial Treatment	**Acres**	**398**	
Post-Harvest Fuels Treatments[1] in Timber Harvest Units			
Pile and Burn (mechanical and/or hand treatments)[2]	Acres	805	2
Post-Harvest Underburn[3]	Acres	655	2
Connected Actions			
Harvest System			
Helicopter	Acres	54	6
Skyline	Acres	1155	6
Ground	Acres	797	6
Transportation			
Temporary Roads Reconstruction	Miles	3.3	-6
Temporary Roads Construction	Miles	3.0	6
Road Maintenance/Haul Route	Miles	98	-6
Road Realignment	Miles	1	5, 6
Road Decommissioning	Miles	1.99	5
Road Storage	Miles	1.37	5
Rock Pit Management	Each	10	6
Post-Harvest Planting			
Early Seral Planting	Acres	16	1
Shelterwood Planting	Acres	9	1,3
Gap Planting	Acres	34.8	1,3

Proposed Activity	Unit of Measure	Proposed Action	Purpose – Need Addressed
Dominant Tree Release Planting	Acres	Up to 58.25	1,3
Key Issues			
Fire Regenerated Stands Harvested	Acres	0	
Other			
Subsoiling: Subsoiling would occur in harvest units where needed to keep compaction below Forest Standards and Guidelines for high compaction levels Subsoiling would also occur on skid roads located in regeneration harvest units and gaps. **Temporary Road Decommissioning:** All temporary roads used in project activities would be decommissioned upon completion of activities or connected activities. **Scarifying Temporary Roads:** Soils may be scarified to aid in vegetation establishment. **Down Wood and Snag:** At least 240 lineal feet per acre of decay class I and II material greater than 20” diameter and 20 feet in length would be retained within the regeneration harvest units. Where the preferred size of material is not available, 240 lineal feet per acre of the next largest trees proposed to be harvested would be left. On average 4 snags (or live trees for snag creation) per acre would also be left in the regeneration harvest units.			

[1]: Post-harvest fuels treatments methods may change depending on feasibility and funding. Post-harvest fuels treatments would occur in timber harvest units; therefore the acreage of post-harvest fuels treatments are not included in the total acres of treated units.
[2]: Mechanical treatment may include: grapple piling in slash concentrations, yarding tops attached, mastication, or any other mechanical device).
[3]: These acres are possible underburn acres due to dbh and location, not all acreage may be underburned. Acreage not underburned may have other post-harvest fuels treatments assigned before implementation.

Harvest treatments would occur in stands ranging from 26-56 years old. No harvest would occur in stands over 57 years old. Non-commercial understory habitat and hazardous fuels treatments would occur in stands ranging from 20-450 years old. Table 8 provides a summary of forest age classes and treatment acres for Alternative 3.

Table 8 Summary of Forest Age Classes and Treatment Acres - Alternative 3

	<57 years old	57-120 years old	>120 years old
Acres of Harvest Units (including skips)	2620	0	0
Acres Proposed for Harvest	2005	0	0
Non-Commercial Treatment Acres (including skips)	70	0	308

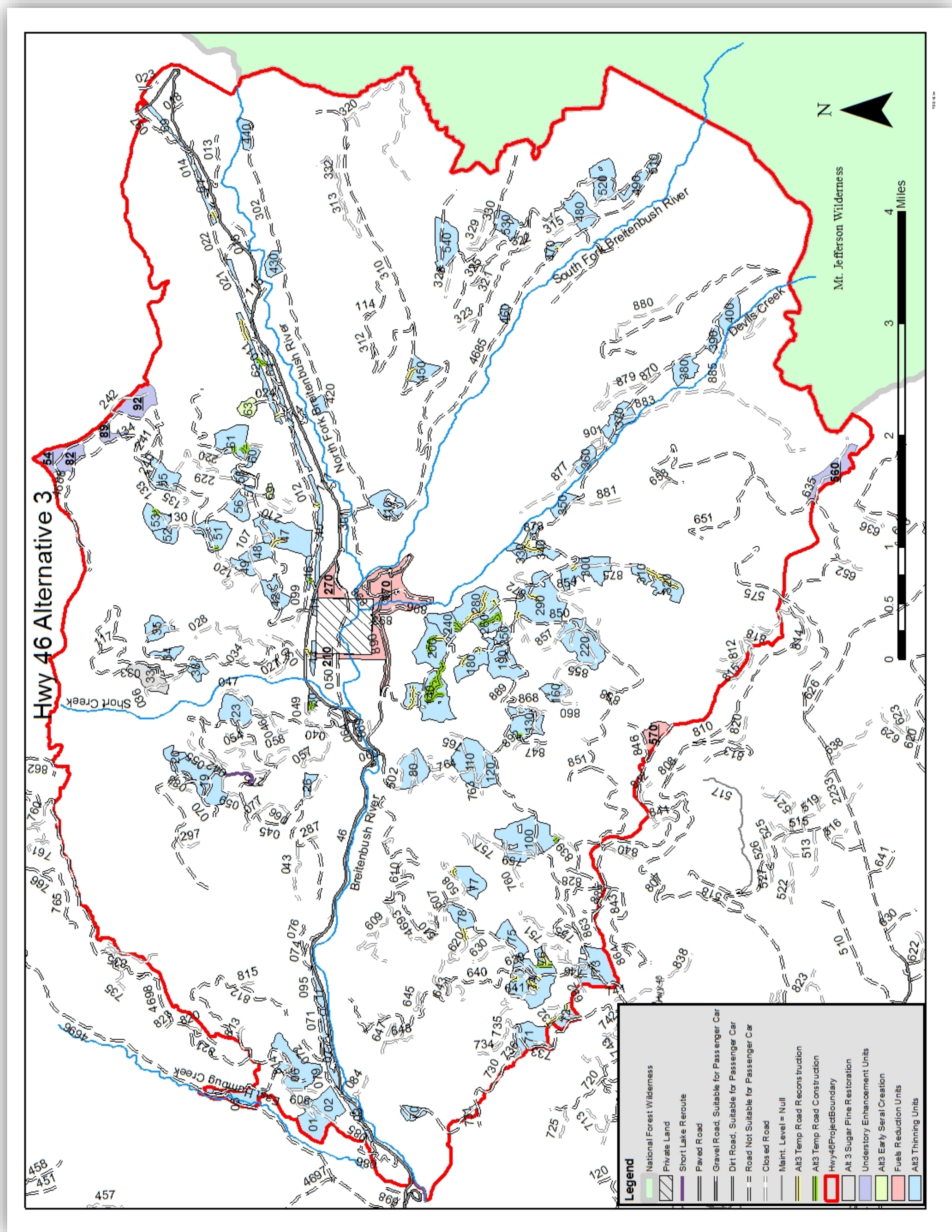

Figure 7 Map of Alternative 3

2.4 Alternatives Considered but Eliminated

Alternative that Utilized FS Road 46 as Only Haul Route to Highway 22

The original proposed action included hauling all timber down FS Road 46 to Highway 22. This alternative would increase heavy equipment and log truck traffic in the vicinity of Breitenbush Resort and Conference Center. Due to public safety and noise concerns during logging and hauling operations, this haul route was modified to reduce traffic from operations in the vicinity of private land holdings in the project area, and the original haul route not analyzed.

Alternative with More Early Seral Habitat Creation

In order to meet the purpose and need of moving the watershed seral distribution towards historic levels, more acres were considered for early seral habitat creation during planning and project design. The IDT developed guidelines for quality early seral habitat creation, and considered slope, exposure, plant association and location (limited vehicle access and not in the late successional reserve). If the acres did not meet the guidelines, the stand was dropped or thinning prescribed, and those acres were not analyzed for early seral creation.

Alternative with No Early Seral Habitat Creation

During public scoping, comments were received asking us to consider an alternative with no early seral creation. Because this alternative would not meet the purpose and need of moving the watershed seral distribution towards historic levels, it was not further analyzed.

2.5 Comparison of Alternatives

Table 9 summarizes and compares treatments and connected actions that would occur under each alternative.

Table 9 Comparison of Alternatives

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3
Timber Harvest Treatments				
Thinning outside Riparian Reserves	Acres	0	1801.45	1373.95
Thinning in Riparian Reserves	Acres	0	716	514
Quality Early Seral Creation	Acres	0	45	16
Sugar Pine Shelterwood	Acres	0	94	9
Gaps	Acres	0	47.8	34.8
Dominant Tree Release	Acres	0	72.75	58.25
Skips	Acres	0	877	671
Meadow Restoration	Acres	0	8	0
Total	Acres	0	3662	2677
Estimated Volume	MMBF	0	~40	~24

Proposed Activity	Unit of Measure	Alternative 1	Alternative 2	Alternative 3
Non-commercial treatments				
Understory Habitat Enhancements	Acres	0	155	155
Streamside treatments	Acres	0	20	20
Hazardous Fuels Treatment	Acres	0	223	223
Total	Acres	0	398	398
Post-Harvest Fuels Treatments[1] in Timber Harvest Units				
Pile and Burn (mechanical and/or hand treatments)[2]	Acres	0	897	805
Post-Harvest Underburn [3]	Acres	0	1113	655
Connected Actions				
Harvest System				
Helicopter	Acres	0	317	54
Skyline	Acres	0	1532	1155
Ground	Acres	0	936	797
Transportation				
Temporary Roads Reconstruction	Miles	0	4.01	3.3
Temporary Roads Construction	Miles	0	5.11	3
Road Maintenance/Haul Route	Miles	0	108	98
Road Realignment	Miles	0	1	1
Road Decommissioning	Miles	0	1.99	1.99
Road Storage	Miles	0	1.37	1.37
Rock Pit Management	Each	0	10	10
Post-Harvest Planting				
Early Seral Planting	Acres	0	45	16
Shelterwood Planting	Acres	0	94	9
Gap Planting	Acres	0	47.8	34.8
Dominant Tree Release Planting	Acres	0	Up to 72.75	Up to 58.25
Key Issues				
Fire regenerated stands harvested	Acres	0	988	0

[1]: Post-harvest fuels treatments methods may change depending on feasibility and funding. Post-harvest fuels treatments would occur in timber harvest units; therefore the acreage of post-harvest fuels treatments are not included in the total acres of treated units.

[2]: Mechanical treatment may include: grapple piling in slash concentrations, yarding tops attached, mastication, or any other mechanical device).

[3]: These acres are possible underburn acres due to dbh and location, not all acreage may be underburned. Acreage not underburned may have other post-harvest fuels treatments assigned before implementation.

Comparison of Treatments Proposed in Riparian Reserves for Alternative 2 and 3

The treatments proposed in Riparian Reserves for Alternative 2 and 3 are described and displayed below in Tables 11 and 12. All units were surveyed by fisheries, hydrology, wildlife, and botany specialists. Each unit was gridded to capture streams, springs, wetlands and other waterbodies that may not be mapped on the GIS layer. Based on stream and riparian characteristics, a recommendation was made for no-treatment buffers and other potential treatments (e.g., down wood creation) for each waterbody.

Alternatives 2 and 3 propose both active and passive management of Riparian Reserves: thinning, gap creation, down wood augmentation, and no treatment (table 10). Within Riparian Reserves, stand-specific treatments were prescribed by the Silviculturist in consultation with the District Hydrologist and Fish Biologist and are listed in the Design Elements in Table 13. Stand treatments promote variable density within and among stands, including Riparian Reserves, by leaving skips, varying thinning intensities, and introducing gaps in selected stands (see the Vegetation Report). Within Riparian Reserves, no-treatment buffers protect stream shade, bank stability, large wood recruitment and other riparian processes; outside of the buffers, treatment in Riparian Reserves are designed to meet or accelerate meeting ACS objectives. Unit design elements developed by the interdisciplinary team directed the management action and the protection needed to accomplish resource goals.

Table 10 Riparian Reserve Acres Proposed for Treatment

Activity	Riparian Reserve Acres Proposed for Treatment			
	Alternative 1	Alternative 2		Alternative 3
	Total	Total	Over 80	Total
Thinning		751	183	567
Commercial Thinning	0	716	177	514
Sugar Pine Restoration	0	0	0	0
Quality Early Seral	0	0	0	0
Understory Habitat Enhancement	0	4	1	4
Hazardous Fuels Reduction	0	49	2	49
Meadow Restoration	0	3	3	0
DTR Gaps (1/4-1/2 acre)	0	2	0	0
Streamside Treatment	0	20	0	20
Total Treatment	**0**	**771**	**183**	**587**
No Harvest	N/A	674	192	480
Total Riparian Reserves in proposed units	N/A	1,447	375	1,066
Total Riparian Reserves in Project Area	13,502			
Percent of Riparian Reserve Treated	0	5.7	1.4	4.3
Total Riparian Reserves in Watershed	27,925			
Percent of Riparian Reserve Treated	0	2.8	0.7	2.1

In order to add additional structural complexity, vegetative diversity, and habitat diversity to stands, some of the Riparian Reserve stands proposed for thinning also have small gap creation, totaling approximately 2 acres. These small ¼ acre gaps would increase stand diversity and productivity, enhancing terrestrial habitats which are also a component of the ACS objectives (see Wildlife Section and Appendix E). These gaps are planned primarily out of the Riparian Reserves but may have portions extending into the outer Riparian Reserve beyond the secondary shade zone. Table 11 shows a list of these proposed units.

Table 11 Proposed Wildlife and DTR Gaps Within Outer Riparian Reserves for Alternatives 2 and 3

Unit	DTR Gaps in Unit		Approximate Gap Acres in Riparian Reserve
	#	Size	
320	6	¼ acre	0.3
350	2	¼ acre	0.4
380	4	¼ acre	0.7
400	3	¼ acre	0.3
520	6	¼ acre	0.4
Total	21	¼ acre	2.1

Several streams were identified during field surveys to have a shortage of large woody material within the channel or floodplain, lack of riparian diversity, and/or opportunity for hardwood release. Selected streams for treatment were chosen for their vegetation characteristics at the stream catchment scale and at the site-specific scale. The large majority of riparian stands along the entire length of the streams in units 6, 100, 190, 430, and 520 are dense plantations lacking structural and species diversity. In these five young plantation units, fall and leave treatment would occur in approximately 20 to 75% of the units' no-harvest buffers along approximately 3.2 miles of streams to reduce densities, open the canopies, increase growth and vigor of remaining trees, and add medium to large wood to forest floor and stream channels (Table 12). These treatments will occur with consideration to protecting or enhancing future shade trees and large wood that have potential to contribute to conditions in-stream in the long term.

Table 12 Proposed Streamside Treatments for Alternatives 2 and 3

Unit	Stream	Treatment Description	Estimated Acres	Class 2 Stream Miles	Class 3-4 Stream Miles
6	Fox Creek	Fall and leave to 70 TPA density patches along the lower Fox Creek downstream of tributary confluence.	2.6	0.25	-
100	Leone Creek and tributaries	Fall and leave to 70-90 TPA density along the entire north side and patchy thinning with small gaps on south side of the southwest stream channel. Also fall and leave along parts of Leone Creek and east tributary to Leone in north part of units. Tip trees into streams.	7.6	-	1.0
190	Hill Creek	Lightly fall and leave in small hardwood release gaps within the 60 foot no-harvest buffer treat along Hill Creek.	2.3	0.4	-
430	Class IV tributary to North Fork Breitenbush River	Fall and leave trees into stream channel as source wood for the North Fork Breitenbush River downstream within 50 feet of the channel to 90 TPA.	2.2	-	0.2
520	Unnamed Class 3 and 4 streams	Fall and leave to 70-90 TPA within 60 foot no-harvest buffer on all streams, with 3-4 small hardwood release gaps along the class 3 streams.	5.5	-	0.8 (class 3) 0.5 (class 4)
Total Estimated Streamside Treatment			20	0.65	2.5

2.6 Project Design Elements Common to Alternatives 2 and 3

The design elements in Table 13 were developed to reduce the environmental effects of the proposed activities and ensure project activities are implemented to comply with standards and guidelines, goals, objectives, conservation strategies and Best Management Practices.

Table 13 Design Elements Common to Alternatives 2 and 3

Table 13: Design Elements for Action Alternative			
Unit #	**Reason**	**Design Feature**	**Dates**
		Haul Route	
71, 72, 73, 74, 75, 76, 77, 78, 100, 110, 120, 130, 140, 160, 180, 190, 200, 220, 240, 250, 260, 280, 290, 300, 310, 320, 340, 350, 360, 370, 380, 390, 400	Respond to Key Issue #1 – Public Safety. Reduce the amount of log truck traffic in the vicinity of the Breitenbush Resort and Conference Center	• Timber will be hauled over the 2231 road to Highway 22 and not down Highway 46.	
		Silviculture	
All	Protect legacy trees	• Legacy trees should be retained and included in the thinning spacing. If legacy trees are determined to be a safety hazard or need to be felled for operational purposes, they shall be felled and left in place. Legacy trees are defined as trees left from the previous stands that are typically larger than the remaining trees. In this project area legacy trees are defined as all trees >30 inches dbh.	
All	Prevent noxious weed spread	• Keep the edge of gaps and DTRs at least 200 feet from drivable roads and 100 feet from each other.	
200[1)], 220[1)], 240-260, 280-540	LSR assesment guidelines	• Individual trees exceeding 20 inches dbh shall not be harvested except for the purpose of creating openings, providing other habitat structure such as down logs, elimination of a hazard from a standing danger tree, or cutting yarding corridors. Where trees larger than 20 inches dbh are cut, they will be left in place to contribute toward coarse woody debris. [1)] for portion of unit in LSR only.	
200[1)], 220[1)], 240-260, 280-540	LSR assesment guidelines	• Leave at least 10% of the unit area in un-thinned patches and between 3 and 10% of the unit area in dominant tree gaps no larger than ¼ acre each.	
All where planting occurs	Meet stocking requirements identified	• Plant to stocking level and species composition identified in the silvicultural prescription.	

Table 13: Design Elements for Action Alternative

Unit #	Reason	Design Feature	Dates
	in National Forest Management Act		
Fuels			
All	For Soil Productivity (Duff retention and ground cover standards)	• Retain existing duff percentages in accordance with Forest Plan Standard and Guidelines, See integrated prescriptions for unit specifics. Duff retention will be monitored as part of any activity that may affect the soil resource, such as spot or pile burning, or broadcast burning. • Where chipping operations are planned, depth of chips should not exceed 3 inches and should not exceed 40% ground cover of an area for any given acre. Chipping equipment traffic would be maintained within existing roads, trails footprints, or similar areas to minimize compaction.	
170, 210, 270	Minimize visual impacts of hazardous fuels treatments	• Fuels treatments occurring in or adjacent to the Breitenbush and Devils Creek summer homes or Breitenbush Resort will require representatives from the district recreation staff, the district archeologist, the Breitenbush Summer Home Association, and the Breitenbush Hot Springs Resort to be consulted in the design phase of the fuels treatment projects in or adjacent to these areas. • Additionally, within these units the following elements will be incorporated into treatment specifications: o All work would be done with hand treatments only, no mechanical treatments would be used o Areas of shrubs and trees would be retained in “skips” to provide vegetation buffers where needed o Burning would be minimized to the greatest extent possible	
7, 11, 80, 150	Reduce impacts to recreating public	• No fuels treatments will occur in or adjacent to Breitenbush Campground, Cleator Bend Group Camp, Fox Creek Group Camp while campgrounds are open in fee status.	April 15 – September 30
13,24,83	Protect threatened, endangered, sensitive and survey and manage plant species	• No burning in buffers prescribed for survey and manage *Pseudocyphellaria rainierensis, Chalciporus piperatus* and *Rhizopogon truncatus*	
All	Protect key riparian features and integrity	• Underburning in Riparian Reserves will occur only during low intensity burning conditions. Ignition will not occur in Riparian Reserves but fire will be allowed to back into Riparian Reserve areas. Hand line construction in Riparian Reserves must be coordinated with Hydrologist/Fish Biologist if deemed necessary. Wet line construction is preferred.	
12, 17, 18, 24, 27, 32, 32a, 33, 35, 47, 73, 84, 93, 95, 96, 270, 430 & 450	To avoid disruption of nesting spotted owls	• Under burning, fuel treatments and slash burning is prohibited. (no spring burning)	March 1 – July 15

Table 13: Design Elements for Action Alternative			
Unit #	**Reason**	**Design Feature**	**Dates**
270	To avoid disruption of nesting spotted owls	• All activities including chainsaw use and burning in the east half of stand is prohibited	March 1 – September 30
		Wilderness	
560	Mitigate sound impacts from non-commercial units	• Restrict activities to recreation off-season • Accomplish treatment with non-motorized equipment • Expedite activities to affect only 1 year	Operate from October 15th through June 15th
		Noise	
All	Reduce noise disturbance from harvest operations	• No harvest operations during weekends or Memorial Day, 4th of July or Labor Day	All Year long
24, 32, 32a	Reduce noise disturbance from helicopter operations	• Restrict helicopter yarding to off season time period for the Breitenbush Hot Springs Resort. This restriction does not apply to other logging activities. • Encourage the design and location of flight paths to landings that travel away from the Breitenbush Hot Springs Resort in order to minimize sound impacts from helicopter logging.	No operations from Memorial Day through Labor Day
All Helicopter units	Reduce noise impacts	• No helicopter operations prior to 8 am.	
27, 28, 30, 42, 200, 240.	Reduce noise disturbance from skyline operations	• Restrict logging season to off season time period for the Breitenbush Hot Springs Resort.	No operations from Memorial Day through Labor Day
		Recreation	
All	Reduce impacts to recreating public	• Road Management Objectives for traffic to FS Roads 46, 4685, 4696, and 2231, requires weekend and holiday haul restrictions between Memorial and Labor Day Weekends. No hauling on Memorial, 4th of July, and Labor Day holidays. Notify Public Affairs Office to coordinate public information updates (temporary road closures, delays) with two weeks prior notice.	Memorial Day to Labor Day
All	Reduce impacts to recreating public	• No weekend helicopter operations Memorial Day through Labor Day weekends Friday 6 pm through Monday 8 am. No helicopter operations on Memorial, 4th of July, and Labor Day holidays.	Memorial Day to Labor Day
7, 11, 80, 44, 150, 170, 210, 270	Reduce impacts to recreating public	• No weekend operations from Memorial Day through Labor Day on Friday 6 pm through Sunday. No harvest activity on Memorial Day, 4th of July, and Labor Day holidays.	Memorial Day to Labor Day
7, 11, 80, 44, 150, 170, 210, 270	Reduce impacts to recreating public	• No operations within a ¼ mile of developed recreation sites, recreation residences, and private resort areas between the hours of 10 pm and 8 am to help minimize noise disturbance.	

Table 13: Design Elements for Action Alternative			
Unit #	**Reason**	**Design Feature**	**Dates**
All	Reduce impacts to dispersed site creation and expansion	• Prevent off road travel and dispersed site creation. Place natural obstacles such as down wood and rock in a natural arrangement to prevent creation of new dispersed sites where they don't presently exist. Bury boulders 1/3 of the way in the ground where possible.	
All	Reduce impacts to dispersed site creation and expansion	• Rehabilitate all landings to prevent site from becoming a new dispersed site. Place natural obstacles such as down wood and rock in a natural arrangement to prevent creation of new dispersed sites where they don't presently exist. Bury boulders 1/3 of the way in the ground where possible.	
All	Reduce impacts to dispersed site creation and expansion	• In units where proposed landings are currently dispersed sites, rehabilitation of sites will be necessary to restore site to desired condition for continued use as a dispersed site or return to a naturalized state. Consultation with a recreation specialist will be required in the design phase for units in or adjacent to these areas. Rehabilitation may include: Placing natural obstacles such as down wood and rock in a natural arrangement to prevent expansion of dispersed sites. Burying boulders 1/3 of the way in the ground where possible.	
All	Reduce impacts to dispersed site creation and expansion	• Close temporary roads to traffic and rehabilitate to prevent new off road recreation use. Subsoil road surface of temporary roads to prevent new road creation. Place natural obstacles such as down wood and rock in a natural arrangement to prevent creation of new dispersed sites where they don't presently exist. Bury boulders 1/3 of the way in the ground where possible.	
All	Reduce impacts to recreating public	• No operations on opening weekends of Cascade elk/deer rifle seasons; restriction is limited to the opening weekend of each hunt.	
510	Reduce impacts to recreating public	• All logging debris to be completely cleaned up by piling a minimum of 100 feet from existing trailheads. Burning of logging debris piles acceptable if trailhead is accessible and public safety is accounted for. Keep the trailhead open for use. Keep trail #3366 open Friday-Sunday when logging Unit 510. Notify PAO/recreation staff to coordinate public information updates (temporary road and trail closures, delays) with two weeks prior notice.	
All	Reduce impacts to recreating public	• Commercial hauling on a road open to all vehicles (mixed used, levels 2-5 road), must use a warning sign indicating "Trucks" or "Log Haul", in order to prevent OHV use on roads beyond those signs. Notify Public Affairs Office to coordinate public information updates (temporary road closures, delays) with two weeks prior notice.	All year
70, 71, 72, 73, 74, 75, 76, 77, 78, 100, 110, 120, 130, 140, 180, 190, 200, 220, 240, 250, 260, 280, 300, 310, 320, 330, 340, 350, 360, 370, 380, 390, 400	Reduce impacts to recreating public	• Snow plowing of Road 2231 to haul over Boulder Ridge during the winter is allowed. Attempt to minimize the number of seasons impacted by plowing to reduce recreational impacts to the McCoy Motorized Use Area.	

Table 13: Design Elements for Action Alternative

Unit #	Reason	Design Feature	Dates
All	Reduce impacts to recreating public	• Inform public of mixed use road closures, due to harvest activity, on Forest Service websites, two weeks prior to harvest activity. Notify Public Affairs Office to coordinate public information updates (temporary road closures, delays) with two weeks prior notice.	
All	Reduce impacts to recreating public	• Post an advance notice of future harvest activity and mixed use road closures, two weeks prior to harvest activity at Forest Service designated OHV staging areas. Notify Public Affairs Office to coordinate public information updates (temporary road closures, delays) with two weeks prior notice.	
Scenic Quality and Eligible Wild and Scenic Rivers			
7, 32, 510	Minimize visual impacts	• A 50 ft. horizontal no-harvest buffer will be maintained on either side of trail segments of Mansfield, Crag, South Breitenbush, and South Breitenbush Gorge trails that would overlap with proposed treatment units and surrounding tent campsites in the Fox Creek group campground. Markings to delineate this buffer would be faced away from the trail. Slash piles and all boundary markers within 100 ft. of trail or trailhead would be removed. A recreation specialist and/or landscape architect would be consulted during layout and prior to implementation.	
6, 16, 18, 21, 22, 23, 27, 28, 30, 32, 35, 47, 69, 180, 200	Minimize visual impacts	• Gaps would be designed to mimic natural openings (no long, straight edges or sharp angles), and where possible, placed adjacent to natural features such as meadows or rock outcrops. Placement of gaps would vary so that they wouldn't be adjacent to one another, linear, or in a grid-like pattern. Gaps, other than visual enhancement gaps, would be placed at least 100 ft. from trails.	
2, 47, 69	Minimize visual impacts	• Placement of gaps would be done after consultation with recreation staff and/or landscape architect.	
2, 3, 6, 7, 11, 13, 28, 30, 44, 80, 150, 170, 210, 270, 410, 430, 460, 470, 480, 490, 510, 520	Minimize visual impacts	• Stumps to be flush cut to 4" on the high side on all portions of the unit within 100' of system roads inside the ¼ mile Eligible Wild and Scenic River corridor. This activity will occur post sale as a KV project.	
31, 42, 45, 46, 64, 69	Minimize visual impacts	• Stumps to be cut to 4" on the high side within 100' of system roads. This activity will occur post sale as a KV project. • All trees marked within 100 feet of a system road will be marked on the side away from the road. All slash piles will be chunked.	
2, 3, 6, 7, 11, 13, 28, 30, 31, 42, 44, 45, 46, 64, 69, 80, 150, 170, 210, 270, 410, 430, 460, 470, 480, 490, 510, 520; all	Minimize visual impacts and protect values in the Wild and Scenic corridor	• Visible landings to be shaped to blend with the landscape and ground cover to be reestablished. Preferred slash disposal methods include chip/disperse, chip/remove, truckload remove, hand pile/burn	

Table 13: Design Elements for Action Alternative			
Unit #	**Reason**	**Design Feature**	**Dates**
portions within ¼ mile of Wild & Scenic River corridor			
46, 150	Minimize visual impacts	• Temporary haul roads would be designed to blend into surrounding topography and follow natural patterns to decrease apparentness on the landscape	
		Wildlife	
55, 57, 58, 60-64, 89, 92, 420, 430	Protect peregrine falcons from disturbance impacts	• All harvest and fuel treatment related activities are restricted	January 15 – July 31
Scorpion, Mansfield and Switchback	Protect nesting peregrine falcons	• Rock pit blasting is restricted, crushing is not restricted.	January 15 – July 31
32 & 32a	Protect nesting peregrine falcons	• Helicopter yarding restriction	January 15 – July 31
170, 210 & 270	To avoid disturbance to foraging and nesting harlequin ducks	• Seasonally restrict all project related activities within 200' of the Breitenbush River and Devils creek	March 15 – July 15
13	Protect nesting osprey	• restriction all activities	March 1 – July 31
32, 32a	To avoid disruption of spotted owl nesting	• All harvest related activities including road building, hauling, plowing, chainsaw use, yarding, loading trucks, etc. are prohibited	March 1 – July 15
5 (North and East of the 4698 road, 16a (eastern one acre), 24, 25, 26, 27 (western 2 acres), 35, 64, 73, 75, 140, 180	To avoid disruption of nesting spotted owls	• Chainsaw and heavy equipment use are prohibited	March 1 – July 15
12, 24, 32, 32a, 93, 95, 96, 300, 310	Prevent disruption of spotted owl nesting	• Helicopter yarding is prohibited	March 1 – July 15

Table 13: Design Elements for Action Alternative			
Unit #	**Reason**	**Design Feature**	**Dates**
Scorpion, Unit 74, Lower Skunk, Skunk, Dead Lily, Switchback, Unit 220 and Fox Creek pits	Prevent disruption of nesting spotted owls	• Rock source blasting is prohibited	March 1 – July 15
32	Protect spotted owls	• Avoid placement of a three acre gap in the Northeastern edge of unit	
Botany			
24, 83	Protection of threatened, endangered, sensitive and survey and manage plant species	• Buffer *Pseudocyphellaria rainierensis* 100 feet to maintain habitat and microclimate for species persistence. Botanist will help with layout to maximize protection of the population.	
13, 24	Protection of threatened, endangered, sensitive and survey and manage plant species	• Buffer *Chalciporus piperatus* 100 feet to maintain habitat and microclimate for species persistence. Botanist will help with layout to maximize protection of the fruiting body.	
83	Protection of threatened, endangered, sensitive and survey and manage plant species	• Buffer *Rhizopogon truncatus* by 50 feet. Botanist will help with layout to maximize protection of the fruiting body.	
1,2,6,13,26, 27, 28, 30, 31,44,45,62, 64, 83, 270	Protection of sensitive and survey and manage plant species	• Avoid surface disturbance to known populations of *Peltigera pacifica* and *Sparassis crispa* during harvest operations if possible. Botanist will help with layout to provide adequate site management.	
44, 62, 64 and 370	Control of noxious weeds	• Pre-Treat knapweed sites along the roads to the project area and sites within units to ensure weed seed will not be spread by project activities.	
3,6,7,11,13,14,17,19,23,25,26,27,28, 30,31,32,33,34, 35,38,39,40,42, 45,46,	Control of noxious weeds	• Contain existing well established weed populations. This includes monitoring and treatment of weed-containing special habitats, gaps and roads after the timber sale for 5 years	

Table 13: Design Elements for Action Alternative			
Unit #	**Reason**	**Design Feature**	**Dates**
47,48,50,51,52, 54,55,56,57,58, 59,60, 61,62,63,64,69, 73,80,81,87,93, 100, 150, 210, 250, 260, 450			
All	Control of noxious weeds	• Clean all equipment used off roads in project work to avoid bringing seed into the project area. Equipment should work in non-weed infested areas first (USFS will provide map).	
All	Control of noxious weeds	• Obtain gravel and fill for road construction and reconstruction from a weed-free rock source	
All	Prevent weed infestation	• Seed (with genetically local grasses and shrubs) and mulch all heavily disturbed areas such as landings and closed roads with native species.	
6,16,18, 21-2427, 28,35, 47,69, 180, 190	Control of noxious weeds	• Seed all gaps with native local forage species to out compete weeds	
5,19,21,22,23, 34, 35,45,47,52, 55,64,69,73,74, 75,83,94,100, 110,130, 140,160,170, 190,200,220, 250, 270, 280, 300,320, 410, 440,490,510	Maintain wetland microclimate	• Protect wetland habitats with a 100 foot buffer.	
21,22,35, 47, 69, 190	To avoid weed encroachment into the unique areas.	• Place gaps 200 feet from wetland special habitats	
48, 53	Maintain microclimate	• Protect mesic meadows with a 100 foot buffer	
3,19,33,38,42,51,54,83,86, 170,180, 290,300,530	Maintain microclimate	• Avoid direct impacts to dry special habitats such as rock gardens, dry meadows and talus slopes. Use directional felling away from habitats and no road building or skidding through habitats.	
110, 490	Maintain microclimate	• Protect wetland habitats with a 60 foot buffer	

Table 13: Design Elements for Action Alternative			
Unit #	**Reason**	**Design Feature**	**Dates**
45,52,64,200, 340	Maintain microclimate	• Protect sedge meadows with a 50 foot buffer	
220, 270	Maintain microclimate	• Protect wetlands and skunk cabbage swamp with a 30 foot buffer	
All units containing Special habitats	Protect special habitats	• Avoiding placement of equipment, landings, skyline corridors, and designated skid roads through special habitats including running cables across rocky outcrops.	
All	Protect special habitats	• Special habitats discovered during layout will be brought forward for a field review by the IDT. Additional buffers may be implemented to protect the resource.	
Roads			
45, 46, 62, 64, 69, 410, 420, 430, 440, 450, 460, 470, 480, 490, 510, 520, 530, 540	Minimize erosion and sedimentation	• Haul routes are not suitable for wet weather haul. Wet weather haul is restricted on 4600012, 014, 016, 024, 026, 097; 4688099; and the entire 4685 road system.	
All	Minimize erosion and sedimentation	• All disturbed sites related to reconstruction and or maintenance such as waste area sites and culvert replacements will require erosion control methods	
All	Minimize erosion and sedimentation	• Newly installed culverts will meet 100 year flow (Q100) on perennial streams.	
All		• All work done to or on a road will be consistent with the Road Management Objective for that road	
All		• Right of Way Authorizations and/or Land Use Agreements with the State of Oregon required to provide legal access will be obtained prior to harvest activities.	
Soils and Aquatics (Fish and Hydrology)			
All harvest units	Protect and enhance riparian features	• A minimum no harvest riparian buffer of 100 feet on all fish bearing streams. • A minimum no harvest riparian buffer of 60 feet on both sides of perennial, Class III streams are prescribed to minimize sediment delivery to streams and reduce the potential for temperature increases. • A minimum no harvest riparian buffer of 30 feet on both sides of the intermittent, Class IV streams are prescribed to minimize sediment delivery to streams. • Apply Riparian treatments as prescribed in Appendix G: Riparian Reserves Treatment Detail • Buffers are measured out from the trees growing nearest to the stream not from the edge of the water or stream bed.	

Table 13: Design Elements for Action Alternative			
Unit #	**Reason**	**Design Feature**	**Dates**
		• Potential unstable areas within some riparian reserves units will need to be surveyed before project implementation. As prescribed in Appendix G: Riparian Reserves Treatment Detail. Unstable area within riparian reserves will be mapped, the soils scientist will assist with layout to avoid areas of instability.	
6, 100, 190, 430, 520, 32a	Protect and enhance riparian features	• In streamside treatment and meadow restoration units, no commercial harvest is allowed within the minimum 30-60 foot buffers specified above. Trees cut within the no-harvest buffer for restoration purposes will be directionally felled and left on site and in the stream channel.	
All harvest units	Reduce compaction directly adjacent to stream channels	• Equipment is prohibited within 60 feet from all streams. • Ground based equipment and skid roads should be at least 60 feet from the no harvest buffer for all streams (fish-bearing to intermittent), except at designated stream crossings. These widths are required unless a change is approved by the district hydrologist or district fish biologist.	
All harvest units	Reduce soil compaction and displacement	• Soil conditions should be monitored during wet weather season and high precipitation events. The soil scientist will be available for consultation if re-routing or restrictions become necessary. • Site evaluation is recommended during wet weather or high precipitation events using the following: a. Operations will be suspended before rainfall or precipitation results in off-site movement of sediment into drainage courses and any trenching, or rutting is detected. b. Soil factors such as: i. Saturation/high soil moisture levels (ideal operations occurs under dry soils); ii. Exposure and high levels of standing water/high water table (for example water pooling, etc.) iii. Potential existence of surface or subsurface sensitive soils (such as clay, clay loam or others applicable soil textures). iv. Existing soil disturbance (expose soils levels) v. Type of proposed logging system, etc.	Wet weather or high precipitation season
5, 24, 44, 62, 64, 110, 220, 470 and 520	Protect water quality and reduce damage to stream channel	• The number of stream crossings shall be minimized (no greater than 16 total in the project area). • All stream crossings should be placed perpendicular to stream channels and swales • All stream crossings for ground based equipment and new temporary roads will be approved in advance by the District Hydrologist (or Fish Biologist). • Intermittent and ephemeral stream crossings will require temporary placement of bunk logs and slash to minimize damage to channel bed and banks. • Stream crossing activities (skidding) will be restricted to dry season, when there is no flow or greatly reduced flow.	
62, 64	Protect water quality and reduce damage to stream channel	• Perennial stream crossings will require temporary culverts and hydrologist approval on design and location for crossing equipment to minimize damage to the stream channel and sediment input to the streams. • Construction and removal of all perennial stream crossings for temporary roads will be restricted to dry season, when stream flow is reduced.	
All harvest units	Protect water quality and reduce damage to stream channel	• Temporary roads in Riparian Reserves will be minimized: Wherever possible, temporary roads would be located on ridge tops, gentle slopes, or would utilize locations previously disturbed by historic logging.	

Table 13: Design Elements for Action Alternative			
Unit #	**Reason**	**Design Feature**	**Dates**
		• Temporary roads that must be located within the Riparian Reserves will be placed well outside of the primary shade zone (approximately 60 to 80 feet on each side of streams) and cross perpendicular to the stream where necessary. • All temporary roads in Riparian Reserves will be decommissioned after treatment activities are completed following BMP's and additional design elements. • Landings will be located outside of Riparian Reserves wherever possible. The number and acreage of landings in Riparian Reserve will be minimized by: a. Restricting landings to existing roadbeds wherever possible b. Locating landings an absolute minimum of 100 feet away from any streams c. Allowing no more than 15 total new landings within Project Area Riparian Reserves. • All new landings in Riparian Reserves will be decommissioned after treatment activities are completed following BMP's and additional design elements.	
All harvest units	Protect water quality and reduce damage to stream channel	• Pre-bunched log piles should be at least 60 feet from ephemeral swales and all stream channels. Any crossings with feller-bunchers should be perpendicular to ephemeral swales and channels.	
All harvest units and associated access.	Minimize erosion and sedimentation	• Construction or maintenance of roads will not be done when soils are saturated or run-off occurs. A stable fill would be constructed across all streams when crossed by new temporary roads. • Unclassified or temporary roads used outside the standard operating season should generally be rocked, snow covered, or frozen to reduce the potential for erosion, unless other mitigating or extenuating circumstances are present. • The reopening of temporary or unclassified roads should occur in the dry season (May through October) to avoid surface erosion from exposed soil. Open roads should be storm proofed if they have to sit through extended periods of wet weather. Wet weather management will be followed upon consultation with Forest Service personnel.	Winter/wet season
All harvest units and associated access	Minimize erosion and sedimentation	• All non-paved roads used for wet weather haul will have at least 4 inches of aggregate material, with minimum size determined by road slope and proximity to streams	
All harvest units and associated access.	Minimize erosion and sedimentation	• Native surfaced roads are restricted from hauling when soils are saturated or run-off occurs	
All harvest units and associated access	Minimize erosion and sedimentation	• Wet weather haul is only permitted on roads pre-designated for wet weather haul. • On all wet weather haul routes, additional cross-drains leading off onto the forest floor will be constructed within 100 feet above stream crossings to minimize direct delivery of road sediments to streams.	Winter/wet season

Table 13: Design Elements for Action Alternative

Unit #	Reason	Design Feature	Dates
		• Wet weather haul will be monitored by the Timber Sale Administrator, with input from Engineers, Fisheries Biologist, Soil Scientist, and/or Hydrologist. When necessary, haul may be suspended during rainfall to prevent off-site movement of sediment into stream courses. • Haul may also occur when the road surface is either covered with a relatively continuous snow pack of at least 2"or is frozen, and forecasts indicate that rapid warming and thawing is not likely. • Dust abatement of road surfaces would be used if roads become excessively dusty during the summer. Pump chance locations must be approved by hydrologist or fish biologist. Pump chance locations on fish bearing stream must include fish screens or bypass on intakes.	
All harvest units	Ensure sufficient water flow in streams	• Water sources used by project operations will be reconstructed or maintained as necessary to protect stream bank stability, riparian vegetation, and water quality. Water used for fire treatments and dust abatement will be drafted from various water sources outside of Listed Fish Habitat. At all drafting locations, 90% of stream flow will be maintained to reduce risk to aquatic species and water quality and pump intakes will be screened to prevent aquatic organism entrapment.	
All harvest units and associated access	Minimize erosion and sedimentation	• Culvert replacements will be done during periods of no/reduced-flow for streams (intermittent and perennial) and during the instream work season (June 1st – August 31st). • Culvert replacements on perennial or live streams will require additional erosion control measures, including flow bypass (drop channels) and channel dewatering.	June 1 – August 31 work window
All harvest units	Reduce off-site movement of sediment into drainage courses. To decrease soil displacement and compaction.	• Ground based equipment operations over snow/frozen soil may occur in the following conditions: o 0 inches of frozen soil−Need at least 18 inches of settled (packed) snow o 4 inches of frozen soil−Need at least 9 inches of settled (packed) snow o 6 inches of frozen soil−No snow cover necessary If necessary, pre-pack snow on designated routes before work commences. • Over snow operations will be suspended or re-routed if thawing, soil exposure or uneven snow pack occurs.	
All skyline harvest units	Minimize impacts to stream channels	• Skyline yarding is not allowed through the buffers on Class 1 streams. Require full or one-end suspension when yarding in the remaining (outer) portion of the Riparian Reserve. • Full suspension a minimum of 60 feet from the stream channel edge would be required when yarding over Class 2 and Class 3 (perennial) streams. Require full or one-end suspension when yarding in the remaining (outer) portion of the Riparian Reserve. • Full suspension a minimum of 30 feet from the stream channel edge would be required when yarding over Class 4 intermittent streams. Full suspension limits will be extended to match no-harvest or no equipment buffers where they are set due to concerns regarding stability. Require full or one-end suspension when yarding in the remaining (outer) portion of the Riparian Reserve.	
All harvest units	Minimize impacts to stream channels.	• Where cable yarding requires corridors through a riparian area, corridors will be laid out to minimize the number of trees cut. Trees located within no-harvest buffers that must be cut to facilitate yarding corridors will be felled towards the channel (if feasible) and left on site.	

Table 13: Design Elements for Action Alternative			
Unit #	**Reason**	**Design Feature**	**Dates**
All harvest units	Provide adequate drainage and avoid unnecessary soil disturbance	• All skid trails and landings should be water-barred to provide adequate drainage. Water bar location shall occur where local terrain facilitates effective drainage of the skid trail or landing while avoiding unnecessary soil disturbance. An example would be to construct water bars every 100 feet on slopes less than 15%, and every 50 feet on slopes greater than 15%. Water bars should be keyed-in to the cut bank and have a clear outlet on the downhill side. In lieu of water bars, where available in concentrations, slash can be scattered on corridors, skid trails and landings.	
All harvest units	Minimize compaction and disturbance levels and for soil productivity (ground cover and nutrient loss maintenance); during project implementation	• Ground based equipment should generally operate in the dry season, May through October, unless otherwise restricted by other resource concerns or waived by Forest Service personnel, based on site specific conditions (mentioned above) and the objective to reduce soil disturbance as stated in previous design elements. • Existing skid and haul roads should be used before new skid road locations are approved. They should not usually exceed 15 feet in width, and the objective is to maintain a 10 to 12 foot width throughout the length. • Where practical the skidder, cat, shovel or forwarder should travel on slash Skid roads will generally be 100 to 200 feet apart with conventional line pulling operations, and 40 to 60 feet apart with processor / forwarder operations. • Ground based equipment is limited to slopes less than 30%. Ground based equipment may be allowed on slopes greater than 30% but less than 40% in a few selected instances where it is determined that yarding on these steeper slopes is more beneficial to the various resources than implementing some other logging system. Determining factors will include a site specific evaluation in the field by Forest Service personnel, the operational period and current (and expected) weather conditions, and the ability of the operator / contractor to implement the work successfully and safely. • Partial or one end suspension is required on skyline units, except at tail trees and landings. Given the irregular topography in some units, sections of ground lead may occur along some skyline roads. Generally this is acceptable, but approval usually requires a site specific, on-the-ground review of the area by Forest Service personnel. • Where operable, harvested trees should be topped and limbed in the units in order to provide small limbs and needles for nutrient recycling (upon fuels, timber specialist and soil scientist consultation). • Avoid disturbance to the existing large down woody debris concentrations created by the initial entry in the managed stands as much as practical.	
380	To protect shallow groundwater and subsurface streams	• Several streams go subsurface mid-way down the unit, indicating shallow groundwater. Restrict equipment use in lower part of unit.	
All harvest units and associated access.	Reestablish hydrologic and geologic processes	• All temporary roads will be made hydrologically stable and decommissioned after completion of project activities. Decommissioning of temporary roads may include: blocking the entrance, removal of culverts, out-sloping the road surface, pulling back displaced material onto the road way, installation of water bars, re-vegetation of the road prism, and/or the sub soiling of compacted surfaces when necessary.	
All harvest units	Protect key riparian features and integrity	• All existing down wood will be retained within Riparian Reserves to maintain aquatic objectives	

Table 13: Design Elements for Action Alternative			
Unit #	**Reason**	**Design Feature**	**Dates**
Rock Pits	Reduce erosion and sedimentation, protect water quality	• Any expansion beyond existing boundaries or reclamation of rock pits will require development of a Pit Plan and analysis.	
70, 140, 190 and 250	Reduce compaction levels and improve overall productivity.	• Mitigation subsoiling to a depth of 18 to 24 inches is required by the Purchaser / Logger, who would subsoil primary skid roads, landings or temporary haul roads used in the logging operations.	
8, 9, 10, 17, 23, 31, 35, 56, 57, 58, 59, 61, 63, 70, 73, 74, 78, 140A, 150, 180, 220, 450 and 520 the highest priorities are Units 35, 63, 73, 180 and 520	Reduce compaction levels and improve overall productivity.	• Enhancement subsoiling to decompact the soil surface to a minimum depth of 20 inches to a maximum of 24 inches at the completion of logging activities (Purchaser end of operation or post sale) on old skid roads and landings from this or previous entries. • Subsoiling should be done using the munching or roughening technique (excavator and attachments). Mulching, seeding and slashing (re-applying the stored slash) the area upon decompaction is strongly recommended to improved infiltration and soil productivity within the disturbed area.	
1, 2, 3, 5, 7, 12, 13, 14, 20, 25, 27, 29, 32, 34, 38, 40, 42, 49, 50, 52, 53, 61, 65, 66, 68, 69, 72, 79, 82, 83, 86, 87, 88, 93, 94, 95, 96, 97, 290, 300, 310, 320, 330, 350, 380, 390, 400, 480, 490, 530,	Protect soil resources	• No prebunching allowed.	
Cultural			
	Protect cultural resources	• There are 14 cultural sites (06180400008, 06180400011, 06180400114, 06180400224, 06180400317, 06180400328, 06180400441, 06180400586, 06180401056, 06180401059, 06180401103, 06180401105, 06180401122, 06180401130) within the Hwy 46 Project that are considered eligible or potentially eligible for inclusion in the National Register of Historic Places (NRHP) and must be protected from project activities or evaluated to determine eligibility to the NRHP. Presale, Timber Sale Administrator and Fire Management must work closely with the Archaeologist to insure these sites are protected for the full term of the Timber Sale Contract. The Zone Archaeologist will layout the protection buffer.	
	Protect cultural resources	• Changes to the current unit configurations and/or the addition of any new units, will require consultation with the Zone Archaeologist in order to protect the known and unknown heritage resources.	

Table 13: Design Elements for Action Alternative			
Unit #	**Reason**	**Design Feature**	**Dates**
	Protect cultural resources	• Project activities planned outside of the area as defined in the heritage resource inventory schema must be coordinated with the district archaeologist prior to initiation. This includes the establishment of additional harvest landings, helicopter landings, guy-line equipment anchors, slash burning and the removal of roadside danger trees. New road construction (including temporary roads) should avoid ridgetops.	
	Protect cultural resources	• Post-harvest subsoiling of any skid or spur road located in high probability ground for the occurrence of cultural resource must be coordinated with the zone Archaeologist. This could require a cultural resource survey prior to subsoiling.	
	Protect cultural resources	• Although no other surface or subsurface evidence of cultural resources was found in the proposed project area, the possibility remains that more prehistoric or historic cultural resources are present and could be exposed/uncovered during project activities. If cultural resources are encountered during the course of this project, earth-disturbing activities in the vicinity of the find should be suspended, in accordance with federal regulations, and the zone archaeologist notified to evaluate the discovery and recommend subsequent courses of action. Therefore, contract provision BT6.24 must be included in all project prospecti and contracts. The contract provision outlines the procedures to follow in the event heritage resources are discovered during the life of the timber sale.	

2.7 Mitigation and Enhancement Common to Alternatives 2 and 3

Table 14 Snag and Down Wood Recommendations Common to Alternatives 2 and 3

Unit	Acres	Snag creation	Trees left for future snag creation	Down wood creation	Total leave trees for snags and down wood
6	3	5	5	9	19
14	13	20	23	39	82
16	3	5	5	9	19
17	16	24	29	48	101
18	2	3	4	6	13
21	3	5	5	9	19
22	3	5	5	9	19
23	3	5	5	9	19
24	1.5	3	3	5	11
28	3	5	5	9	19
32	3	5	5	9	19
35	6	9	11	18	38
47	7	11	13	21	45
59	4	6	8	12	26
63	12	18	22	36	76
180	6	9	11	18	38
200	3	5	5	9	19

Snags would be created after harvest and slash treatment in gaps and early seral habitat treatments areas at the rate of 1.5 per acre in units 6, 23, 35, 47, 59, 63, 180 and 200. Techniques may include topping, girdling and/or inoculation.

Down wood would be created after harvest and slash treatment in gaps over 1 acre and early seral habitat treatment areas at the rate of 3 trees felled per acre of the largest available in units 6, 14, 16-18, 21- 24, 28, 32, 35, 47, 59, 63, 180 and 200. The minimum amount to be left is 240 lineal feet/acre.

Table 15 Survey and Manage Species Buffer Recommendations Common to Alternatives 2 and 3

Units	Sensitive Species	Buffer Distance
24, 83	*Pseudocyphellaria rainierensis*	100 ft.
13, 24	*Chalciporus piperatus*	100 ft.
83	*Rhizopogon truncatus*	50 ft.

Table 16 Special Habitat Buffer Mitigation Recommendations Common to Alternatives 2 and 3

Units	Special Habitat	Buffer Distance*
220, 270	wetlands and skunk cabbage swamp	30 ft.
5,19,21,22,23, 34, 35,45,47,52, 55,64,69,73,74,75,83,94,100, 110,130, 140,160,170, 190,200,220, 250, 270, 280, 300,320, 410, 440,490,510	wetland	100 ft.
110, 490	wetland	60 ft.
48, 53	mesic meadow	100 ft.
45,52,64,200, 340	sedge meadow	50 ft.

No-disturbance buffer distance is based on Special Habitat Management Guide. Buffers would be expanded if Aquatic Resource Specialists deems them insufficient to maintain hydrologic function.

2.8 Monitoring Common to Alternatives 2 and 3

Operations: Contract administrators would monitor treatments during implementation to ensure contractors are in compliance with their contract. Contract elements monitored would include harvest specifications, bole damage to residual trees, down wood and snag retention, skid trail spacing and use of designated skid trails.

Fuels Treatments: Santiam River Zone fire and fuels personnel would monitor fuel loading prior to and post application of fuels treatments. Fuels treatment results would offer data to use in the future.

Road Management: Detroit Ranger district engineering personnel would monitor road management through contract administration and routine road maintenance inspections.

National Aquatic Best Management Practice Monitoring: The National Best Management Practices Program provides a standard set of core best management practices and consistent documentation of the use and effectiveness of the practices. Post-implementation best management practices monitoring may include review of aquatic management zones, erosion prevention and control measures, cable and ground based yarding operation effects, and site treatment.

Forest Plan Implementation Monitoring: The Forest Supervisor’s Staff performs annual project monitoring at each Ranger District and compiles the results in the yearly Forest Monitoring Report. Implementation of treatments from this project would be subject to Forest Plan Implementation monitoring. Other implementation monitoring elements may include temporary road decommissioning, snag and large down wood abundance, and any seeding or planting of vegetation.

Reforestation: Ensure stand is sufficiently stocked within five years. Forest Service Manual directs us to conduct first and third year stocking surveys to determine if the site can be certified.

Dead Wood Habitat Monitoring: Detroit Ranger District wildlife personnel would monitor snag and large down wood habitat levels in units prior to wildlife tree and down wood enhancement activities and after prescribed burning, if applicable. This would determine existing habitat levels and compare those with the amounts needed for mitigation and enhancement activities. Monitoring may also be conducted after underburning to evaluate the level of tree mortality and snag creation from fire.

Invasives Monitoring: Detroit Ranger District botany personnel will monitor spread of existing weed populations in timber sale units and along roads leading into the project area for 5 years post-treatment. Populations of invasives will be treated as they are detected.

Chapter 3 - Affected Environment and Environmental Consequences

This section of the DEIS considers the environmental consequences of implementation of the various alternatives. The following discussion of effects follows CEQ guidance for scope (40 CFR 1508.25(c)) by categorizing the effects as direct, indirect, and cumulative. The focus is on cause and consequences. For this analysis, in general, direct and indirect effects have been discussed in the context that most readers are accustomed to: those consequences which are caused by the action and either occur at the same time and place, or are later in time or farther removed in distance but are still reasonably foreseeable (40 CFR 1508.8). Cumulative effects are discussed where there is an effect to the environment which results from the incremental effect of the action when added to other past, present, or reasonably foreseeable future actions (40 CFR 1508.7).

The analysis of direct, indirect, and cumulative effects on each resource includes defined analysis area boundaries, as well as the length of time effects are expected to last. These are specific to each resource and therefore may vary in physical and temporal scale.

Interdisciplinary Team

The interdisciplinary team (IDT) includes Forest specialists for each discipline (Chapter 4, for team members and their qualifications). Specialists on the IDT prepared technical reports to address the affected environment and expected environmental consequences of the proposed action and alternatives of the Hwy 46 project. All reports are maintained in the project file, located at the Detroit Ranger District in Detroit, Oregon. In some cases, this chapter provides a summary of the report and may only reference technical data upon which conclusions were based. When deemed appropriate, those parts of specialist reports that are not included in this DEIS are incorporated by reference (40 CFR 1502.41).

Role of Science

Science information improves the ability to estimate consequences and risks of decision alternatives. The effects of each alternative are predicted based on science literature and the professional experience of the IDT specialists. The conclusions of the IDT specialists are based on the best available science and current understanding. Relevant and available scientific information is incorporated by reference and a complete bibliography is included at the end of this DEIS. Referenced material is a consideration of the best available science.

Cumulative Effects

The Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, “agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions.”

The cumulative effects analysis in this document is also consistent with Forest Service National Environmental Policy Act (NEPA) Regulations (36 CFR 220.4(f)) (July 24, 2008), which state, in part:

> CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects the actions considered

> (including past, present, and reasonable foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making. (40 CFR 1508.7)

Appendix D provides a summary of past, present, and reasonably foreseeable activities in the project area that could contribute potential cumulative effects to the environment along with the Hwy 46 project.

3.1 Forest Vegetation

3.1.1 Summary of Effects Analysis

Alternative 1, the no action alternative, would have no direct effect. Indirectly, high stand stocking density and canopy covers would continue to restrict regeneration and slow tree growth. Sugar pine presence would decline on the landscape as would early seral habitat.

The implementation of Alternative 2 would reduce inter-tree competition within the thinned portions of the stand. This would increase vigor, allowing the remaining trees to grow in diameter at a faster rate than without thinning. Tree crowns would grow to become larger in diameter and deeper in height. Vegetation and advanced regeneration on the forest floor would also benefit. Shrubs such as vine maple, rhododendron, and big huckleberry would increase in density and height. Shade tolerant tree species such as western hemlock and western redcedar would be released to grow further into the mid and overstory. Skips, clumps, and the creation of dominant tree release gaps would add to the structural heterogeneity of the stands as well as increase species diversity. Quality early seral units along with one to three acre wildlife gaps would increase the amount of grass-forb stage habitat within the project area. A wide variety of species would benefit, including deer, elk, songbirds, and numerous pollinators. The existing sugar pine population in the project area would benefit from reduced competition was well as the establishment of a new rust resistant cohort, ensuring the continued presence of the species. Two meadows would be restored or enhanced, promoting both wet site plants and early seral obligate species. Wood products made available to local mills would amount to approximately 40 million board feet of volume. This would provide or sustain logging and mill jobs in the North Santiam canyon as well as support local businesses in Detroit.

Alternative 3 would be similar to Alternative 2 in the plantations, but older fire regenerated stands would not be treated. This would reduce the commercial thinning acres by approximately 25%, reduce early seral habitat acres by approximately 65%, reduce sugar pine treatment acres by approximately 90%, and reduce timber volume supplied to the local economy by approximately 40%.

3.1.2 Scale of Analysis

The scale used to evaluate direct, indirect and cumulative effects on forest vegetation associated with the Hwy 46 project is the project area. The project area consists of 31,295 acres within the Breitenbush 5th field watershed. By using the project area, it is possible to evaluate potential impacts in an area large enough to encompass other disturbances, both human and natural, and it is a logical analysis area to assess stand conditions based on plant associations.

3.1.3 Affected Environment

Location

The Hwy 46 project area is located approximately 6 miles northeast of the town of Detroit, Oregon, in Marion County. The legal description of the area is T 9 S, R 6 E, sections 1, 11 – 15, 21 – 28, 35 and 36, T 9 S, R 7 E, sections 3 – 36, T 9 S, R 8 E, sections 7, 18, 19, 30 and 31, T 10 S, R7 E, sections 1 – 6 and 8 – 12, T 10 S, R 8 E, section 6.

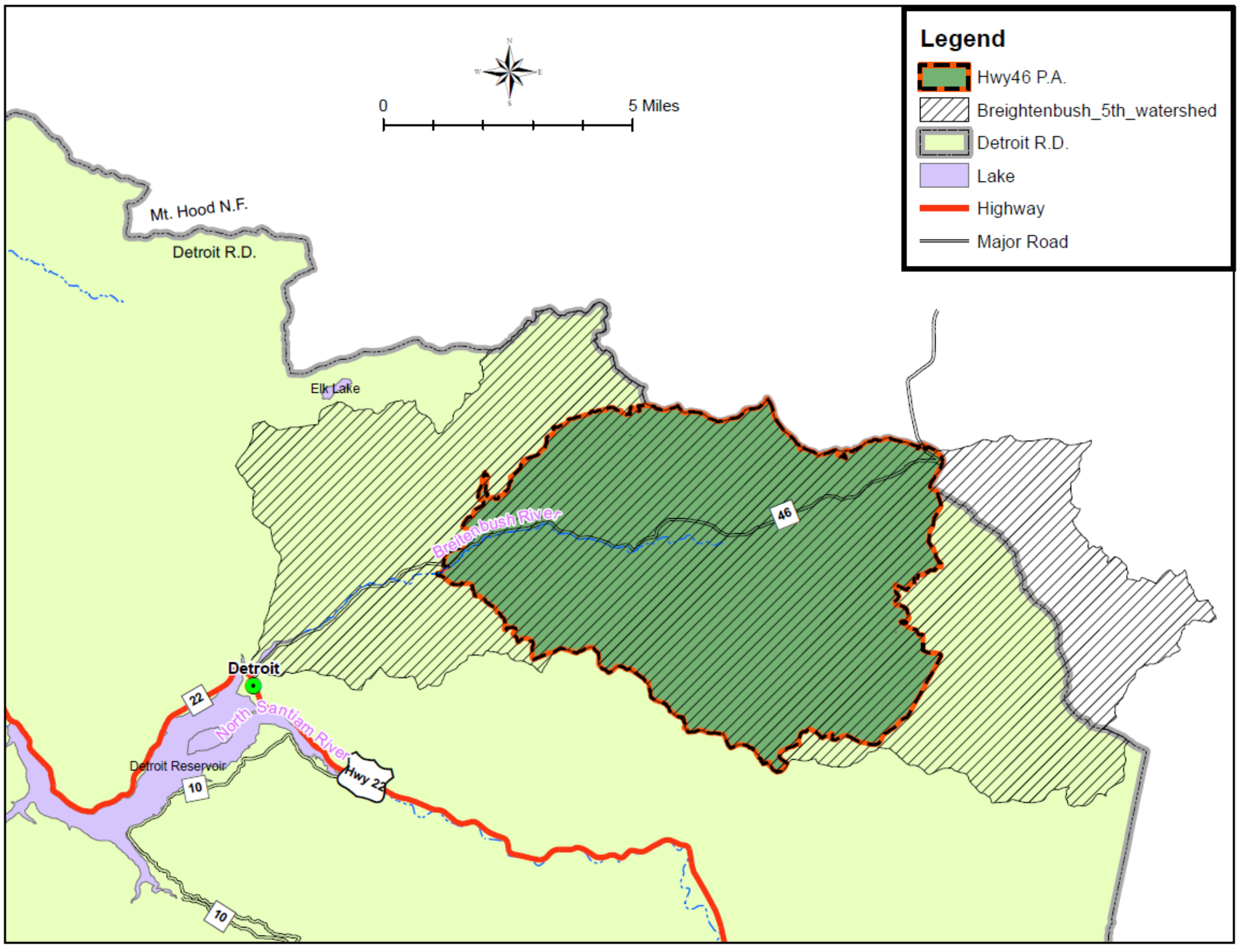

Figure 8 Project Area and Breitenbush 5th Field Watershed

Landscape Conditions – Breitenbush Watershed

The project area is within the 69,461 acre North Fork Breitenbush River fifth field watershed. Of this, 61,428 acres (88%) are on the Detroit Ranger District. The District portion of the Breitenbush Watershed has 14,872 acres (24%) LSR, and 10,872 acres (18%) Wilderness.

The Breitenbush Watershed Analysis indicates that the historical distribution of seral stages (pre-European) were as follows:

Table 17 Historic Seral Stage Distribution Breitenbush Watershed

Seral Stage	Percentage of area.
Early, post-disturbance	9.0%
Mid-seral, closed canopy	17.0%
Mid-seral, open canopy	5.2%
Late seral, open canopy	8.4%
Late seral, closed canopy	60.4%
Total	100.0%

Analysis by Lisa Helmig (Forest Silviculturist,Willamette N.F.), and Jane Kertis (Ecologist, Willamette N.F.) indicates that the seral stages in the Breitenbush Watershed are currently distributed as follows:

Table 18 Current Seral Stage Distribution Breitenbush Watershed

Seral Stage	Percentage of area.
Early, post-disturbance	4%
Mid-seral, closed canopy	29%
Mid-seral, open canopy	8%
Late seral, open canopy	11%
Late seral, closed canopy	48%
Total	100%

Data from GNN. Combined potential veg group, qmd of tallest 25 trees and canopy cover into coarse seral stages.

Landscape Conditions – Hwy 46 Project Area

Stand replacing disturbance has been at work in this area for thousands of years. Historically, large scale disturbances have been from infrequent, high intensity fires. Stand ages from the Vegetation Events Geographic Information System (VEGIS) GIS layer indicate that fires burned large portions of the 31,295 acre project area between 1600 and 1800. Approximately 40% of the stands within the project area were initiated during this time. Another round of fires burned portions of the landscape around the turn of the twentieth century, particularly in the northern part of the project area, with approximately 21% of the area in this age class. Although commercial logging started in the watershed shortly after that, it did not ramp up until the 1960s with even-aged management. Since the mid-1990s, there has been virtually no stand replacing disturbance.

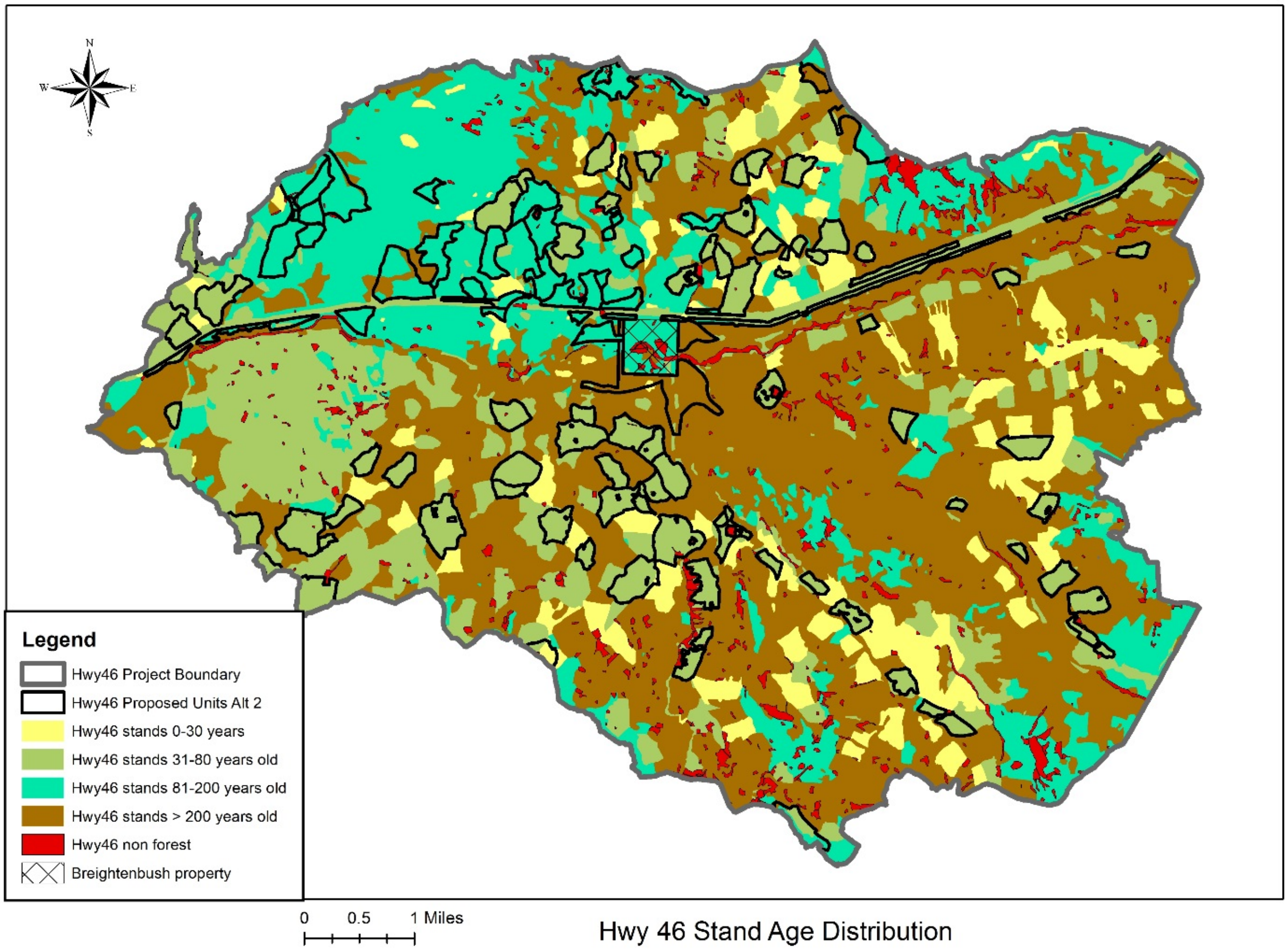

Figure 9 Stand Age Distribution in the Hwy 46 Project Area

Table 19 Stand Replacing Disturbance

Time Period	Primary Disturbance	Acres	% of Project
Prior 1600	Fire	1,914	6%
1600-1800	Fire	12,436	40%
1800-1916	Fire	6,700	21%
1917-1959	Fire/Timber harvest	790	3%
1960-1996	Timber harvest	9,392	30%
1997- present	Timber harvest	20	< 0.1%
No data		43	
Totals		**31,295**	**100**

Stand Conditions

The stands proposed for management with this project fall under three general categories: plantations, fire regenerated Douglas-fir/hemlock stands, and fire regenerated Douglas-fir/noble fir stands. Plantations are the result of past clear-cut harvesting, broadcast burning, planting of Douglas-fir, fertilizing, pre-commercial thinning, and sometimes pruning. Fire regenerated Douglas-fir/hemlock stands are the result of intense wildfires in the late 1800s which seeded in naturally. Fire regenerated Douglas-fir/noble fir stands are high elevation and variable in age.

Table 20 Alternative 2 and 3 Units by Category

Category	Unit Numbers	Total Acres
Plantation	1-3, 5-7, 11, 19, 20, 23, 26, 30, 33-35, 38, 42, 44-49, 51-53, 55-64, 69-78, 80, 100-140a, 160, 180-200, 220, 240-490, 510-540, 560, 570	2,690
Fire regenerated	12, 13, 14, 16, 17, 18, 21, 22, 24, 27, 28, 29, 31, 32, 32a, 39, 40, 41, 50, 54, 81-84, 87, 89, 92, 94-97, 150, 210	1,347

Table 21 Stand Range of Conditions

Category	Stand Age	Overstory avg. diameter	Overstory trees per acre	Overstory canopy cover
Plantations	20 - 56	9.5 - 18.2”	105 - 397	60 - 95%
Fire regenerated	93 - 145	12.1 - 27.2”	86 - 293	40 - 95%

Plantations are generally characterized by dense monocultures of Douglas-fir. On southern aspects these plantations have very little understory regeneration and varying amounts of vegetation. Some of the more northerly aspects tend to have more naturally occurring regeneration underneath them, composed primarily of western hemlock with smaller amounts of western redcedar, grand fir, and pacific yew. Competition is high with mortality occurring in many of the stands. Crown ratios are small, leading to reduced diameter growth. Although fairly well established on some of the northerly slopes, regeneration is suppressed by the overstory and growing slowly.

Fire regenerated stands are older than the plantations in this project, and tend to have larger trees. Species composition in the overstory varies for pure Douglas-fir to mixed Douglas-fir with noble fir, western white pine, western hemlock, western redcedar, pacific silver fir, and sugar pine. A few of these stands have relic older trees scattered within them that are remnants from before the fire that regenerated the stand. Understory regeneration is variable and is predominantly western hemlock with western redcedar, grand fir, pacific yew, and mountain hemlock at the higher elevations. These stands are similar to the plantations in that there is high competition between the overstory trees and suppression in the regeneration.

All of the plantation stands are considered to be in the stem exclusion stage (Oliver and Larson, 1990). Stem exclusion stands have a dense overstory canopy cover that blocks out light to the forest floor and limits understory development. All of the stands in which overstory management is proposed have a high continuous overstory canopy cover, most averaging 80% or more. The trees are competing for sunlight, water, and nutrients causing reduced tree growth and vigor as well as limiting understory vegetation. The understory is mostly limited to shrubs with few small trees scattered throughout resulting in single-storied stands.

Most of the fire regenerated stands are also in the stem exclusion stage with several beginning to transition into the understory re-initiation stage (Oliver and Larson, 1990) due to previous commercial thinning. The latter is characterized by dense overstory canopies with an understory of climax seedlings and saplings, predominantly composed of western hemlock with smaller amounts of western redcedar and occasional grand fir and pacific yew.

Examples of fire regenerated stands

Figure 10 Douglas-fir/hemlock Stands. Stem exclusion stage on the left. Stand re-initiation stage on the right.

Figure 11 Left: Unit 50 Douglas-fir/hemlock. Right: Unit 97 Douglas-fir/noble fir.

3.1.4 Environmental Consequences

Direct and Indirect Effects

Alternative 1 - No Action

Direct Effects

There are no direct effects of choosing the no action alternative.

Indirect Effects

The high stand densities that currently exist in these stands mean that there is strong competition between trees for light, water, and nutrients. Canopy closure restricts light to the forest floor, inhibiting the development of vegetation in the understory. Tree seedlings that may initially establish are out-competed and would either stagnate or die (Chan et al 2006). Without a developing understory, most of the stand structure is restricted to the even-aged overstory trees which have little variation in size and species composition. Diameter growth of most of the trees would be inhibited by inter-tree competition as well. As the development of large trees is delayed, so would the development of large snags. Although some trees would succumb to competition as density continues to increase, it would generally be the smaller suppressed trees that die. High stocking density and canopy covers would continue to restrict regeneration of shade intolerant species such as Douglas-fir and sugar pine. As older sugar pine die, their presence in the project area would be reduced without young trees to replace them. With continued fire suppression, the current shortage of early seral habitat for wildlife species would continue to decline. Suitable foraging habitat for large game animals as well as habitat for many bird species and pollinators would continue to decrease (Hanely 1984; Kie et al 2003; Betts 2010; Ellis and Betts 2011).

Eventually small gaps would form in the overstory as trees die from competition, wind throw, or other disturbance. Advanced regeneration of more shade tolerant species, such as western hemlock, would take advantage of these openings and begin growing into the overstory. Gradually structural and species diversity would increase in the stand (Franklin et al 2002; Oliver & Larson 1996). Left to natural process, an uneven-aged structure would eventually arise if no further stand level disturbance occurs, but it would take many decades or centuries to develop. Figure 12 are examples of a stand (adjacent to, but not within the Hwy 46 Project) that was planted circa 1921 and never commercially thinned afterwards. There is very little structural and species diversity in this stand and growth rates are slow due to the intense inter-tree competition. This is a good example of what similar plantations would look like if not treated.

Figure 12 Examples of a Douglas-fir plantation from the 1920s that was never thinned

Alternative 2

Commercial Thinning

Alternative 2 is proposing to commercially thin 2,549 acres. The silvicultural prescriptions are designed to reduce tree density and inter-tree competition which would result in:

- Maintenance or improvement of stand health and vigor.
- Acceleration of large diameter tree development due to enhanced growth.
- Increased structural and species diversity by allowing advanced regeneration to release into the mid and overstory.
- Increased shrub and herbaceous growth developing more understory complexity.
- Providing timber products to the local economy.

Most of the commercial thinning would be implemented using various Designation by Description (DxD) prescriptions. With this method, trees are designated as cut trees if they are within a given spacing of trees larger in diameter. For example, in a 15 foot DxD prescription, all smaller trees within 15 feet of the largest trees would be cut, leaving the largest trees spaced between 15 to 30 feet apart. This is essentially a “thin from below”, favoring the largest and most vigorous trees in the stand. Desired residual trees per acre as well as average diameter are used to calculate the spacing. Maximum diameter cut limits and species retention can be identified in the prescription to protect relic old trees or minor species components.

A variety of thinning intensities are prescribed in this project. These intensities are generally based on average tree diameter and stocking levels. Heavier thinnings of 40-60 residual trees per acre (tpa) are prescribed for stands with larger trees, as these trees need more space to grow than smaller ones. Most of the plantations are of similar age and structure and are prescribed thinnings to 70-90 tpa. A few of the youngest plantations would receive a thinning ranging from 80-110 residual tpa to allow the trees room to grow without lowering the canopy cover below 40%.

Thinning to 40-100 tpa is prescribed to provide a wide range of canopy covers within the stands while still maximizing areas of stand and individual tree growth. This treatment is prescribed for Unit 28 which already has some species and structural diversity and would be applied with individual tree marking to ensure diversity retention and to allow for clumpiness desired for this stand.

Figure 13 Left: Example of recent thinning in an 80-90 year old fire regenerated stand. Right: Example of recent thinning in a 40-50 year old plantation

Direct and Indirect Effects

An immediate direct effect of thinning is reduced overstory canopy cover. Thinning reduces tree densities and opens up the canopy throughout the stand. This allows additional light to the forest floor thereby promoting understory vegetation development and natural tree regeneration, which can lead to multiple canopy layers and more structurally complex stands (Bailey and Tappeiner, 1998; Bailey et al, 1998; Harrington et al, 2005; Chan et al, 2006; Ares et al, 2009; Davis and Puettman, 2009). Figure 13 shows examples of stands that have been recently thinned. Canopies are receiving more light which allows the trees to allocate more resources to growth. Vegetation in the understory is also beginning to respond to the increase in light.

A short-term adverse impact to understory vegetation and below ground fungi would be the mechanical damage from logging (Courtney et al 2004). These short-term adverse effects would be expected to recover within a few years post-harvest as regrowth of herbs and shrubs occur. This effect would be reduced by minimizing additional soil impacts with the use of designated skid trails with ground–based yarding systems and log-suspension capabilities of skyline and helicopter yarding systems.

Indirect effects would include increased tree diameter growth, increased understory growth, and attainment of an uneven-aged structure in a shorter time frame (Ares 2009; Baily et al 1998; Chan 2006; Baily and Tappeiner 1998). Reductions in stand density would reduce inter-tree competition, allowing individual trees to use more sunlight, water, and nutrients. As trees grow in height, they would be able increase the relative size of their crowns resulting in increased tree diameter (Oliver and Larson, 1996). Increased light availability to understory trees would increase their height growth, allowing them to move into the mid canopy and overstory. In many situations these trees are of a different, more shade-tolerant species than the overstory. Releasing them to grow would increase the species diversity in the upper levels of the crowns as well as the vertical structure of the stand.

An additional effect is providing wood products to the local economy. This would create or maintain logging and mill jobs as well as help support local businesses in Detroit during harvesting operations.

Figure 14 Western hemlock growing into the mid-story approximately 30 years after thinning.

Skips, Clumps, and Dominant Tree Release (DTR) Gaps

No-treatment areas, called skips, are proposed within the stands to promote complexity by providing variable density within and among stands. Skips can be areas left untreated due to 1) resource considerations such as protection buffers adjacent to streams and special habitat areas, 2) logistical considerations such as logging feasibility, 3) areas not in need of thinning or 4) leaving untreated areas embedded within a stand to promote complexity. This combination of treatment and no treatment would result in skips within the stands to promote variable density both at the stand scale and across the landscape. Alternative 2 proposes to leave 877 acres of skips within the commercially treated portions of the project.

Clumps are groups of 2 to 5 trees immediately adjacent to each other that would be left in units in Late Successional Reserve (LSR). These groups of trees scattered throughout the thinned portion of the stand would increase both spatial heterogeneity and structural diversity as the stand grows. Alternative 2 proposes to leave a total of 117 clumps within plantations in the LSR.

Dominant tree release gaps (DTR) are also proposed as a tool to promote complexity by providing variable density within stands, allowing for maximum tree growth, increased crown depth and expansion, enhanced species growth into the mid and overstory, as well as allowing for understory development. One or more dominant trees are left and all other trees within a radius of these tree(s) are removed, creating either a ¼ acre gap or a ½ acre gap around the tree(s). If desirable advanced regeneration is present in the opening, it would be released by the treatment and grow into the overstory at a faster rate. If no advanced regeneration is present, the appropriate species would be planted. Generally for this project, ¼ acre DTRs would be created on northerly slopes where climax species such as western hemlock and western redcedar are present (planted if not present); while ½ acre gaps would be created on southerly slopes and planted with seral species such as sugar pine, western white pine, or incense cedar. Climax species may be planted in the shady (southern) portions of these gaps as well. Stand selection for DTR placement is based on a variety of factors including plant association, stand structure, and land allocation. Alternative 2 proposes to create approximately 250 DTRs for a total of about 74 acres.

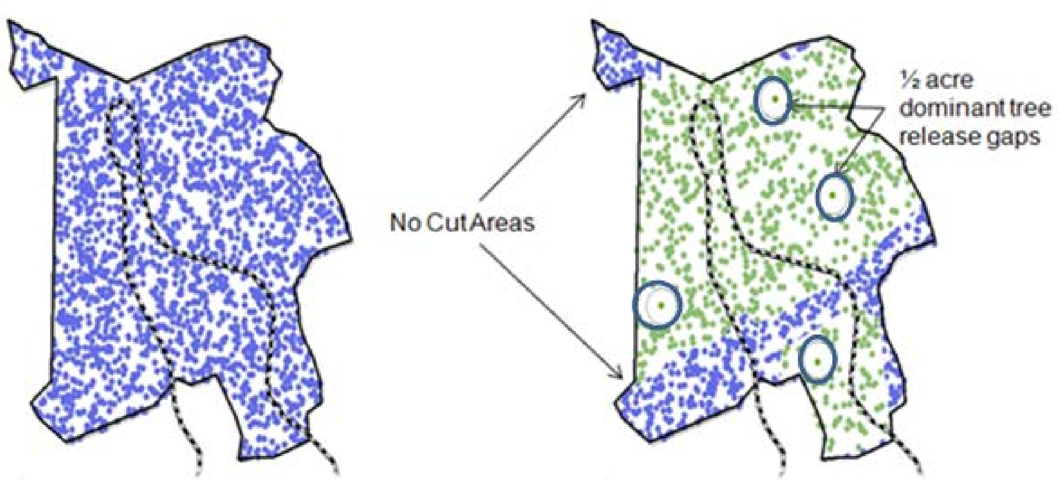

Figure 15 Graphic representation of thinning with skips and DTR gaps

Figure 16 Google Earth image of recently created dominant tree release (DTR) gaps in a thinned stand

Direct and Indirect Effects

The immediate effects of these treatments to the stand would be increased horizontal structural diversity, as well as increased light to the forest floor. An increase in wood products would also result. In the longer term, dominant trees that are released would become more open grown, larger in diameter, and more likely to develop larger limbs lower to the ground. Trees along the edge of the gaps would also increase in size more rapidly with the increased sunlight and reduced competition. Species diversity would increase as existing and planted trees grew into the mid-story as well as understory vegetation developed in the openings (Ares 2009; Baily et al 1998; Chan 2006; Baily and Tappeiner 1998).

Quality Early Seral Habitat

Early seral habitat results from significant stand disturbance that removes most of the tree canopy cover. In this stage of succession, abundant light is available for hardwood vegetation growth such as shrubs and trees as well as other plants such as grasses and forbs. The primary creators of early seral in the West Cascades are fire, wind, insects, and logging. Natural disturbance typically leaves a legacy structure in the form of snags and down wood, which is important to many forms of wildlife including cavity nesters, rodents, and amphibians. Quality early seral habitat, also known as complex early seral habitat, has legacy structure. Historic practices of clear-cut logging and burning remove most of this structure, reducing the value of the resulting early seral to some wildlife, plant, and insect species.

With the cessation of clear-cut logging in the watershed twenty years ago and continued fire suppression, early seral habitat has been substantially reduced within the project area. The powerline corridor contains most of the early seral habitat, and it encompasses less than 1% of the acreage in the project area. Historically, the Breitenbush watershed maintained about 9% early seral due to wildfire (USDA 1996, 2014).

Alternative 2 includes four units for early seral habitat creation (Units 14, 17, 59, and 63). These units were the only stands within the project area meeting all of the characteristics identified by the wildlife biologist for big game forage. These characteristics include:

- Gentle slopes, generally southerly in aspect
- Suitable plant association types favoring vine maple
- Avoiding plant associations that favor rhododendron or beargrass
- Limited vehicle access
- Not in Late Succession Reserve

The proposed regeneration harvesting would meet all Green Tree Retention guidelines outlined within the Northwest Forest Plan providing a minimum of 15% of each unit uncut in a combination of skips and scattered trees (USDA, 1994; REIC, 1996a; REIC, 1996b). An average of 7 to 8 tpa of live larger trees would be left for snag recruitment and down woody material in the harvested portions of the stands. Units 14 and 17 are mature stands and would provide the largest potential snags for quality early seral habitat. All four units would be broadcast burned, planted at 150-200 tpa with seral species, and seeded with native grass species for big game forage. One foot square scalps to mineral soil would be created at the time of planting around each planted seedling to reduce competition from surrounding vegetation and increase survival. Some snags may also be created from the residual trees.

Wildlife Gaps

Gaps one to three acres in size are proposed to be located in twelve units (Units 6, 16, 18, 21, 22, 23, 28, 32, 35, 47, 180, and 200) for a total of up to 45 acres under Alternative 2. These gaps would contribute to the quality early seral habitat as described in Quality Early Seral Habitat above as well as adding species and structural complexity at both the stand and landscape level. Seven to eight trees per acre of residual trees would be left in each gap to increase stand diversity and for future snag and down woody recruitment. Gaps would be broadcast burned where practical and all would be planted with seral conifers at 150 to 200 trees per acre.

Direct and Indirect Effects

Both the Quality Early Seral and Wildlife Gap creation would substantially reduce canopy cover in the areas treated. More light would be available to the remaining trees around the edge of the treatment area as well as to the forest floor. This would result in an increase in hardwood, shrub, and forb development, as well as increased flowering and fruit production. Planted seral species would have adequate light to grow. Residual trees and trees on the perimeter of the openings would be released from competition for decades, resulting in larger diameters and deeper crowns. Numerous wildlife species would benefit from the vegetative response, including deer, elk, song birds, cavity nesters, humming birds, and other early seral dependent species.

Sugar Pine Restoration

The primary range of sugar pine extends from northern Mexico, through the Sierra Nevada, Northern California, and Southern Oregon. The very northern extent of its range is in the Hwy 46 project area. Sugar pine are moderately shade tolerant, particularly when they are young, needing some protection from the sun as they establish. As they get older their tolerance for competition decreases, and other species can out-compete them if lower intensity disturbances, primarily wildfire, do not thin stand densities. These wildfires not only help prolong the existence of the established sugar pine, they are also essential for their regeneration (Sugihara and McBride, 1992) (Garza, 1995). Fire suppression over the last 100 years, extensive logging, and the introduction of white pine blister rust at the turn of the 20th

century have reduced the population across its range (Waring and Angell, 2011). Most of the sugar pine found in the project area are lone big trees surrounded by dense Douglas-fir stands. One area of fire regenerating sugar pine was found during project reconnaissance. The presence of these trees means that sugar pine has been part of this landscape for a long time and now appears to be losing its place in the ecosystem due to lack of disturbance allowing it to regenerate.

Proposed treatments aim to both protect and reinvigorate existing sugar pine as well as re-establishing it in areas suitable to its prolonged existence. Prescriptions would include shelterwood with reserve cuts, broadcast burning, planting of rust resistant stock, and pre-commercial regeneration release. Ten units have been selected for this treatment which include: 6, 12, 33, 39, 40, 83, and 93-96. Only portions of each unit would receive the shelterwood cut, the rest of the area would be commercially thinned. A total of approximately 94 acres would be treated to restore sugar pine. Prescribed burning would reduce logging slash and prepare the site for planting. Large sugar pine would have the slash pulled back from their base to help protect them during burning. Sugar pine would also be planted in other units in gaps created for early seral or in DTRs created for species diversity along with other seral species. One foot square scalps to mineral soil would be created at the time of planting to reduce immediate vegetative competition to the tree seedlings.

Direct and Indirect Effects

Shelterwood prescriptions would leave approximately 20-30 trees per acre of existing sugar pine and other large diameter trees such as Douglas-fir. The direct effects of the shelterwood cuts would be a decrease in canopy cover with a corresponding increase in sunlight reaching the forest floor. Air movement through the stand would increase and could cause some less windfirm trees to blowdown in high wind events. Most of the trees left would be relics and the more dominant trees in the stand and should be resistant to most wind events, however some smaller trees may be left as well to meet the prescription and these trees may not be as windfirm. Planted trees would create a new cohort of sugar pine, incense cedar, and western white pine. Douglas-fir would likely seed in as well from the reserve trees, as would some sugar pine. Sugar pine would have an increased presence on the landscape for the next several decades or centuries when compared to the no action alternative.

Figure 17 Left: Sugar pine competing with other conifers in Unit 83. Right: Previously treated sugar pine stand within the project area.

Understory Habitat Enhancement

These treatments include enhancement of understory vegetation and meadow restoration. The principle objective of these treatments is to increase sunlight to the forest floor to enhance or restore desirable vegetation other than trees. Units 54, 82, 89, 92, and 560 would thin conifers less than 7 inches dbh to reduce shading of ground vegetation. No commercial harvest of conifers is proposed for these units. Total treatment is approximately204 acres.

Unit 32a is a high elevation meadow that has been encroached by conifers since the last severe fire there around the turn of the twentieth century. Historic aerial photos and field surveys indicate that this meadow once contained much more moisture and meadow vegetation, which is now being shaded out. The proposed treatment is to cut and remove most of the conifers within the boundaries of the historic meadow, leaving 3-5 tpa of larger live trees and retaining any relic conifers from before the fire.

The northwest portion of unit 73 is a dry meadow being encroached by Douglas-fir. Enhancement would involve falling and leaving the encroaching trees on approximately 6 acres.

Figure 18 Left: Meadow portion of Unit 73. Right: Encroached meadow in Unit 32a.

Direct and Indirect Effects

The direct effects of the proposed treatments would be increased light reaching the forest floor. Indirectly, existing vegetation would grow and new vegetation adapted to more sunlight would become established. Flowering and fruit production would increase, benefiting a wide variety of pollinating species (Neill and Puettmann 2013). In unit 32a, the reduction in water uptake by the trees currently there should help to restore moisture to portions of the meadow as well as reduce shade, allowing meadow plants to re-establish. Benefits described for early seral habitat would also apply for the meadow enhancement units.

Riparian Treatments

The project area is deficient in hardwoods along streams. Foliage from hardwoods provide nutrients for macro-invertebrates which provide food for fish down steam. Past silvicultural practices harvested timber to the edge of many streams and planted Douglas-fir along the streamside. Thinning the Douglas-fir would allow more sunlight to hit the ground, encouraging hardwoods such as red alder and vine maple to re-establish along the stream banks. Several reaches within five different plantation units have been identified for treatment. Units 6, 100, 190, 430, and 520 would have conifers thinned to the stream bank for some the portions of streams. In addition, small gaps (less than ¼ acre in size) would be created within these treatment areas in locations where it would be the most beneficial to hardwood release. Total acres of these gaps would not exceed 4 acres. All portions within the no-harvest buffers would be felled and left. Thinning intensities would match the prescription for the rest of the unit. A total of approximately 20 acres of riparian treatment is proposed.

Direct and Indirect Effects

As with other similar treatments described in this project, immediate effects would include reduced canopy cover over the stream areas increasing sunlight reaching the stream and forest floor. This would result in an increase in growth, in both height and abundance, of any existing hardwoods such as vine maple or red alder. Residual trees left would increase their rate of diameter growth and crowns would increase in size and depth. In the long run, these treatments would result in larger trees growing along the stream sooner than if there is no treatment. This would eventually lead to larger snags and increased down woody material to the stream as well.

Figure 19 Stream in Unit 430 in need of hardwood restoration.

Visual Enhancement Gaps

To enhance scenic views, three gaps have been proposed in this project. Units 27 and 30 would each have a ½ acre “scallop” along the powerline corridor with residual overstory to soften the view of the straight line of the corridor. A few trees would be left in the scallops to help “soften” the visual contrast between the timber and the corridor. Unit 69 would have a 1/3 acre gap below road 46 to increase the view of Mt. Jefferson from the summit pull-out. All trees in this gap would be cut.

Direct and Indirect Effects

For units 27 and 30, the immediate effect would be the reduction in trees per acre and canopy cover in the areas treated. As with other gaps described in this project, residual tree growth would increase and forest floor vegetation would respond as well. Scotch broom, an invasive species, is present in the powerline corridor and there is risk of it spreading into the gaps.

Fuels Treatments

Several stands adjacent to the Breitenbush Resort property and summer home area have been identified as needing understory fuels treatments to reduce the risk of wildfire. Units include 170, 210, and 270. Proposed treatments include thinning conifers less than 7 inches dbh to a 15 foot spacing, pruning, brushing, chipping, hand piling, and pile burning.

Direct and Indirect Effects

Initially there would be a reduction in the number of small trees and some rhododendron and vine maple in portions of the units. Overstory canopy cover would not be affected. Both western hemlock and the shrubs cut would re-establish after a few years.

Late Successional Reserve (LSR)

Late-Successional Reserves are to be managed to protect and enhance conditions of late-successional and old-growth forest ecosystems. Silviculture treatments are to benefit the creation and maintenance of late-successional forest conditions and are subject to review by the Regional Ecosystem Office (REO). Exemption criteria from REO review for commercial thinning were established in 1996 (REIC 1996a and 1996b) and projects that fully meet these criteria do not require a project review.

In the Hwy 46 Project, there are 38 units that are either completely within or have a portion within the LSR, totaling 1,018 acres. Of this, 35 units encompassing 808 acres are prescribed for commercial thinning. These prescriptions meet the exemption criteria set by the REO by meeting the following requirements

- The purpose of the proposed treatment is to accelerate the rate of development of late-successional conditions and reduce the risk of large-scale disturbance.
- Timber volume production is only incidental.
- The proposed stand for commercial thinning is less than 80 years old, overstocked, and not structurally complex.
- A proposed treatment is an intermediate treatment resulting in 10% or more of the stands' acreage in unthinned patches and 3-10% in small openings (1/4-acre).
- Trees >20 inches dbh shall not be cut except for the purpose of creating openings, providing other habitat structure, elimination of a hazard, or cutting yarding corridors.
- Snag objectives are included by designing prescriptions that include developing large trees for potential future snag recruitment, retaining agents of mortality or damage, retention of snags, and leaving skips to allow currently competition mortality processes to naturally continue.

In addition, clumps of 2-5 trees would be left within the thinned portion of the units, as described earlier in this section.

Direct and Indirect Effects

The effects would be reduced canopy cover and increased sunlight to the forest floor, leading to increased vegetative response, increased tree growth, increased horizontal structural diversity, and increased species diversity in forbs, shrubs, and trees. These treatments would result in these stands attaining late seral characteristics decades sooner than if left untreated.

Alternative 3

The primary difference between Alternative 2 and 3 is the elimination of any treatments in fire regenerated stands. This would affect the number of acres treated for commercial thinning, quality early seral habitat, DTRs, and sugar pine restoration. It would also have an effect on the amount of wood provided to the local market. See Table 22 for a summary.

Table 22 Comparison of Alternatives

Activity	Acres treated Alternative 1	Acres Treated Alternative 2	Acres Treated Alternative 3
Commercial Thinning	0	2,489	1,874
Dominant Tree Release	0	74.25	61.25
Quality Early Seral Habitat	0	45	16
Wildlife Gaps	0	45	28
Sugar Pine Restoration	0	94	9
Understory Habitat Enhancement	0	155	155
Riparian Treatments	0	20	20
Visual Enhancement Gaps	0	1.3	0.8
Fuels Treatments	0	223	223
Timber Volume (Million Board feet)	0	40	24

Direct and Indirect Effects

The direct effects of implementing Alternative 3 compared to Alternative 2 is 640.5 (25%) less acres of commercial thinning, 13 (18%) less acres of DTRs, 29 (64%) less acres of quality early seral habitat, 17 (38%) less acres of wildlife gaps, 85 (90%) less acres of sugar pine restoration, 0.5 less acres of visual enhancement gaps, and 13 (38%) million less board feet of timber products. The trees within the older stands not treated would continue to experience high competition. The crown level would continue to rise and regeneration within the stands would grow slowly or stagnate. As disturbance creates holes in the canopy, structural diversity would increase slowly as western hemlock or other species grow into the gaps, although this would most likely happen on a much longer time scale when compared to Alternative 2.

Cumulative Effects

Alternative 1 – No Action

With implementation of Alternative 1, no cumulative effects to forest stand and structure would occur as the effects of Alternative 1 do not overlap in space and time with effects from any past, present or reasonably foreseeable future actions.

Alternative 2 and 3

Effects on forest stand structure from Alternatives 2 and 3 overlap in time a space with the 294 acres of powerline corridor traversing the project area that is maintained in an early seral condition by the Bonneville and PGE power companies. 92 acres of early seral creation in Alternative 2 and 45 acres from Alternative 3 would contribute to early seral habitat for the next 20 years, until a young forest is re-established in units treated.

3.2 Fire and Fuels

3.2.1 Summary of Effects Analysis

Proposed actions for Alternative 2 and 3 would reduce fuel loadings following timber harvest, improve fire suppression capabilities, reduce risk from wildfire to public and private lands and structures, and introduce fire as an ecological function to portions of the landscape. Treatment of activity generated fuels would be accomplished through a variety of techniques including piling, chipping, mastication, and prescribed burning to meet Forest Plan standards and guidelines for post-harvest fuel loadings. Fire suppression capabilities would be enhanced and risk from wildfire reduced through reduction of fuel densities in strategic areas such as roads corridors and areas adjacent to structures and private lands, lookout maintenance, and decreased fire intensity in stands following post-harvest fuel treatments. Alternative 2 includes 1130 acres of underburning and 981 acres of pile burning, and Alternative 3 incudes 605 acres of underburning and 894 acres of pile burning. Both Alternative 2 and 3 include 169 acres of hazardous fuels treatments. Immediately following timber harvest activities an increase in fire intensity will occur until treatments are completed.

3.2.2 Scale of Analysis

Landscape level and project wide data was used to analyze the historic role of fire and its effects across the project area. Stand specific data was used in the fuels treatment recommendations for individual units.

3.2.3 Affected Environment

Fire on the Landscape

Within the Hwy 46 planning area naturally occurring lightning fires were one of the primary agents of disturbance prior to Euro American settlement. Before the beginning of fire suppression and large scale timber harvest activities, fires of variable size and intensity created a mosaic of forest types and age classes that affected wildlife habitat, stand dynamics, soil properties, and watershed hydrology. Some amount of fire on the landscape had also been introduced by the Native American communities within the greater geographic area, but these events are thought to be focused primarily in the valley bottoms to the west, outside of the planning area. Small specific sites may have been burned to maintain or enhance berry production and camas fields but the extent of this burning is not fully understood (Morrison and Swanson 1990).

Fire Regime and Frequency

A fire regime describes the pattern, frequency, and intensity of the wildfires that prevail in an area. While the traditional model of Douglas-fir/western hemlock forests has emphasized high severity fire as the primary disturbance agent, recent studies are beginning to suggest that lower severity non-stand replacing fires may have also played a role in successional pathways (Tepley 2013). These non-stand replacing fires foster the development of multi-cohort stands where shade-intolerant and shade-tolerant species both form distinct age cohorts. The impacts of fire varied greatly across this region and helped to shape the historic structural diversity that resulted in a variety of age classes and seral types.

Fire frequency is a general term referring to the reoccurrence of fire in an area over a given time. The idea of a fire frequency or return cycle as a regular occurrence is not as predictable in the Western Cascades and the Hwy 46 planning area as it is in drier forest types, and can range anywhere from 95 to 145 years between events (Agee 1993). Within the East Humbug and Scorpion Creek drainages Garza (1995) observes a mean fire frequency index of 142 years but also found evidence of surface fires at return intervals of less than 25 years. The highly variable nature of fire frequency and intensity in the western

Cascades creates a mixture of both stand replacing and non-stand replacing fires that leads to multiple developmental pathways and variations in stand structure.

Between 1970 and 2016 there were 198 recorded fires in the planning area, with 39% attributed to lightning and 61% human-caused. Of these fires 83% were suppressed at 0.1 acres or less, with four fires reaching more than 10 acres and one fire over 100 acres that was reported with a final size of 335 acres. While fires continue to occur on the landscape fire suppression efforts have been largely successful in preventing fire from playing its natural role as a disturbance agent.

The Hwy 46 planning area is a mixture of fire regimes and includes the following:

- Fire Regime II: 0 to 35 year fire return interval; high severity (over 75% mortality)
- Fire Regime III: < 35 to 150 year fire return interval; mixed severity (25-75% mortality)
- Fire Regime IV: < 35 to 150 year fire return interval; high severity (over 75% mortality)
- Fire Regime V: 150+ year fire return interval; high severity (over 75% mortality)

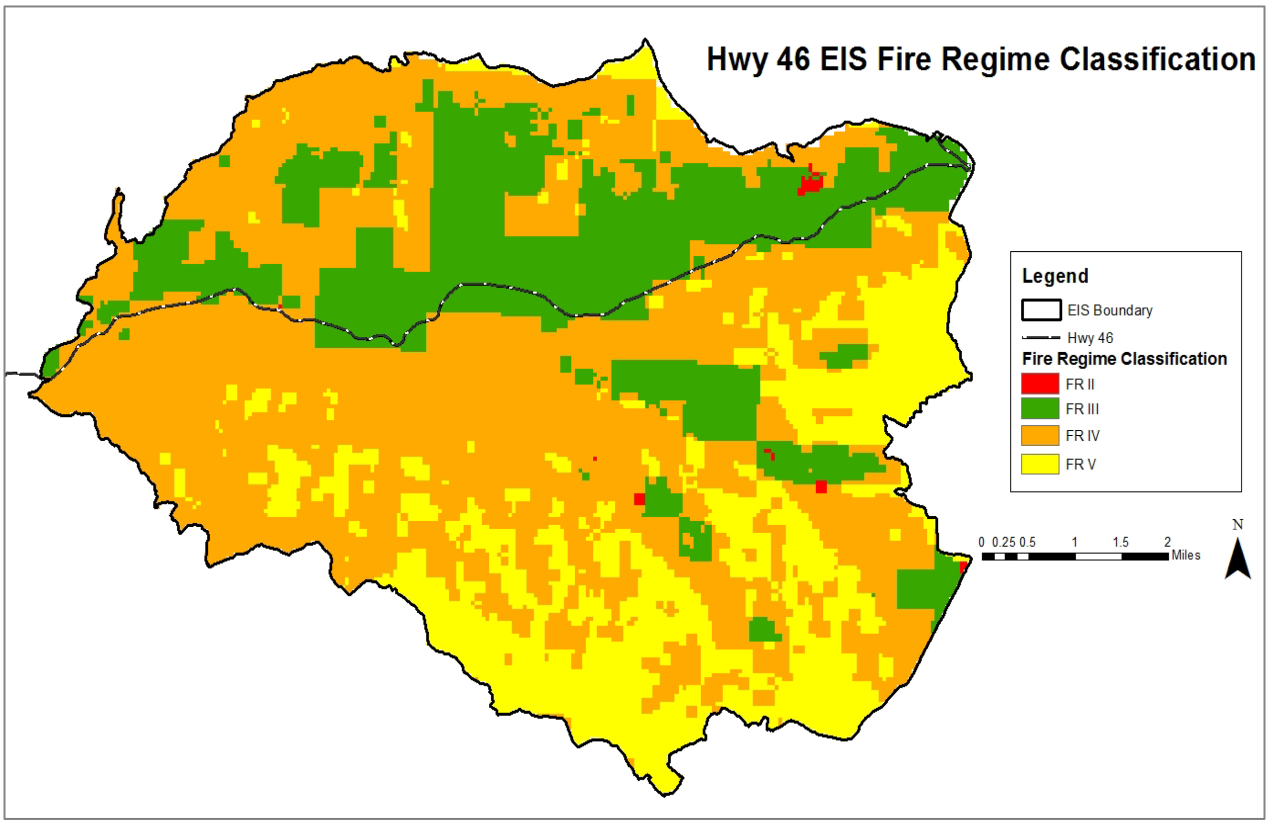

Figure 20 Fire Regime Classification Hwy 46 Planning Area

Fire Effects on Sugar Pine

The Hwy 46 planning area is at the northern most range of sugar pine. As an early seral shade intolerant species regeneration of sugar pine without disturbance is not possible. Sugar pine seedlings prefer mineral soil seedbeds for germination and mature trees are classified as intermediate in fire tolerance with a thick fire-resistant bark and open canopy that retards aerial fire spread. Frequent burning reduces site productivity over time which favors sugar pine as it has been observed to grow faster on lower productivity sites than Douglas fir, whereas Douglas fir can outgrow sugar pine on higher productivity sites. Low to moderate severity surface fires would also reduce understory development which can create competition for resources. During a drought in the mid-1980s many older sugar pine were killed by bark beetles that tend to attack weaker trees under stress for resources.

Garza (1995) shows a wide variance in the fire frequency index throughout the East Humbug and Scorpion Creek drainages ranging from 48 to 469 years. He also found that sites with sugar pine in this area have a shorter fire frequency index (116 years) than sites without sugar pine (156 years). The last documented large fire to occur in these drainages took place in the late 1800s, approximately 126 years ago.

Wildland-Urban Interface

The project area surrounds both the Breitenbush Hot Springs Resort and the Breitenbush and Devils Creek summer home tracts. These areas have been identified as communities at risk in the Marion County Community Wildfire Protection Plan. Much of the area that surrounds the structures within these communities is dense older forest with heavy fuel loadings and narrow road access that could inhibit fire suppression activities in the event of a wildfire. In 2014, 51 acres of mastication work was completed within the Breitenbush Hot Springs Resort and Conference Center, and between 2006 and 2012 50 acres of fuels reduction was completed by the US Forest Service within the summer home tracts. While this work has improved defensible space conditions and access for fire suppression resources there is still a substantial risk from wildfire within these communities.

Figure 21 Within and around the Breitenbush and Devils Creek summer homes areas of dense vegetation exist that may contribute to increased fire intensity making protection of structure in a wildfire difficult.

Figure 22 Areas that have received hazardous fuel treatments such as this can help reduce fire intensity and provide for a safer environment to suppress wildfires and provide structure protection.

Fuel Profile and Fire Behavior

The following are summaries of expected fire behavior and fuel profile conditions of stands within the planning area (NWCG 1982).

Fuel Model 5 (Young Plantations): These stands are comprised of shrubs or young conifers with little to no dead wood where fire often carries through surface and ground fuels. Fires occurring in these stands are often of low intensity due to the light surface fuel loading. However, under severe weather conditions such as high wind events or times of the year when foliar fuel moisture is low these stands can see an increase in fire intensity. Plantations that have been recently thinned fall into a separate category due to their heavier fuel loadings.

Figure 23 Fuel Model 5

Figure 24 Fuel Model 8

Fuel Model 8 (Mature Plantations and Fire Regenerated Natural Stands): These are stands with closed canopies of short needle conifers where surface fuels are primarily needles and small accumulations of twigs and branches. Some limited areas of heavy fuel accumulation may be present but do not substantially effect fire behavior. Most fires are slow burning ground fires although under severe weather conditions such as high wind events or periods low humidity and high temperatures these fuels may pose a hazard and transition from a surface fire to a crown fire.

Fuel Model 10 (Older Natural Stands): These are older stands with multiple canopy layers and greater quantities of large down dead material. During periods of elevated fire danger this fuel type is more likely to result in higher fire intensities and has a greater probability of individual and group tree torching.

Figure 25 Fuel Model 10

Figure 26 Fuel Model 12

Fuel Models 11, 12 (Stands Post Commercial Harvest): Following timber harvest stands will see an increase in the amount of fuel distributed on the forest floor. These elevated fuel loadings will create potential for increased fire intensity until fuels reduction activities take place or sufficient time elapses for fuels to break down and decompose (approximately 5 to 15 years).

3.2.4 Environmental Consequences

Direct and Indirect Effects

Alternative 1 - No Action

Under Alternative 1 the effects of fire suppression and past management activities would continue. Lack of fire disturbance would prevent the creation of new early seral conditions and inhibit the establishment of new sugar pine. Existing open areas and meadows would continue to fill in with conifers and mid-seral closed canopy conditions will continue to dominate the landscape. Plantations would remain at their current stocking levels and short-term impacts to fire danger would be avoided as no resulting slash would be created during harvest operations. Over time however these stands will begin to self-thin either through competition for resources, insect damage, disease, or a combination of environmental factors. Fuel loadings and fire danger would increase as a result of this self-thinning, similar to that following commercial harvest, but without any mitigating fuels treatments. Without release from dense stocking levels tree vigor would decline and average tree diameter and bark thickness growth would stagnate leaving dense stands of small diameter trees susceptible to fire damage in the event of a wildfire. Fuels would continue to accumulate in the Breitenbush Summer Homes and Hot Springs Resort area and those communities would remain at a risk to wildfire.

Alternative 2

Post-harvest Fuels Treatments

Following timber harvests there will be an increase in potential wildfire behavior. The greatest risk from fire will come in the first five years following harvest while needles and small twigs remain attached to branches and limbs. Depending upon the amount and distribution of fuels following harvest, fires will be fairly active with high intensities, particularly in areas of heavy thinning and gaps where direct sunlight is able to reach the forest floor.

Fuel reduction treatments such as piling and burning of limbs and branches, chipping, or prescribed underburning can mitigate the effects of commercial harvests and reduce long term wildfire risk and intensity. Fuels treatments will generally be completed within 1 to 2 years following harvest and reduce total fuel loading to within or below standards set by the Willamette Forest Management Plan Standards and Guidelines FW-212 and 252.

While stands will see a short term increased risk from fire post-harvest, over the long term the individual trees will become more fire resistant as increased growth rates will create larger diameter thicker barked trees that will be able to withstand higher temperatures for longer durations in the event of a wildfire.

All Underburns

Each underburn will have an individual Prescribed Fire Plan developed with specific prescription parameters. Prescribed burning will be conducted when threat of fire escaping from the defined unit boundaries is low and smoke management forecast are favorable. Some units will be seasonally restricted from burning activities to avoid impacts to wildlife during critical breeding periods. Units that are prescribed underburning may require fireline dug down to mineral soil around the perimeter of the burn unit.

Post-Harvest Underburning

Underburning following timber harvest would take place on approximately 1130 acres and is intended to achieve a variety of resource objectives. The primary objective is the treatment of activity generated slash created by timber harvest to bring fuel loading within or below standards established by the Willamette

Forest and Management Plan to reduce threat from wildfire. Underburning is the most effective way to mitigate post-harvest fuel loading and breaks up fuel continuity across the landscape by treating entire units. These burns target the consumption of the smaller diameter fuels, the primary drivers of fire behavior. Once this size class of fuels are consumed future fires within these stands would lack sufficient fuel loading to burn with much intensity and would be easily controlled. Some material such as downed logs, duff, and some small pockets of live and dead fuels will remain after any underburns but would generally not affect the ability of firefighters to safely and effectively suppress any future fires within these stands.

Secondary objectives for underburns include a variety of natural resource benefits including promotion of early seral species, improvement of big game forage, and creation of new snags. Acceptable mortality resulting from prescribed fire in overstory trees would be 0-10%, and burns would be timed to minimize consumption of duff and large woody debris. While fire would naturally occur at a larger scale throughout the planning area and have a greater degree of variability in terms of its intensity and severity, prescribed underburning allows for a controlled replication of the natural fire disturbance process while minimizing threats to public safety and private property.

Figure 27 Post-harvest underburning will create a mosaic of burned and unburned areas throughout stands

Figure 28 Underburns will be timed to ensure adequate duff and down wood retention

Sugar Pine Underburning (only in Alternative 2)

Underburning in stands identified as sugar pine habitat improvement areas will have the same objectives and effects as post-harvest underburning with different mortality objectives. In these units mortality in mature sugar pine will be kept as close to zero as possible. Removal or redistribution of fuels at the base of sugar pines may be needed to reduce fire behavior within proximity to trees. Other conifer species within these stands will have a higher mortality range of 5-15% to create pockets of snags and canopy gaps for establishment of new sugar pine habitat. No mortality created by prescribed burning would be salvaged.

Hand or Machine Piling and Burning

Piling and burning of harvest created slash would take place on approximately 981 acres. Pile burning would mitigate most post-harvest fuel loading but would not provide the same replication of the natural fire disturbance process as prescribed underburning. Piling will be focused on concentrations of post-harvest slash to reduce overall fuel loading and decrease fire hazard, but some amount of material would be left to decompose on site and break down over time. In areas where these concentrations remain some elevated resistance to fire control will exist until the material fully breaks down, approximately 5-15 years after harvest. Burning would generally take place in the fall when fire season has been declared over and there is little chance of fire spreading outside of the created piles.

Hazardous Fuels Treatments

Hazardous fuels treatments would take place on up to 169 acres around the Breitenbush Hot Springs Resort and Conference Center and within the Breitenbush and Devils Creek recreation residence areas. The units proposed for this project are intended to serve as an area where hazardous fuels treatments could take place as a collaborative effort between the Breitenbush Hot Springs Resort and Conference Center, summer home owners, and the Forest Service. Not all acres may be treated depending upon the need and desires of all partners involved in the project.

Hazardous fuels treatments include non-commercial thinning and pruning of trees less than 7 inches in diameter and treating the resulting fuels through burning or chipping. The purpose of these treatments is to reduce the intensity of any wildfires that may impact these communities in the future through the establishment of defensible space, or the distance between vegetation and structures. Adequate defensible space aids in the protection of structures from wildfire and provides a safer environment for firefighters to operate in. Hazardous fuel treatments are also intended to reduce fuel loadings along the road systems in and around these communities. This will allow for the safe ingress and egress of firefighting resources and the public throughout these communities during a fire and increase the ability to effectively utilize road systems as fire control lines. Reducing hazardous fuels and improving defensible space around structures will increases both firefighter safety and the probability of success in protecting these communities.

To mitigate any potential visuals concerns resulting from work within the hazardous fuels units adjacent to the Breitenbush community and summer homes, the following mitigations and design elements will be implemented:

- All work will be done with hand treatments only, no mechanical treatments will be used
- Areas of shrubs and trees will be retained in “skips” to provide vegetation buffers where needed
- Burning will be minimized to the greatest extent possible

Unit 570

Unit 570 is a 24 acre unit on the north slope of Gale Hill. The location serves as a fire lookout point for the Breitenbush watershed during lighting storms and provides a vantage point for locations that are not visible from the districts primary fire lookout at Coffin Mountain. This project proposes to selectively thin and clear pre-commercial conifer trees (less than 7 inches dbh) to maintain visibility from this vantage point into the Breitenbush watershed.

Table 23 Comparison of Fuels Treatments by Alternative

Treatment	Unit of Measure	Alt. 1	Alt. 2	Alt. 3
Post-Harvest Fuels Treatments (1)				
Hand Piling	Acres	0	61	54
Mechanical Treatments (2)	Acres	0	920	840
Post-Harvest Underburn	Acres	0	1130	605
WUI Treatments				
Hazardous Fuels Treatment (not including skips)	Acres	0	169	169
Total Fuels Treatment	**Acres**	**0**	**2280**	**1668**

(1): Post-harvest fuels treatments methods may change depending on feasibility and funding.
(2): Mechanical treatment may include: grapple piling in slash concentrations, mastication, or any other mechanical device).

Alternative 3

Alternative 3 would treat 612 less acres of activity generated fuels due to the reduction in harvest acres and no burning would take place in stands containing sugar pine. The hazardous fuels treatments around the Breitenbush Hot Springs Resort and summer homes area would still be implemented as well as the lookout point maintenance at Gale Hill.

Cumulative Effects

Alternative 1

No cumulative effects would take place as no post-harvest fuels treatments or hazardous fuels projects would take place.

Alternative 2 and 3

Effects to fire and fuels from actions proposed in the Hwy 46 project (Alternative 2 and 3) overlap in time and space with effects from the following actions:

- **Breitenbush Hot Springs Fuels Reduction**: In 2014 51 acres of mastication work was completed within the Breitenbush Hot Springs Resort. Maintenance of this work or the completion of additional of work in the future would overlap in time and space with the 169 acres of hazardous fuels reduction treatments proposed in the Hwy 46 project and would provide additional protection from risk of wildfire.
- **Breitenbush and Devils Creek Summer Homes Fuels Reduction Project:** Between 2006 and 2012 approximately 50 acres of hazardous fuels reduction was completed by the US Forest Service within the summer home tracts. These areas would be maintained or improved upon during the implementation of the 169 acres of hazardous fuels work in Alternatives 2 and 3 to provide protection to structures from wildfire.

3.3 Soils

3.3.1 Summary of Effects Analysis

Potential short-term impacts to the soil and geology resource from management and harvest activity, as discussed in the Willamette National Forest Final Environmental Impact Statement (FEIS 1990), include displacement, compaction, nutrient loss, and instability. In most situations, preventing soil impacts is the most effective and feasible way of ensuring long-term soil productivity.

As part of the vegetation management activities, all action alternatives have the same basic effects and the same soil protection measures, as described on a unit by unit basis.

Anticipated effects to the soils resource will be below and within the Willamette National Forest Standards and Guidelines. The soils design elements were designed to maintain long term soil productivity, provide erosion control, and to meet or exceed the requirements consistent with the standards and guidelines of the Willamette National Forest's Land and Resource Management Plan (1990) and Oregon State Department of Environmental Quality guidelines.

With a proper project implementation and use of the design elements, no adverse effects to soil resources are expected.

3.3.2 Scale of Analysis

For the soil resource the scale of analysis for both direct / indirect effects and cumulative effects is almost always the “unit”, i.e. the stand polygon or activity area proposed for silvicultural treatment. The unit of measure for evaluating those effects is generally considered the percent of the “unit” affected (by field reconnaissance of potential harvest units and surrounding areas for this planned project). The summing of acres for various units, such as the total acres of skyline logging in a given alternative, is not an evaluation criterion for soils impacts. Impacts are evaluated on a unit-by-unit basis, and are generally the same in any given unit for all action alternatives, unless otherwise noted.

Evaluating impacts and their potential significance between or among alternatives requires a discussion of the duration and intensity of those impacts. The following definitions apply to impacts in this section.

Duration

Short-term: The effects last for a few weeks to one or two years;
Intermediate: The effects last from one or two years to about a decade:
Long-term: The effects last from about 10 years or longer.

Intensity

Low, negligible, little or no, minimal, minor: The impacts are essentially zero, at the lowest levels of detection, or very slight but still noticeable.
Moderate, reasonable: The impacts are readily apparent, but meet standards and guides.
Excessive, substantive, major, critical: The impact is moderately severe and likely approaches the upper limits of standards and guides.
Significant, unacceptable: The impacts are severe, and likely exceed standards and guides or do not meet Best Management Practices.

3.3.3 Affected Environment

The Breitenbush watershed is located above Detroit Reservoir and has a total area of about 69,400 acres, almost all of which is located on the Willamette National Forest. This project area contains both High Cascade and Western Cascade physiographic provinces. The dividing line runs approximately south and northeast from the area of the confluence of the North and South Forks.

Most of the proposed units in this project area are located within the Western Cascades physiographic region, on strata that were once called the Little Butte Sequence. Much of this area has been remapped by Walker and Duncan (1989) as “Tu”. The project area lies at the eastern boundary of their mapping area and also extends east beyond it. “Tu” includes undivided Miocene and Oligocene tuffaceous sedimentary rocks, basalt flows, tuffs and breccias form the foundation for most West Cascade drainages (Walker and Duncan, 1989) in this area. The strata often consist of a heterogeneous assemblage of continental, largely volcanogenic deposits of basalt and basaltic andesite, including flows and breccias, complexly interstratified with epiclastic and volcanoclastic deposits of basaltic to rhyodacitic composition. They also include extensive rhyodacitic to andesitic ash-flow and air-fall tuffs, abundant lapilli tuff and tuff breccia, andesitic to dacitic mudflow (lahar) deposits, massive to bedded, fine to coarse grained, tuffaceous sedimentary rocks, and volcanic conglomerates. Radiometric potassium/argon dates on parts of this formation are mostly 32 to 17 million years old (Walker and Duncan, 1989).

Overlying these older formations, the higher elevation main ridges are capped with flows and flow breccias of olivine andesite, basaltic andesite, and some basalt. These rocks, the “Tba” of Walker and Duncan (1989) have previously been designated as the Sardine Formation by some authors (Peck, et al, 1964). These flow deposits lie in an unconformable position on the older Tertiary deposits and erupted mostly from widespread, northwest trending dikes and dike swarms and related plugs and lava cones. Their potassium-argon age dates range from about 17 to 10 million years ago or Middle to late Miocene (Walker and Duncan, 1989).

Overlying these upland volcanic deposits are even younger, ridge capping basalt flows, the “Tb” of Walker and Duncan (1989). A few proposed units appear to be located on these strata. Some volcanic flows of this unit are lithologically similar to flow rocks of the High Cascade volcanic sequence and some are more like flows that were previously mapped as part of the Sardine Formation. Potassium – argon ages of rocks of this unit range in age from about 10 to 4 million years (Walker and Duncan, 1989).

The High Cascades portion on the eastern side of the project area contains the youngest volcanic rocks of the Cascade range, mostly Pliocene or Pleistocene in age. Some of the oldest lava flows of the High Cascades appear to have covered the youngest Western Cascade strata. Since then, most volcanic events have generally been confined to the High Cascades proper (Hammond, et al, 1980). Most of the High Cascade volcanic eruptions, which form the broad base of the High Cascade platform, contain basalt flows, flow breccias, and pyroclastic deposits. They represent the early part of the volcanic eruptions, and their ages range from about four to one million years. The youngest and most recent deposits are generally less than one million years in age and include intra-canyon flows, low shield volcano out pouring, and the more pronounced stratacone deposits, like those on Mount Jefferson or Three Fingered Jack (Walker and Ducan, 1989) (Hammond, P. E., et al, 1980).

In the last several million years, all these rock formations have been extensively modified by stream erosion, mountain glaciation and slope instability (Ricker, 1982). The surface expression of these rock formations has been extensively altered by erosion since late Pliocene time, especially with Pleistocene to Holocene glacial activity and large scale slope instability. The upper Breitenbush drainage was likely heavily affected by the large ice cap glaciers that covered the High Cascade platform with sheets of ice hundreds of feet thick. During numerous glacial periods, large valley glaciers surged away from the Cascade crest and traveled west down the main drainage. The drainages of the High Cascades are typically U-shaped, glaciated valleys with flat valley bottoms and steep rocky valley walls that abruptly transition to rolling uplands at the higher elevations. More recent late Pleistocene glaciations were likely much smaller, and localized valley glaciers carved smaller cirques on the north aspects of these same stream uplands.

The rocks and strata of some of the older Tertiary volcanic deposits (usually the “Tu” strata) sometimes weather to form deep colluvial and residual soils that can give rise to unstable soils. Stabilized slump / earth flow features, such as sag ponds, bench and scarp topography, and disrupted drainages are common in many parts of this project area. It seems likely that slump / earthflow instability has been a significant factor in slope development and stream channel morphology for the last several thousand years, certainly since the end of the Pleistocene. However, large scale slope instability from slump / earthflow complexes and debris chutes has been relatively inactive in the last 500 to 1000 years or more, except in some localized areas.

This complex relatively recent geologic history has produced a myriad of diverse landforms and soils. In general soils on these side slopes have been stable and productive for at least several hundreds of years. Soils formed either directly on the underlying volcanic bedrock, on the more limited glacial deposits, or on jumbled combinations of the two in the slump complexes. Both types have similar size gradations that range from silt loams to gravelly or cobbly, sandy loams. Depth to bedrock is highly variable and can range from a few feet to many times that amount. The various land types are generally well drained where permeability is rapid in the surface soils, and rapid to moderate in the subsoil. Because of high infiltration rates, overland flow is generally uncommon. In the proposed units, side slopes range from near zero to about 80%, but are generally less than 60%. Offsite erosion is generally not a concern because of the extensive vegetative ground cover and the gentle to moderate side slopes.

Stand ages in this project area are somewhat variable and indicate natural or human caused impacts. There is some evidence that under burning happened in older stands when stand replacement fires occurred in nearby areas. Other areas were not burnt or under burnt in the extensive stand replacement fires that traveled through much of the District approximately 150 to 500 years ago. It is likely that aboriginal or natural fires were common along the ridge lines in this project area prior to settlement by Europeans. As a result, natural accumulations of down woody debris are highly variable across many areas.

3.3.4 Environmental Consequences

Direct and Indirect Effects

The major short-term effects to soil productivity from harvest activity, as discussed in the Willamette National Forest Final Environmental Impact Statement (FEIS 1990), include management indicators of displacement, compaction, nutrient loss, and instability (Table 24). The total area of cumulative detrimental soil conditions should not exceed 20% of the total acreage within the activity area, including roads and landings.

Table 24 Management Indicators for Assessing Effects to Soils

Issue	Management Indicator	Justification
Displacement	50% of topsoil or humus enriched soil horizons are removed from an area of 100 square feet that is at least 5 feet in width	FW-081
Compaction	Increase in soil bulk density by at least 15% and/or a reduction in macropore space of 50% over the undisturbed soil	FW-081
Nutrient Loss	Insufficient duff retention or large woody material to ensure adequate nutrient cycling	FW-085
Instability	Increase in size, intensity or number of slope failures	FW-086

Alternative 1 – No Action

Stands will continue to develop. Many of the stands proposed for treatment currently have little understory vegetation because of the lack of sunlight to the forest floor. Intermediate and suppressed trees would slowly be removed from the stand through mortality and decay. In areas of heavy stocking, stands would stagnate. Blow down and snow down would continue to increase fuel loading in the short to intermediate term. Global climate change could alter the capacity of some stands to continue to carry the current density of trees in a healthy manner.

In general, plant diversity would diminish as well as soil biota because of the lack of sunlight. In areas already compacted or disturbed, the soil building process will continue to return the soil to near pre-harvest conditions in the longer term. Short-term to intermediate term impacts from harvest, such as soil disturbance, dust (or mud), slash accumulation and disposal, and longer term impacts such as compaction and nutrient loss would not occur.

Slope instability is a geologic process that is currently active in parts of this project area and can potentially affect some proposed units. Most potentially actively unstable or potentially highly unstable soils were deleted from the units in the action alternatives. Consequently, in the short or intermediate term, no effects to slope instability are anticipated whether the units are managed or not. Stand density is such that little change in stability is anticipated in the short to intermediate term. In the long term, loss of stand integrity with disease, storm or fire might cause an increase in slope failure.

Alternative 2 and 3

Effects between both action alternatives would be the same except for acreage harvested. The major short-term impacts to soil productivity from harvest activity include displacement, compaction, nutrient loss, and instability. Forest-wide (FW) Standards and Guidelines (FW–081), state that the total area of cumulative detrimental soil conditions should not exceed 20% of the total acreage within the activity area, including roads and landings. Anticipated direct effects to the soils resource would be within Willamette National Forest Standards and Guidelines. In most situations, preventing soil impacts is the most effective and feasible way of reducing cumulative effects and ensuring long-term soil productivity. All prescriptions or design elements discussed are designed to meet or exceed the requirements outlined in the National Best Management Practices for Water Quality Management on National Forest System Lands (USDA, 2012)..

<u>Displacement</u>: Little physical evidence can be found in any unit to indicate displacement from previous management activity has been a problem. Stand, shrub and brush growth, as well as duff accumulation over the decades, have provided an effective ground cover. To adequately protect the soil resource, the primary yarding objective for all units will be either ground based systems with predesignated skid roads and directional falling as appropriate, or skyline yarding with one end suspension, except at tail trees and landings. All ground based yarding activities will be adhere to contract clauses (as stated in soil report) and/or line pulling and directional falling would be implemented; in all cases, existing skid or haul roads will be utilized before any additional new skid or forwarder roads are developed. Skyline operations in thinning units with small wood and intermediate supports usually impacts less than 1% of the unit area. Most of the units with steeper ground had little or no existing disturbance levels. Disturbance from yarding will be well within the Regional and Forest standards, and significant adverse impacts are not anticipated. With appropriate suspension during logging, soil disturbance is minimal and off site erosion is essentially non-existent. During harvest, the retention of stream adjacent trees and the requirement of full suspension yarding over or away from stream courses will minimize or eliminate off-site erosion. Some units (or portions thereof) may be helicopter yarded to minimize development of the transportation system that would be needed for more conventional logging systems. In this project, helicopter yarding is not needed for increased soil protection.

<u>Compaction:</u> The primary previous impact to the soil resource from management is compaction, the effects of which can remain apparent for decades. Evidence of compaction from previous entry is still present. Field reconnaissance of the proposed units shows some level of existing compaction, primarily within the existing plantations. .The field investigation indicated that units 70, 140, 190 and 250 exceeded the Willamette National Forest FW-081 Standard of 20% of an activity area impacted by compaction. In unit 360, the area above the road on the ridge had higher compaction, but the bulk of the unit was skyline with very little existing compaction. The remaining units were sufficiently within the standard. Although standards and guides would be imposed for the units, it is possible that some ground based units may approach or exceed the 20% standard at the completion of yarding, grapple piling, and pile burning. Consequently, three actions are recommended in order to bring the units into compliance with the current standards by reducing overall compaction below the 20% level. These actions are: 1) As mitigation in Units 70, 140, 190, and 250 all primary landings, temporary haul or principal skid roads utilized by the purchaser / logger would be subsoiled (to a depth of 18 to 24 inches) at the completion of logging activities; 2) In addition, some subsoiling of landings and primary haul or skid roads is a proposed enhancement in many ground based units to insure that cumulative levels remain well below the 20% standard; and 3) Some post-sale enhancement subsoiling is recommended for areas not utilized by the Purchaser or included within the sold units. Potential units include 8, 9, 10, 17, 23, 31, 35, 56, 57, 58, 59,

61, 63, 70, 73, 74, 78, 140A, 150, 180, 220, 450 and 520 or portions of other units where both skyline and ground based systems may be employed. Of these, the highest priority are units 35, 63, 73, 180 and 520.

With the use of designated skid roads, the reuse of the existing skid road system, and the subsoiling of landings and primary skid roads, compaction is not anticipated to exceed the 20% value in any unit, it should generally be below the 15% level (or much lower), except unit 190, where compaction levels will be reduced from pre-thinning levels, but the 20% objective may or may not be achieved. Based on previous experience, this effort should be successful.

Skyline operations in thinning units with small wood and intermediate supports usually impacts less than 1% of the unit area. Skyline yarding with one end suspension is proposed for parts or all of many units. Most of these units had low existing compaction levels at generally less than 5%, at least in the areas of steeper side slopes. Skyline landings are primarily planned at old existing landings, road turnouts, and road junctions. Little new spur road would be required. Effects from existing compaction and skyline yarding are not anticipated for any individual unit.

The use of temporary truck roads considerably reduces the amount of compaction for most units by reducing both the number of trips across the ground and shortening the skidding distance. The use of the existing road system in the area and the potential to create new temporary roads on the relatively flat ground in order to reduce soil compaction, is recommended. Given that, temporary roads should be subsoiled at the completion of harvest activities. Subsoiling may be curtailed in some areas in order to reduce the amount of root pruning of leave trees, to avoid excessive amounts of exposed soil, or to avoid stumps or large rocks.

Nutrient Loss: Potential nutrient loss is primarily controlled by duff retention standards. Duff retention is the amount of duff thickness remaining after management activities are completed. Duff retention objectives would be specified for each unit to maintain nutrient cycling. Duff retention values range on the low end from 10-30% to as much as 60 to 80% on sensitive slopes. Monitoring and field reconnaissance in recent years has shown that the duff retention percentages for under burns in partial cuts, thinning, or fuels reduction within unmanaged stands, which maintain an intact live root mat and live canopy cover over most of the unit, could be lower and still achieve adequate soil protection.

For all action alternatives, within the managed plantations, slash would be scattered in the units, piled and burned, or perhaps broadcast or under burned. Piling may occur by hand or with a grapple machine. Grapple piling occurs with a grapple not with a dozer brush rake. Grapple piling requires one pass of the machine across the landscape, and the machine works while sitting on slash. Extensive monitoring of grapple machine piling operations indicates that little or no additional compaction or displacement occurs, when properly implemented. In many cases only a few acres of any particular unit are hand piled or machine piled.

Burning the piled slash may develop sufficient heat to affect the underlying soil. However, the hotter portions of pile burning involve a very small part of the acreage in any unit, usually less than 1% of the area. Also pile burning is usually done in the fall or winter months when duff and soil moistures are higher, and this helps reduce the downward heat effects to the soil. Pile burning is considered a minor effect and not cumulative because of the limited overall acreage involved.

Another aspect of long term nutrient availability and ectomycorrhizal formation is the amount of larger woody material retained on site. Management activities would be planned to maintain enough large woody debris (dead and down) to provide for a healthy forest ecosystem and ensure adequate nutrient cycling (FW-085). At this time, site specific needs would be considered commensurate with wildlife objectives as outlined in FW-212a and FW-213a (as amended). Concentrations of larger down logs that were produced with the initial harvest should be left undisturbed as much as possible. With the retention of adequate duff and woody debris, potential adverse impacts to long-term soil productivity are not anticipated.

Instability: The Breitenbush drainage is generally considered a moderately stable to very stable. Based on field reconnaissance, 14 units (or portions thereof) could have instability concerns, units 5, 6, 12, 25, 38, 42, 53, 60, 77, 84, 93, 95, 100 and 290. Unit 37, which also has instability concerns was dropped. The removal of trees with harvest from these units could in the short to intermediate term, reduce evapotranspiration as compared to the current condition. This could result in slight increases in the ground water level, which might affect slope instability down slope. However, this is not considered a critical concern for three reasons: 1) these changes are anticipated to be within levels that are similar to natural rainfall amounts at two to ten year storm events. The potential intermediate impacts from thinning and a reduction in stem density will be quickly ameliorated by the increased growth on the leave trees; 2) if no action occurs, suppression will result in the stands loosing trees or growth with a similar loss in evapotranspiration; and 3) monitoring of commercial thinning harvest implemented on potentially highly unstable or actively unstable terrain has shown good release and not exacerbated slope instability.

Field review of previously thinned units in the past several years on both stable and unstable land types has shown no increase in either slope instability or erosion in either uplands or riparian reserves. Thinning within those units with potentially highly unstable or actively unstable terrain will not immediately promote greater slope stability. However, thinning will create healthier stands with bigger trees that have larger crowns and more roots. Those areas with shallow, debris chute type soil failures where rooting depth plays a part in slope stability, will see improvements within a few years as crowns begin to respond to the increased sun light. Larger trees create more roots and tend to increase slope stability, and if failures do occur, they provide larger wood for down slope riparian areas. For those units with slump / earthflows, failure depths are below the rooting zone. However, evapotranspiration will maintain or increase with bigger trees, and that will reduce pore water pressure in the longer term. With thinning, these stands will return to current levels of water usage within a few years, and this rate will be maintained or increased for decades into the future as the stand matures, crowns expand, and root mats enlarge and deepen.

Transportation system to access units and suitable landing sites for ground based, skyline or helicopter yarding systems may require temporary roads, opening old logging roads constructed many decades ago, or by using new temporary roads. Temporary roads are located on gentle stable side slopes, with common material. Little or no full bench construction is required, and if needed, end haul of excess excavation will be transport to a suitable waste area. Use of these old logging roads will allow for drainage structure improvements and fill stabilization. Some specific geotechnical works were conducted within 3 units of the project. The geotechnical work consisted in site assessment for some hauling road extension, construction and waste site conditions on units 97, 140, 490.

An opportunity to conduct road decommissioning in the area of Short Lake prompted the need to tie FS Rd 040 into FS Rd 045 by using Rd 059 (as signed in the field) and a short section of new construction of approximately 1000 feet in length. This new construction is the Short Lake reroute mentioned in Table 63. Road 059 (as signed in the field) is an existing road that is located on a broad flat ridge. The new connection route drops from the end of the ridge to the west in two broad switchbacks. This new section is located on side slopes that range from 0 to about 20%. Grades are favorable at 5 to around 12%. Soil depths are greater than 10 feet so the entire route is located in common material. No drainages, seeps, or wet soil areas are evident along this route. Most of the length of proposed new route essentially follows existing old skid / haul road, and most of the route is located in an existing plantation. The new Short Lake Reroute as stated in the Road Investment Strategy Analysis (Table 63) would result in 1 to 1.3 miles of road decommission within the lake area.

Unsuited areas, such as cliffs, rock outcrops, critical rocky areas, or wetlands and dry meadows were mapped as part of the field reconnaissance. Skyline corridors running through unsuited areas within a unit are acceptable to access suited portions of the unit. Trees in the unsuited area that need to be cut to maintain the integrity or safety of the skyline corridor will be left for down woody debris (following Forest Plan recommendations). Partial suspension is the logging requirement over rocky areas, full suspension is required over wetlands, dry meadows and riparian sites.

Cumulative Effects

The impacts are evaluated on a unit-by-unit basis, and are generally the same in any given unit for all action alternatives, unless otherwise noted. The primary previous impact to the soil resource from management was compaction, the effects of which can remain apparent for decades. Potential cumulative effects from displacement, nutrient loss, and instability with previous management were not observed in the field reconnaissance. Existing compaction levels have been documented and discussed for the various units. The soils design elements are designed to limit the amount of additional compaction, and the subsoiling is intended to reduce compaction where levels would exceed standards and guides. It is possible that some ground based units may approach or exceed the 20% standard at the completion of yarding, grapple piling, and pile burning. Specifically, 70, 140, 190 and 250 have subsoiling as a mitigation to insure compaction is reduced to more acceptable levels. In addition, for most ground based units, some purchaser subsoiling is recommended as enhancement to lower compaction amounts further. The objective is to remain below the 20% cumulative level, maintain long-term soil productivity, and provide a level of erosion control that is consistent with State guidelines.

Prescriptions for soil protection and watershed considerations take into account past and predicted future land management activities. No single unit measure of long-term soil productivity is widely used. Information on the survival and growth of planted seedlings may indicate short-term changes in site productivity. However, the relationship of short-term changes to long-term productivity is not fully understood. Experience indicates that the potential impacts on soils are best evaluated on a site-specific, project-by-project basis. The major soils concerns—compaction, nutrient loss, displacement and instability—are most effectively reviewed for short- and long-term effects at the project level. With proper project implementation, unacceptable cumulative effects on soils are not anticipated from the action alternatives. Soil protection measures and best management practices as defined in this report would preclude the need for additional cumulative effects analysis. Deviations from the standards and guidelines would trigger further cumulative effects review, and no deviations are planned.

3.4 Hydrology

3.4.1 Summary of Effects Analysis

Alternative 1 would retain stands and roads in current condition with no changes to peak flow responses and negligible to immeasurable changes to surface flows and water storage. Lack of road maintenance would continue to pose risks of stream channel diversion. Variably thinning stands and creating local disturbances under Alternatives 2 and 3 would alter the hydrology on the site scale, but due to the design elements that avoid or limit impacts and a less than 3% reduction in the ARP level on the subwatershed scale, effects would be minor to immeasurable. Under Alternative 2, local disturbances would include 16 ground-based crossings on intermittent streams and 2 temporary road crossings and culvert upgrades. Alternative 3 would treat less acreage, have one less ground-based stream crossing disturbance, and less road miles maintained. Negligible to minor effects to runoff from underburning stands and pile burning treatments are anticipated, due to the low intensity and low acreage, respectively, of affected ground. Conifer encroachment would continue to transition the meadow in Unit 32a towards a forested condition under Alternatives 1 and 3, whereas under Alternative 2, meadow restoration would improve hydrology for wet meadow vegetation species, pollinators and wildlife.

Desired riparian conditions, with high species and structural diversity and large dead and down wood would continue to slowly develop over time as natural disturbances take place. Alternatives 2 and 3 propose to treat 771 and 587 acres of Riparian Reserve, respectively, to improve stand conditions towards meeting ACS objectives by reducing stand densities, to increase light to the forest floor, improve stand vigor and increase stand diversity. Primary shade to streams would be protected, with slight reductions to the secondary shade zones and maintenance of stream temperatures. Action alternatives would protect approximately 90% or more of the recruitment zones for large wood where Riparian Reserves are treated, with attributable reductions in wood recruitment to streams experienced in the short-to intermediate-term. Alternative 1 would protect large wood recruitment the greatest in the short to –intermediate term, but would be delayed in its ability to generate larger wood, responsible for forming and maintaining stream channels. Proposed streamside treatments in the action alternatives would restore hardwood riparian plant communities and add large wood to streams, benefitting riparian conditions along 3.2 miles of tributaries. Effects to riparian conditions would be similar for both action alternatives, with the exception that 184 less thinning acres would affected under Alternative 3. Alternative 2 offers the greatest opportunity to improve ACSO's in Riparian Reserves on the watershed scale.

Stream shade and temperature would be maintained with no effects under Alternative 1. Under the action alternatives, stream shade would be reduced slightly but minimized with cutting of trees at 15-16 individual stream crossings and thinning in the secondary shade zone. Canopy closure of at least 50% would be retained in the secondary shade zone and thinning would be excluded from the primary shade zones by a minimum of 60-100 foot no treatment buffers. Treatments would have no measurable effects to stream temperature.

Rates of road related sediment yield are estimated to remain relatively unchanged under Alternative 1, with existing road erosion problems that result in sedimentation to streams unaddressed. Forty-one and 36 stream crossing culverts that are currently in poor condition or undersized would be replaced or upgraded in Alternatives 2 and 3, respectively, yielding approximately 62 and 54 cubic yards of sediment, respectively, during replacement, but stabilizing 10,250 and 9,000 cubic yards of sediment from long-term risk of potential culvert failure. New temporary road construction (5.1 mi), road realignments (0.3), road storage and decommissioning (4 mi) and the Short Lake Reroute (0.4 mi) decrease road generated sediment delivery to streams in the project area by 12 cubic yards annually. Fewer miles of new temporary roads and existing spurs constructed and re-opened, haul routes, and road maintenance/reconstruction would produce slightly less sediment yield to streams than Alternative 2. Alternative 3 would treat approximately 614 acres within Riparian Reserves, and all other treatments would be the same as Alternative 2. Effects on riparian conditions would be similar to Alternative 2. With fewer acres thinned than Alternative 2, dense riparian reserves untreated would be more prone to wildfire, disease, and infestation, and no benefits of meadow restoration.

This section is summarized from the Hwy 46 Hydrology Report, which is incorporated by reference and available in the project record at the Detroit Ranger District Office.

3.4.2 Analysis Methods

The hydrologist analyzed stream temperature data from 10 sites, including long-term monitoring sites and additional project specific sites since 2006. Level II stream surveys were completed on major streams in the project area between 2002 and 2014 and included detailed measures of stream morphology, streamflow, streambed substrates, large wood counts and riparian characteristics. This data was used in conjunction with unit-level riparian reconnaissance to assess the need for treatment to improve riparian conditions.

Fisheries, hydrology, wildlife, botany, and silviculture specialists surveyed all potential units in the project area. Seasonal aquatics technicians surveyed the units and streams during the 2014 and 2015 summer seasons, walking through each of the proposed units and surrounding areas, recording any streams and wet areas that were encountered with a handheld GPS unit. Aquatics technicians also inventoried culverts and surveyed road conditions throughout the project area. Aquatics staff (hydrologist and fisheries biologists) visited the majority of the riparian units. In these units with primarily class 2 and 3 streams, aquatics staff assessed Riparian Reserves to determine if ACSO's were being met, and documented treatment and buffer needs. Photos of stands, GIS information and field data were utilized in discussion and development of site-specific prescriptions with the interdisciplinary team.

Existing data from the Willamette National Forest Geographic Information System (GIS) database was queried to provide stream density, road density, stand condition (age), riparian connectivity, special habitat locations, types of aquatic habitats, and fish distribution. . Aquatic specialists gathered data on current and historic watershed condition from the Breitenbush Watershed Analysis and through GIS analysis of a USFS vegetation database (FSVeg) and high-resolution satellite imagery (WorldView2). Aggregate Recovery Percentage (ARP) was utilized to analyze effects of thinning on peak flow and standard observations of past activities within the watershed considered when determining effects to hydrology, stream channel, water quality and riparian conditions.

Using existing road layers and proposed road changes, the hydrologist used the GRAIP-lite model of the GIS-based NetMap toolset to generate road-related sediment delivery (Benda et al 2007) estimates by alternative. Inputs to the model include slope derived from a 10-meter digital elevation model, NHD streams layer, roads (operational maintenance levels and surface type), and base rate of annual road erosion. Compared with the WEPP model, commonly used for road-sediment generation estimates, GRAIP-lite tool provides more realistic estimates of sediment delivery. The GRAIP-lite model is also limited, however, in that it cannot be adjusted to reflect the effects of hauling traffic and comparisons between alternatives are more restricted to differences in miles of new or re-opened road, decommissioning or realignment of roads and any changes to maintenance level or surface type.

Alternative treatments were analyzed for their effects on hydrology, stream channels, water quality, and riparian conditions at various scales to assess both positive and negative effects and to predict progress towards desired future conditions. Analysis by aquatic specialists used a combination of field reconnaissance, GIS-based analysis, past management records, and professional judgment to evaluate and compare effects of the proposed actions at the local site, the 6th field sub-watershed and 5th field watershed scales.

3.3.3 Affected Environment

Watershed Hydrology

Landscape

The Breitenbush Watershed is a fifth field watershed under the 1994 Northwest Forest Plan Aquatic Conservation Strategy. The Breitenbush River is tributary to the North Santiam River, which joins with the South Santiam River near the confluence with the Willamette River, within the Columbia River Basin. The project area encompasses three sub-watersheds within the Breitenbush Watershed. The majority (63%, 19,743 acres) of the project area is in the sixth field Upper Breitenbush River sub-watershed. The South Fork Breitenbush River and North Fork Breitenbush sub-watersheds respectively make up 19% (5,994 acres) and 17% (5,204 acres) of the project area. Less than one percent of the project area includes small portions of the Humbug Creek, Lower Breitenbush and Cub Creek sub-watersheds.

The Breitenbush River flows westward from the center of the project area from the confluence of its North and South Forks in the eastern Marion County. Major tributaries of the Breitenbush include East Humbug, Fox, Scorpion, Short and Mansfield Creeks entering from the north and Leone, Hill, Devils and Skunk Creeks from the south. The drainages that form this portion of the watershed are typical, low to moderate elevation, dendritic, stream systems. Many stream channels have been altered by both glacial and earthflow activity. These areas often contain a complex drainage pattern that parallels earthflows and fault lines. The Breitenbush River follows a fault line that is a conduit for the hot, hydrothermal waters of the Breitenbush Hot Springs at the upper end of the river below the North and South forks.

Stream Flow/Disturbance History

The hydrology of the Breitenbush Watershed is similar to other typical watersheds within the Western Cascades. The hydrology is dominated by rain inputs and snow/glacial melt from Mt. Jefferson and the High Cascades. Figure 1 shows the average stream flow (discharge) by month for the period of record of the Breitenbush River (Water Years 1933 through 2014). Flows in the winter through spring generally average between 800 and 900 cubic feet per second (cfs) and begin to decline as snowpack and snowmelt diminish in June. Mean annual discharge for the Breitenbush River is 621 cfs.

Peak flows are predominately generated by rain-on-snow events in the transient snow zone, which occur between 1,200 and 4,900 feet elevation (Harr, 1981; Jones and Grant, 1996). Rain-on-snow events are considered the primary effect on peak flows. The transient snow zone covers approximately 88.6% of the Hwy 46 project area. Peak flows occur between October and May.

With an average Aggregate Recovery now estimated over 85% and well over the threshold of concern of 74%, the area’s sub-watersheds are moving into a vegetative condition that buffers the effect of snow accumulation. Snow accumulates in thinned areas in lesser amounts and therefore does not pose the same risk to rain-on-snow events. Regeneration harvest units (15-20 years old) still exist within the project area, allowing accumulation of snow, but these plantations are growing at a rate expecting full recovery within 15 years. Currently, hydrology is responding well within its natural range with the existing vegetation components of the project area. This area includes the following sub-watersheds with corresponding thresholds of concern for Aggregate Recovery Percentage (ARP) within the Breitenbush Watershed:

Table 25 Aggregate Recovery Percentages Threshold of Concern

Sub-watershed	Sub-watershed Acres in Project Area	Threshold of Concern % (midpoint ARP)	Current Condition (2016)
Upper Breitenbush	19,743	70-75	79.89
North Fork Breitenbush	5,204	75	87.12
South Fork Breitenbush	5,994	75	89.33

Stream Channels

From the first order stream channels in the headwaters to the fifth order Breitenbush River, stream channels within the project area exhibit a dendritic pattern. Rosgen type A, B and C channels are present within the proposed project area. Type A channels are characterized by high gradient, transport channels on valley walls and contain larger, volcanic substrates, whereas Type C channels occur in lower gradient, meandering sections of the Breitenbush River on alluvial and colluvial substrates.

Type B channels are present in higher order channels such as Breitenbush River and Devils Creek that flow over cobble and small boulder substrates. Sediments typically move through these channels alternating between flow transport in higher gradients and deposition in lower gradients and by receding flows where channel obstructions, such as boulders and large wood, dissipate flow energies. Channel bar mobilization, stream bank erosion, and debris torrent activity from the steeper terrains feed streams with structure and sediment. The majority of the fine sediment is transported out of the system and into the Detroit Reservoir. Intense precipitation is episodic in nature, and often generates peak flows that are a major disturbance mechanism for stream channels and associated riparian areas in the project area. Stream channels in headwater streams are predominantly intermittent due to the lack of water and sediment storage.

Level II stream surveys conducted in 2002-2014 found that in-stream large wood in the Breitenbush River was below pre-management levels and also low for all the surveyed tributaries (Byars, Devils, Humbug, East Humbug, Hill, Leone, Mansfield, Bummer, Horsetail and Short Creeks, and the North and South forks of the Breitenbush River)**.** Large wood in streams is slowly improving through natural recruitment of fallen large conifers from unmanaged riparian areas and development of large wood adjacent to the channels. Over the last 20 years the riparian condition and channels are gradually recovering needed complexity due to natural processes, changed land management techniques, and an improved understanding of the importance of channel complexity.

Forest Service aquatics technicians completed field surveys and GPS-mapped a total of 60.2 miles of stream channels in and around each treatment unit within the planning area. The field surveys and corresponding GIS work assure more accurate placement of buffers and Riparian Reserve prescriptions. Recorded and updated in the project GIS database are the following types of channels in context with treatment units in the Hwy 46 planning area:

- Class I and II– Public drinking water source or fish-bearing, perennial: 43.4 miles, 13%
- Class III - Perennial, non-fish bearing: 58.7 miles, 17.9%
- Class IV - Intermittent, ephemeral: 227.1 miles, 69.0%

Riparian Conditions

Approximately 43% of the entire project area (13,502 acres) is designated as Riparian Reserves. Present day riparian conditions are shaped by natural and human disturbances, including flooding, mass wasting, timber harvest, fire, and construction of railroads, powerlines and roads.

Past distrubances of fire and intensive timber harvest set today's Riparian Reserves on a trajectory with high density conifer-dominated stands. Riparian areas are dominated by Douglas fir with minor amounts of other conifers. Depending primarily on elevation and aspect, other conifers include western hemlock, western red cedar, noble fir, pacific silver fir, and grand fir. These riparian area include scattered areas of red alder and big leaf maple. Except for the lower reaches of the Breitenbush River which were logged by railroad, the larger streams in the watershed were largely excluded from regeneration harvests and remain in a more natural condition (Breitenbush Watershed Analysis, 1996).

Within the project area, early-seral and late-seral vegetation is currently at the lower end of the natural range of variability (Breitenbush Watershed Analysis 1996). In late-seral stands, shrubs and herbs are re-initiated as conifers die and create gaps in the canopy. A recent study of riparian plant communities in northwest Oregon (McCain 2005) provides data on "relatively unmanaged" conditions. The study describes riparian and upland plant communities based on geomorphic features (e.g. in-channel, cobble bars, terraces, floodplain, etc.). On the "steep banks/terraces" and "high terraces/major floodplain" features common to streams in the project area, deciduous trees had typical percent cover values of 15 to 64%. Valley cross-sections (300-foot riparian transects) on 3rd and 4th order "relatively unmanaged" streams in the west Cascades had a hardwood basal area of 7 to16 square feet/acre and hardwoods were present throughout the 300-foot transect. This study suggests that in "relatively unmanaged" riparian plant communities, there is typically a hardwood, shrub, and herb component. These deciduous and herbaceous species provide many benefits to riparian and aquatic ecosystems, including better food resources and higher productivity for aquatic invertebrates compared to conifer-dominated systems (Wipli et al 2007); increased nitrogen fixation, organic matter cycling, and soil fertility (Compton et al. 2003); and wildlife benefits.

With a lack of both early- and late-seral vegetation classes that have a large deciduous and herbaceous component, it follows that these species are underrepresented on the current landscape. This is further supported by analysis of existing vegetation using high resolution satellite imagery. Aquatic specialists completed an analysis of the Breitenbush Watershed and project area Riparian Reserves using a GIS-based WorldView2 Satellite Imagery and eCognition software analysis of the Breitenbush Watershed (Figures 29-30). WorldView2 imagery highlights areas of high chlorophyll production, which helps distinguish between deciduous and coniferous vegetation. Based on results of this analysis, approximately 88% of Riparian Reserves in the Breitenbush watershed are conifer-dominant and 2% are deciduous-dominant (trees and shrubs). Approximately 2% are mixed conifer and deciduous, and 8% are non-forest (Figure 29).

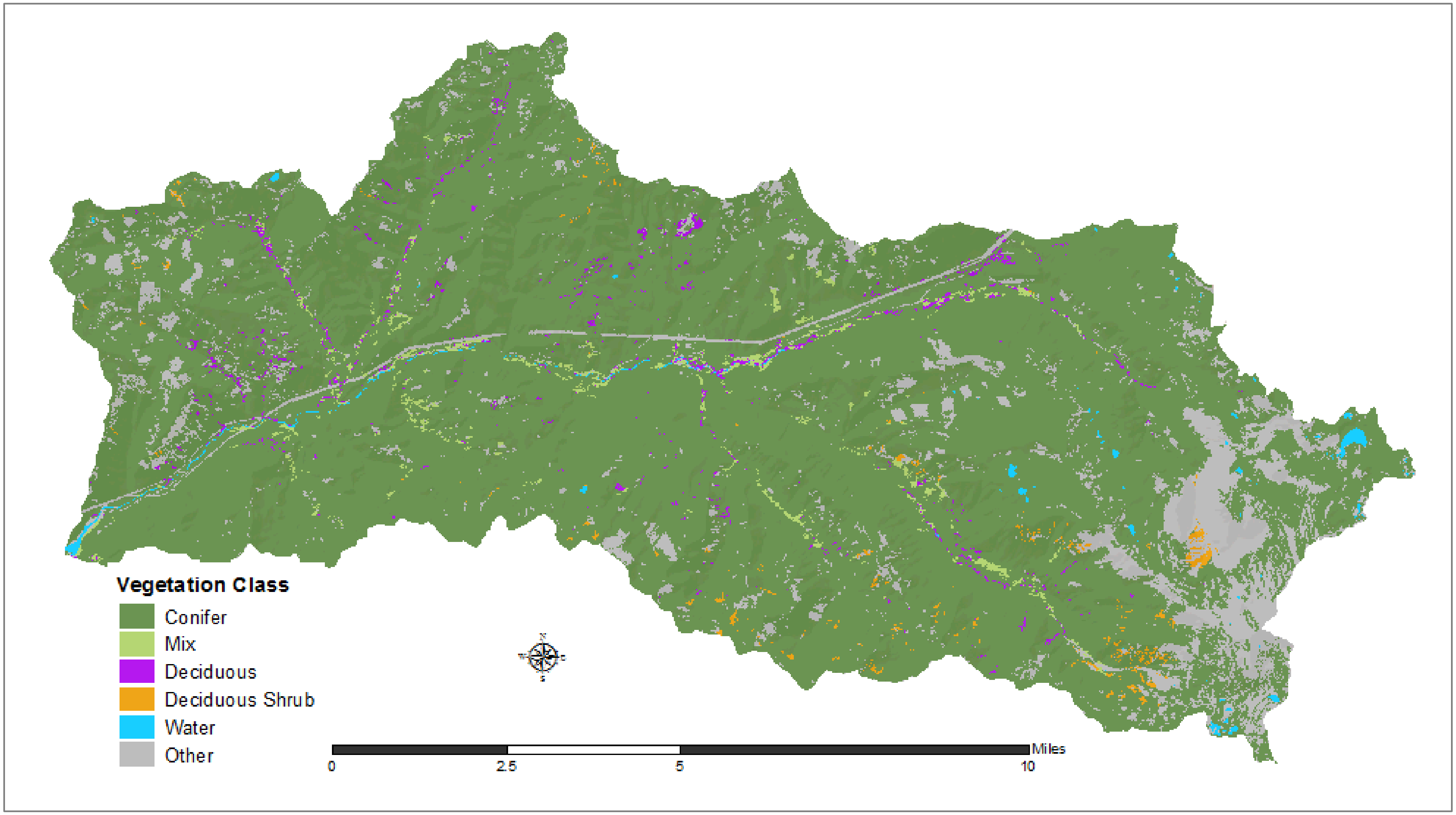

Figure 29 Vegetation classification of the Breitenbush Watershed using high resolution satellite imagery (Worldview) and eCognition software.

Within the scale of the Hwy 46 project area (Figure 30), approximately 91% of Riparian Reserves are conifer-dominant and less than 2% are deciduous-dominant (trees and shrubs) (Table 26). Approximately 2.6% are mixed conifer and deciduous, which occur primarily in late-seral stands along the Breitenbush River. The results of this landscape-scale analysis reveal a very low abundance of deciduous species and are corroborated by surveys at the stand scale, where dense conifers dominate Riparian Reserves and there is often a lack of understory development and species diversity. Some portions of Riparian Reserves in previously unmanaged areas within the project area have higher structural and species diversity and are providing adequate stream shade, root strength and bank stability, sediment filtration and nutrient cycling, large wood supply to waterbodies and floodplains, organic matter input to waterbodies, and habitat for riparian-dependent wildlife. These riparian areas are found to be achieving ACS objective or are on close trajectory to doing so. These riparian areas serve as a reference of desired future condition, guiding development of riparian prescriptions.

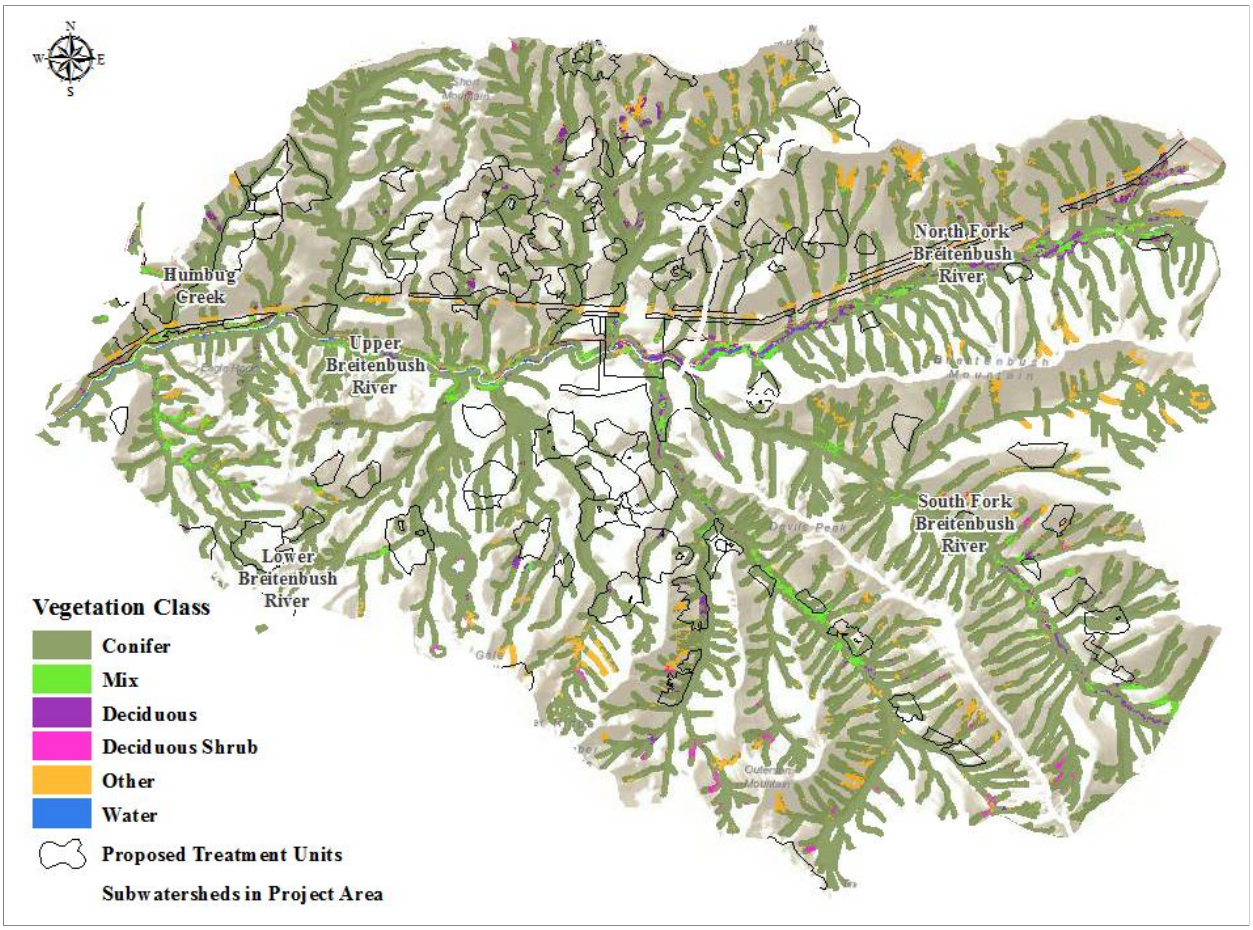

Figure 30 Vegetation classification within the Riparian Reserves of the project area and sub-watersheds using high-resolution satellite imagery (Worldview) and eCognition software.

Table 26 Vegetation Class of Riparian Reserves within the Project Area

Vegetation Class	Acreage in Project Area	Percent of Project Area	Acreage in Riparian Reserve	Percent of Riparian Reserve
Conifer	28,659	92%	12,268	91%
Mixed	534	1.7%	350	2.6%
Deciduous	348	1.1%	230	1.7%
Deciduous-Shrub	101	0.32%	43	0.3%
Other	1,586	5.1%	578	4.3%
Water	55	0.2%	34	0.2%

Of 1,447 acres of Riparian Reserve within the proposed (Alternative 2) units, 973 acres (68% have been harvested in the past, and are considered plantations. Approximately 454 acres (31%) are considered fire regenerated and have not been managed, though most of these are in similar condition to past regeneration harvested Riparian Reserves due to stand replacing fires around the turn of the century. Riparian stands proposed for commercial thinning treatment are a combination of plantations created after clear-cut harvesting and natural fire regenerated areas. All of the plantation stands and most of the older fire regenerated stands are considered to be in the stem exclusion structural stage. Riparian stands to be treated are considered to be in the stem-exclusion stage.

Relative tree densities and structural stages of stands are considered to be outside the range of natural variability. Stands are densely stocked and relatively young, averaging 68 years old (ranging from 26 to 145 years old). Stand densities in the proposed units range from 75 to 397 TPA (trees per acre), averaging 198. In contrast, research in the Coast Range and Western Cascades by Tappeiner et al (1997) and Poage and Tappeiner (2002) indicates that existing old growth stands developed with natural stand densities of 40 to 60 conifers per acre. Pollock et al (2005) found that “riparian stands often develop in a much more open structure, such that stem exclusion is much less common and understory vegetation usually is present throughout the development of a forest.” Stem exclusion stands have dense crowns that block out light to the forest floor and limit understory species and structure development (Oliver and Larson, 1990). The trees are competing for sunlight, water, and nutrients causing reduced tree growth and vigor as well as limiting understory vegetation. Suppressed understories are mostly limited to shrubs and herbs with a few small trees scattered throughout. The existing lack of complexity and diversity may be limiting nutrient cycling, deciduous organic matter input to waterbodies, and habitat for riparian-dependent wildlife.

Figure 31 Example of overstocked, conifer dominant stand lacking structural and species diversity within Riparian Reserves (Unit 520).

Natural accumulations of down woody debris fall on the low side of natural variability in riparian areas in the project area. Stand ages in parts of this project area indicate that fires were very prevalent in the last 70 to 130 years; these fires were natural, human caused or management-induced. Older plantations with lower utilization standards retained considerable large down woody debris. Younger plantations, with commercially higher utilization standards, removed much of this type of woody material. The most recent plantations, which had down woody debris objectives, again began to accumulate larger material within riparian areas.

In addition to streamside areas, riparian areas also include lakes and wetlands. Short Lake and Leone Lake are the only named lakes in the proposed project area. Both lakes have their origins as sag ponds created from depressions related to slump activity, Short Lake is managed as special use area for recreation, aesthetics and ecological values. The project area also contains three other small lake/ponds and numerous wetlands, including swamps, meadows, seeps and springs, which are mapped as Special Habitats (SHABs). Wetland areas are generally small in size and scattered throughout the project area. Most were created either by glacial or slump action. These naturally-formed features add to the complexity and value of groundwater systems.

In general, riparian conditions appear to be partially functioning and on a slow trend toward recovery for this Western Cascade environment. While riparian conditions are generally recovering into the natural range of variability from past management activities, riparian stands selected for treatment are low in structural and species diversity, limited in large wood and would benefit from restorative treatment.

Water Quality:

Water quality is generally high and of high value, in part due to hyporheic flow, for most of the streams associated within the project area. Stream banks and floodplains are generally well vegetated and stable. Surface waters mix with groundwater in the inter-gravel flow (hyporheic zone). Water quality parameters monitored in the project area have been found to fall within the natural range of variability for West Cascade streams. Sediment and water quality conditions are recovering from past timber harvest activities, though naturally occurring landslides and debris flows in unstable areas of the watershed are chronic sediment sources to some streams and downstream waters. Geothermal areas provide unique hydrology to a few locations in the valley bottoms along the Breitenbush River. Hot and highly mineralized water surfaces as seeps or springs these areas.

The Oregon Department of Environmental Quality currently lists portions of the Breitenbush River and South Fork Breitenbush River as water quality impaired (303(d) listed). These segments were submitted in 2010 by DEQ to the Environmental Protection Agency (EPA) and approved. At this writing, no TMDL has been approved by EPA for these listings, so they are considered Category 5: 303(d), TMDL needed. It is anticipated that the lists may change during the NEPA and implementation timelines of this project, due to ongoing legal disputes. The Breitenbush River from the mouth to river mile 12.2, and the South Fork Breitenbush River, from its mouth to river mile 1.6 are listed for Biological Criteria. The Biological Criteria listing indicates that the waters are not of *sufficient quality to support aquatic species without detrimental changes in the resident biological communities*. This assessment is based on a single benthic macroinvertebrate sample collected in 1999 in the reach not having a representative number of taxa present as compared to a regional reference condition. The South Fork of the Breitenbush River, from mouth to river mile 9.4 is listed for sedimentation, based on a single sample collected in 1999.

The Breitenbush is a domestic water supply, considered to be of high quality and value to the Breitenbush Community and City of Detroit, downstream of the project area. Wells also supply water to the Humbug, Cleator Bend and Breitenbush Campgrounds up river from these municipalities. The City of Salem uses the North Santiam River below Detroit Dam as its primary public water drinking water supply. The Breitenbush River is a major tributary of the North Santiam River contributing to Salem’s municipal water supply.

Stream Shade and Temperature

Past harvest near stream channels increased solar radiation inputs and caused subsequent increases in thermal loading of streams. Past harvest has affected approximately 67% of the Riparian Reserve network within the project area. Past harvest practices involved removal of all vegetation. Increased water temperature resulted until such time that shade recovered with regrowth on the site. Today, much of the streamside shade in the previously harvested units of this project area is currently functioning in early to mid-seral vegetation conditions. Many of these areas are now light limited due to closed canopies and primary production in steams may be limited by light exclusion.

Existing condition for temperature in the project area varies widely, attributable to differences in geomorphology, stream channel orientation, and position in the landscape. Stream temperature data were collected at 10 locations in the project area during the summer months (June through September). The data were collected for a minimum of two seasons with a maximum of 10 seasons. A summary of the data for the Breitenbush Watershed is provided in the hydrology report. Changes in the range of maximum temperatures from one water year to the next are attributable to inter-annual differences in precipitation and stream flows. Region-wide low winter snowpack and spring rains in the 2015 water year led to low stream flows and subsequent increased stream temperatures, for many streams. The annual timing of the maximum temperature occurred between July and August in all instances. This suggests that any past management impacted only the increased value for maximum temperature and has not affected inter-annual variability or annual timing of peak temperatures.

No streams in the Breitenbush Watershed and Hwy 46 project area are currently have been listed as a “303d” water quality limited water body for stream temperature. However, the Willamette National Forest does still follow the guidance of the Willamette TMDL Water Quality Restoration Plan (2008) and Northwest Forest Plan Temperature TMDL Implementation Strategies (2012) to protect stream shade and improve stream temperatures in the Willamette Basin.

Sedimentation

Existing sources of sedimentation in streams include hillslope erosion, mass wasting, and road-related erosion. The stability of hillslopes and stream channel banks are closely tied to the water quality of the project area. The majority of the geologic terrain and soils within the Hwy 46 proposed treatment units are not inherently prone to extensive erosion due to high infiltration limiting overland flow unless disturbed as discussed in the Soils Specialist Report (located in the project file). Past timber harvest methods resulted in compaction levels varying from 12 to 16% for most of the units of harvested with ground based logging systems. However, four units exceeded the 20% maximum allowed by the Forest Standards and Guidelines (Soils Specialist Report). With increasing levels of compaction, there is an increased risk of surface erosion due to greater overland flow and less infiltration.

Unstable land types were considered when designing the boundaries of the treatment units and buffers. Stream channels generally transport mobilized sediments into the Detroit Reservoir where the majority settles out. However, fine clay particles can persist as turbid waters in the Breitenbush River. Intensive studies in the late 1990s on suspended sediment and turbidity in the Breitenbush River were conducted by the US Geological Survey, the Forest Service, the Pacific Northwest Research Station, State University researchers and Washington D.C.'s General Accounting Office. The joint effort found hydrated clays (smectite) originating from the toes of earthflows and older and weathered Miocene and Oligocene period basalt and andesitic lithologies in the East Humbug, Short, and Mansfield Creeks to be the main source of sediment and turbidity (Uhrich & Bragg 2003). During larger flood events, these suspended sediments can persist in the river past Detroit Dam down to the Pacific Ocean. The 2016 water year in particular was marked by a noticeable increase in turbidity in Short Creek (Figure 32) and Cultus Creek, both contributing the Breitenbush River and further downstream. Field reconnaissance by the Soils Scientist confirmed the re-activation of the Short Creek slump and a subsequent massive debris flow that will continue to contribute fine sediments downstream in future years. The numerous slope failures in this area of Short Creek recently and over the last 150 years are deemed naturally occurring, as no active land management has occurred in that area (Shank, 2013). Additionally in early 2016, another new slide occurred in the watershed contributing considerable turbidity to Breitenbush River. Field reconnaissance by the Soils Scientist also found the turbidity source of landslide activity in the upper Cultus Creek drainage, encompassing about 5 acres of hillslope. Analysis of past aerial photos indicated that this area had a history of instability and timber harvest (Shank, 2016). Both of these recent slides are anticipated to deliver sediment downstream and contribute to turbidity over the next decade or more.

Figure 32 Recent Short Creek debris flow, about mid-way up. Photo by J. Sheahan Alonso, 5/27/2016

Road-stream crossings can also provide direct contact with the channel and direct pathways for sediment movement to stream channels. Road crossing failures and streams running down earthflows or slumps cause pulses of sediment that move downstream and eventually reach mainstem channels and the Detroit Reservoir. Poorly designed placement of roads historically and limited maintenance of a few roads, has led to road-related sediment delivery due to inadequate drainage spacing or blocked culverts and subsequent concentration of runoff and road surface erosion. Road maintenance reduces the risk associated with these crossings by cleaning the inlets and preventing crossing failures. Road maintenance is a high priority for management located in the East Humbug, Short, Mansfield and Devils Creek drainages.

Since implementation of the Forest Plan in 1990, road maintenance activities have worked to eliminate many of these unstable fill situations. Even so, roads continue to be a large source of human-caused sedimentation in the project area. A few old roads still carry water during winter storm events essentially extending the stream system and occasionally diverting flow from natural stream channels. Additional impacts to streams within the project area include failing culverts and displacement from steep road headwalls. Road densities over 3.5 miles of road per square mile are considered “Not Properly Functioning” (FEMAT 1993). Sub-watershed road densities in the project area range from 1.70 to 5.15 miles per square mile. The Lower Breitenbush River Sub-watershed exceeds the threshold for properly functioning, but only 1% of the sub-watershed is within the Hwy 46 Project Area.

Table 27 Road Densities by Sub-watershed

Sub-watershed	Acres	Square Miles	Percent of Sub-watershed in Planning Area	Road Density (mi/mi^2)
Upper Breitenbush River	20,395	31.87	96%	3.42
South Fork Breitenbush River	13,082	20.44	32%	1.35
North Fork Breitenbush River	16,255	25.40	46%	1.70
Lower Breitenbush River	9,203	14.38	1%	5.15

The GRAIP-lite tool in the NetMap roads GIS toolset was also used to analyze road sediment production and delivery to streams. Estimated sediment from the GRAIP-lite model for existing roads in the Hwy 46 project area and haul roads extending out of the project area is approximately 95 cubic yards of sediment delivered to streams per year. In comparison, the 1999-2000 USGS study of turbidity and suspended sediment estimated an annual load of 20,100 tons for Breitenbush River (Uhrich & Bragg, 2003).

3.3.4 Environmental Consequences

Unless otherwise noted, the geographic scale used to assess direct, indirect and cumulative effects for aquatic resources includes the project activity units, the project area and the Upper Breitenbush, South Fork Breitenbush and North Fork Breitenbush sub-watersheds.

Direct and Indirect Effects

Stream Flows/Disturbance

Alternative 1 – No Action

Implementation of the no action alternative would maintain managed timber stands that do not have a live crown ratio (percent of the tree with limbs) sufficient to reach full potential across the landscape, including riparian areas. The stands would experience reduced growth rates due to competition as transpiration rates decrease due to loss of canopy crown diameters. This could result in potential increase in summer flows due to the decline in the stands ability to utilize available water. There is a higher likelihood of reduced tree health, which limits the ability of tree crowns to intercept and hold snow increasing the risk for tree damage and breakage by snow load accumulation. Infiltration rates would also be affected by the loss of canopy and the drip that occurs from snow interception. Reduced canopies are more exposed to latent heat transfer and rapid snow loss, which reduces the contact time the water stored in the snow, has with the soil (Harr, 1981). However, changes in surface flows would be very small and immeasurable. With ARP values projected to remain well above Midpoint, Alternative 1, No Action, would result in no changes to existing peak flows based on vegetation removal. However, lack of density reduction and fuel treatments of overstocked stands would retain an increased risk of high severity wildfire or disease outbreaks. High severity wildfire or disease outbreaks on the watershed level would have the potential to increase peak flows in the 3 to 5 year period following the event.

The meadow in Unit 32a would not be treated for restoration. Lack of treatment would result in continued growth of existing trees and encroachment of younger conifers. Subsequent reduction in available light from shading and water from increased evapotranspiration to herbaceous meadow species would further the loss of the meadow habitat. Over time in the absence of treatment or natural disturbance, the meadow would successionally advance to a forested condition all together.

The no action alternative would maintain the effects of past artificial disturbance mechanisms, road crossings, and associated ground disturbances. Several miles of roads are in poor condition and funnel water to stream crossings or into alternative drainages. Road maintenance activities that prevent the road prisms from becoming sediment sources would largely be deferred. Without maintenance, road drainage facilities such as culverts would continue to degrade the natural hydrology near road systems within the project area. At the fifth field watershed scale, hydrological effects are anticipated to remain within the existing natural range of variability.

Alternative 2

Under Alternative 2, thinning stands would change the hydrology by reducing competition for light, water, and nutrients in the thinned stands. There would be increased snow accumulation on the thinned acres, roads and landings. A short-term (5 to 10 years) increase in discharge during the wet and the dry periods would occur as a result of thinning. Increased snow accumulation (wet period) would create small increases in peak flows (Jones, and Grant, 2001), and reduced canopy (dry periods) would reduce transpiration rates which could account for small increases in summer flows. These potential changes in discharge and peak flow are not likely to create detrimental effects and would likely be immeasurable due to the limited spatial extent and type of thinning treatment (Pike and Scherer 2003).

Early seral habitat creation, gaps, shelterwood cut, and meadow restoration activities have greater reductions in canopy closure than thinning. Effects of canopy closure reduction include: reduced interception and transpiration, increased snow accumulation, runoff associated with rain-on-snow and water storage, and increased availability of water and nutrients for remaining trees and other vegetation.

Under Alternative 2, meadow restoration in Unit 32a would remove encroaching conifers to enhance habitat for wet meadow vegetation species, pollinators and wildlife. Approximately 3 to 5 trees per acre would be retained, along with the largest relic trees. Opening of the canopy would reduce canopy interception of precipitation, retain snowpack longer into the spring, and reduce evapotranspiration from shallow groundwater, leading to increased storage and duration of available shallow groundwater to support meadow vegetation. The resulting hydrology of the meadow is anticipated to be characteristic of seasonally saturated herbaceous slope wetland with increased saturation of soils from precipitation and snowmelt and decreased transpiration loss. A small intermittent stream channel near the middle bottom of the unit would correspondingly also experience longer duration stream flow, though it would still remain intermittent. Channel stability of the intermittent stream is not expected to change as portions of the stream where the channel becomes incised are buffered from tree removal and runoff is anticipated to be muted by increased storage.

Understory Habitat Enhancement treatment in units 54, 82, 89, 92, and 560 would thin conifers less than 7 inches dbh to reduce shading of ground vegetation. Felling will be done by hand, no material would be removed from site, and there will be no overstory removal. Therefore, no hydrological effects are anticipated from this treatment.

Instability, displacement, compaction, and nutrient loss are the main soils and geology impacts with potential to affect hydrology in the project area. Hydrology effects from these vary with the most important being the movement of water through subsurface and surface zones. Any change in the characteristics of these zones could influence the rate and ability of the water to enter the shallow water table. Use of design elements during implementation would either avoid or minimize effects to soil to keep them below thresholds established in the Forest Plan, in this case, less than 20% of a treatment area. Correspondingly, subsequent effects on hydrology would be localized and not readily apparent when scaled to the watershed area.

To prevent subsurface flow from surfacing in swales by ground based thinning and piling activities, pre-bunched log piles would be staged at least 50 feet away from ephemeral swales and channels. Any crossings with ground based equipment would be perpendicular to stream channels and swales as designated. Under Alternative 2, 16 ground based crossings of have been identified to facilitate removal of wood from treated areas. These crossings would cross small intermittent streams, no perennial streams would be skidded across. Temporary placement of bunk logs and slash will be utilized to facilitate skidding of logs without doing damage to stream banks and channel bottoms. This work will be done in the dry season when there is no or reduced flow in these channels and all logs and slash will be removed from channels prior to the next wet season. From the intermittent crossing locations, there may be a small flush of fine sediment (1/2 cubic yard or less) during the first winter flow after treatments have occurred, but due to the amounts of slash following harvest, the effect would be localized with downstream sediment movement staying under 100 feet from each crossing.

Skid trails, landings, yarding corridors and roads serve as compacted surfaces, locally reducing soil water infiltration and increasing surface runoff and downslope erosion potential. As the Soils report specifies, new road construction and re-opening of temporary spur roads would marginally increase road densities in the short-term. This would be a slightly greater increase for Alternative 2. Decommissioning of an additional 1.99 miles of road in this project would marginally decrease (less than 1%) sub-watershed densities in comparison to the No Action alternative.

Following harvest, most commercially thinned units will be underburned to treat slash and reduce fuel loading. Fire intensities will vary with fuel loading within the units, but could reach high intensities. Loss of vegetation, in addition to timber harvest can decrease precipitation interception and increase runoff. With acceptable mortality in overstory trees of 0-10% from, overstory canopy closure could be reduced slightly more than just reductions from the thinning treatment alone. In the sugar pine treatment stands where a more open canopy is part of the objective, overstory mortality could be higher (5-15%). Understory and ground cover vegetation will be reduced immediately but will grow back quickly in the near-term. With duff retention standards in place, underburning will have minor effects to soils. A mosaic-like effect of reduced understory vegetation and duff on the forest floor is anticipated. Ignition of the underburns would take place outside of Riparian Reserves, providing some buffer of undisturbed ground cover between the burned areas and the streams. In considering the negligible to minor effects of underburning to canopy closure, understory cover, and soils condition, is not likely that changes to hydrological processes of interception and runoff would be measurable nor would they create detrimental effects (Pike and Scherer 2003). Effects to runoff would be similar for hazardous fuels reduction treatment. No effects to runoff are anticipated from pile burning treatments due to the low acreage of affected ground.

Stream flow changes anticipated are well within the variation of normal flows and should not generate a condition that the channel has not responded to through time. Short-term changes may be evident in the time of peak and the duration of flow throughout the year due to changes in transpiration rates and routing of flows. These changes are short lived until such time that the stand closes canopy and utilizes the available water for the site. With the area’s recovery percentage currently above the threshold, and a less than 3% expected reduction in the ARP level is expected if either action alternative is chosen, these effects would be immeasurable and are therefore not anticipated to be adverse.

Table 28 Aggregate Recovery Percentages by Sub-watershed

Sub-watershed	Sub-watershed Acres	Average* Threshold of Concern % (midpoint ARP)	Year	Alt 1 (No Action)	Alt 2	Alt 3
Upper Breitenbush	20,395	74.3	2016	79.89	76.92	77.19
			2020	78.88	76.08	76.17
North Fork Breitenbush	16,254	75	2016	87.12	85.07	84.88
			2020	85.39	83.56	83.38
South Fork Breitenbush	13,082	73	2016	89.33	87.35	87.35
			2020	88.04	86.07	86.07

* Midpoint ARP was originally calculated for subdrainages as part of the 1990 Willamette National Forest Plan. Under the subdrainage classification, the Upper Breitenbush split as the "Middle Breitenbush" and "Devil's Creek" subdrainages. The average midpoint ARP was calculated from the subdrainages that fall within each sub-watershed.

**While the total area of the North Fork Breitenbush sub-watershed is 16,254 acres, only 10,935 acres are actually within Forest Service boundaries and have an available existing vegetation layer. The percent of watershed was calculated using the 10,935 acres for which data was available.

In conclusion, variably thinning stands and local disturbances by proposed project activities are anticipated to cause small scale, minor changes well within the natural range of hydrological variability. Due to the design elements that avoid or limit impacts, implementing this project is expected to produce little, if any effect to the hydrology of the project area under Alternative 2.

Alternative 3

Compared to Alternative 2, Alternative 3 treats almost 500 fewer acres, does not commercially thin in fire regenerated stands, and does not restore the meadow in Unit 32a. Alternative 3 has less ground compaction and disturbance from reduced harvest acreage and a slightly lower road density during implementation than Alternative 2. Post-implementation road densities would be the same for Alternative 2 and 3, which are slightly lower than Alternative 1 due to decommissioning of 1.99 miles of road. ARP percentages would be equal to Alternative 2 for the South Fork Breitenbush sub-watershed, and within 0.2% for the Upper Breitenbush and North Fork sub-watersheds. Given similar or less impacts as compared to Alternative 2 and use of the same design elements, the effects of Alternative 3 are similarly expected to produce little, if any effects to the hydrology of the project area.

Riparian Conditions

Alternative 1 – No Action

Under the no action alternative, riparian conditions would develop the characteristics of structure, openings and down wood naturally over time (decades) and would maintain a higher overstory canopy cover than the action alternatives in the near term. A higher canopy cover prohibits sunlight to penetrate lower canopy levels and the forest floor. It suppresses the vigor and growth of individual large trees, vegetation development in the understory and future recruitment of structural wood in stream channels. Reduced vigor occurs due to the increased competition and damage that may occur from snow or insects. Higher canopies naturally break open over the long term (>100 years) when lower canopy development is anticipated to recover.

Future recruitment of large trees in stream channels is an integral component of riparian diversity, quality aquatic habitat and structural integrity. Current rates of large wood recruitment, provided mostly by stem mortality (from competition, disease, wind and snow downed trees) and bank erosion, would be maintained. Alternative 1 would provide a slightly higher rate of in-stream wood recruitment compared to the action alternatives. The no action alternative would protect 100% of the wood recruitment zones. In some streams, recruitment trees are of sufficient size to meet ACS Objectives (Appendix E), but in other streams with small diameter riparian stands the aquatic benefit is limited, namely through the reduced ability to store sediment and organic matter and contribute to habitat forming processes (e.g. scour). Though small wood has some value, particularly in the smaller headwater reaches, the longevity of recruited small diameter trees is short-lived, as they break down through abrasion and decomposition more rapidly compared to large trees. Small diameter trees are also more likely to be transported out of the system. In-stream wood abundance is low for most streams in the project area and is largely due to past management, historic flooding, and the lack of large enough sized wood to remain stable in channels.

It is anticipated that the no action alternative would have little effect on the long-term objective to create stand diversity and shade due to the natural growth and the resiliency of the stands to respond to change. However, the rate of change would be slower for stand diversity and complexity development within the short term (<100 years). Desired riparian conditions – high species and structural diversity with large dead and down wood – would slowly develop over time (several decades) and depend solely on natural thinning events (stem exclusion mortality and disturbance). Without management to increase the abundance of deciduous and herbaceous vegetation in dense, conifer-dominant stands, ecosystem productivity would remain at relatively low levels. Accelerated restoration of riparian stands that currently don not meet ACS Objectives would not be accomplished.

In addition, the currently dense riparian stands would be at greater risk to high severity fire, insect infestation, and disease – all carried more efficiently through overstocked stands. Although these are natural disturbance processes that contribute to forest habitat and diversity, a large disturbance event, or one of high severity, has the potential to reduce vegetation, large woody material, and stream shade across large areas of Riparian Reserves. Research conducted in the Pacific Northwest has shown that while fire severity may be lower along perennial streams due to relatively cool and moist conditions, fire severity along intermittent streams can be similar to adjacent upland areas (Tollefson 2004). In fact, under some circumstances, riparian areas can become corridors of increased fire spread (Pettit 2007).

Alternative 2

The Northwest Forest Plan (NWFP) prohibits timber harvest in Riparian Reserves except as needed to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain ACS Objectives (NWFP Standards and Guides, TM-1(c)). Riparian reserves make up approximately 36% of the area within the proposed units (1,447 acres). Landscape and stream reach assessments, coupled with field reconnaissance, indicate that current conditions of the Riparian Reserves on the watershed scale are outside the natural range of variability, with many areas are not meeting desired vegetation characteristics needed to attain ACS Objectives. Of 1,447 acres of Riparian Reserve within the proposed units, 972 acres (68%) have been harvested in the past as plantations. Approximately 454 acres are fire regenerated and have not been managed, though most of these are in similar condition to past regeneration harvested Riparian Reserves due to stand replacing fires around the turn of the century. Therefore, there is a need to manage parts of the Riparian Reserves to accelerate attainment of desired conditions. Other areas, however, are currently meeting desired vegetation characteristics and management is not necessary. In some cases, maintaining and/or restoring each one of the ACS Objectives can be a balancing act with trade-offs. For example, to meet the riparian vegetation objectives ("species composition and structural diversity of plant communities" and "habitat to support well distributed populations of native plant, invertebrate and vertebrate riparian dependent species") in young, dense conifer stands, a common silvicultural tool is to remove overstory density to encourage understory growth and structural development. Removal of overstory density, however, could potentially lead to increased thermal loading or reduction of wood volume available for recruitment. Because of these trade-offs, we carefully balance conflicting objectives based on characteristics of each waterbody and adjacent riparian area.

Alternative 2 proposes both active and passive management of Riparian Reserves: thinning, gap creation, down wood augmentation, and no treatment. Within Riparian Reserves, stand-specific treatments were prescribed by the Silviculturist in consultation with the District Hydrologist and Fish Biologist and are listed in the Design Elements in Chapter 2. Stand treatments promote variable density within and among stands, including Riparian Reserves, by leaving skips, varying thinning intensities, and introducing gaps in selected stands (see the Silviculture Report). Unit design elements developed by the interdisciplinary team directed the management action and the protection needed to accomplish resource goals.

Within Riparian Reserves, stand treatments under Alternative 2 would be consistent with the Aquatic Conservation Strategy by increasing structural and biological diversity and developing large conifers. Across the landscape, including Riparian Reserves within the Late-Successional Reserve, stands would be on an accelerated trajectory for developing late-successional conditions by developing multiple canopy layers and larger trees. Improvement in stand health would also reduce the likelihood of catastrophic fire that could remove entire portions of the landscape and negatively affect watershed stability and its ability to provide high water quality and fish habitat. Appendix E discusses how Aquatic Conservation Strategy Objectives will be met with the project. Following are descriptions of the types of treatments proposed and the considerations for analysis with each.

Thinning in Riparian Reserves

Under Alternative 2, thinning treatments are proposed for Riparian Reserves to meet the objectives related to this project. Riparian Reserves represent 36% of the 4,046 acres of stands proposed for treatment under Alternative 2. Approximately 771 acres of the 1,447 acres of Riparian Reserves (56%) would be variably thinned to meet project objectives, representing 5.7% of the Riparian Reserves in the Project Area. Thinning intensities would match the prescription for the rest of the unit, and would retain canopy closure well above 50% in all stands. Where riparian areas are developing the needed characteristics naturally, no thinning was prescribed. Riparian Reserves that were found to be achieving or near achieving ACSO's are fully buffered to the first site tree potential height (172 feet).

The body of literature on the effects of thinning on stream and forest ecosystems is quite extensive. The interdisciplinary team considered several key factors in determining where this type of treatment would be beneficial for the attainment of ACS objectives were considered. In-stream wood recruitment, upland down woody material levels, stand structure, and species composition are described below. Stream temperature, sediment, riparian microclimate, and other factors are described in the sections below. Alternative 2 would treat approximately 771 acres within Riparian Reserves. Appendix G details where treatments are proposed within Riparian Reserves and the vegetation objectives for each unit in Alternative 2 and 3.

<u>Stand Structure and Species Composition</u>

Based on a review of existing literature and stand development theory, Spies et al. (2013) found that the "greatest potential ecological benefits of thinning to accelerate the development of older forest structure (e.g. large trees, large dead trees, spatial structure and compositional heterogeneity, etc.) come in dense uniform plantations less than 80 years and especially less than 50 years old." The benefits of thinning in stands over 80 years old are more variable. Stand conditions were reviewed for each waterbody and recommendations were based on multiple variables, not just age. These factors included tree height and diameter, stand density, species composition, and understory development.

Most stands where thinning would occur within Riparian Reserves are under 80 years old (73%), however, 183 acres of Riparian Reserves in stands aged over 80 years old would be treated in Alternative 2. Appendix G provides a detailed description of Riparian Reserve treatments by unit, including rationale for treatment, the no-harvest buffer widths, and stand age. Where thinning is proposed within Riparian Reserves, increases in abundance of understory vegetation, species diversity, stand structural diversity, and tree growth at a faster rate than background levels are expected. Some modeling has shown that young conifer stands, if left untreated, would follow a trajectory towards forest structure found in certain reference conditions (Pollock et al. 2012); Reference conditions were considered to have mature, late-successional conifer dominated stands with abundant large trees in the overstory, abundant large snags, and a well-developed understory of shade-tolerant trees. However, according to Harrington et al. (2005) thinning tends to increase shrub cover and greatly increase within-stand variability where shrub cover is absent before treatment. Riparian thinning can also promote the development of late successional forest attributes of value to many riparian and upland-associated species (Pabst et al. 2008, Harrington et al. 2005). Based on recent research (Ruzicka et al, 2014), increased tree growth within no-treatment buffers adjacent to thinned stands has been shown to occur. In their study, trees responded to an apparent edge effect up to 15 m (49 feet) downslope of thinned areasand we it expect to have similar beneficial effects within in no-treatment buffers. Because Alternative 2 has more thinning in Riparian Reserves than Alternative 3, 771 and 587 acres respectively the benefits in Alternative 2 would be greater.

In order to add additional structural complexity, vegetative diversity, and habitat diversity to stands, some of the Riparian Reserve stands proposed for thinning also have small gap creation, totaling approximately 2 acres. These small ¼ acre gaps would increase stand diversity and productivity, enhancing terrestrial habitats, which are also a component of the ACS objectives (see Wildlife Section and Appendix E). These gaps are planned primarily outside the Riparian Reserves but may have portions extending into the outer Riparian Reserve beyond the secondary shade zone. Table 29 shows a list of these proposed units.

Table 29 Proposed Wildlife and DTR Gaps within Outer Riparian Reserves for Alternatives 2 and 3

Unit	DTR Gaps in Unit		Approximate Gap Acres in Riparian Reserve
	#	Size	
320	6	¼ acre	0.26
350	2	¼ acre	0.39
380	4	¼ acre	0.64
400	3	¼ acre	0.26
520	6	¼ acre	0.41
Total	21	¼ acre	2.0

<u>In-Stream Wood</u>

In-stream wood is important to the health of aquatic habitats, and many researchers have studied the areas along streams where wood recruitment typically occurs. Wood recruitment zones vary from as little as 8 meters (26 feet) up to about 45 meters (148 feet) depending on various factors (Benda and Bigelow 2014, Spies et al. 2013). According to Benda and Bigelow (2014), wood source areas are highly variable, but are strongly correlated to tree height and the dominant wood recruitment process for each stream reach.

They found that in managed forests of the Cascades Range, where bank erosion and tree mortality are the dominant wood recruitment processes, 90% of in-stream wood originated from within about 8 meters (26 feet) of stream channels and the remaining 10% is supplied from a distance equivalent to one tree height. Figure 33 shows the source distance curves for wood in Benda and Bigelow (2014). In less managed and unmanaged forests, 90% of in-stream wood originated from about 13 meters (43 feet) of stream channels.

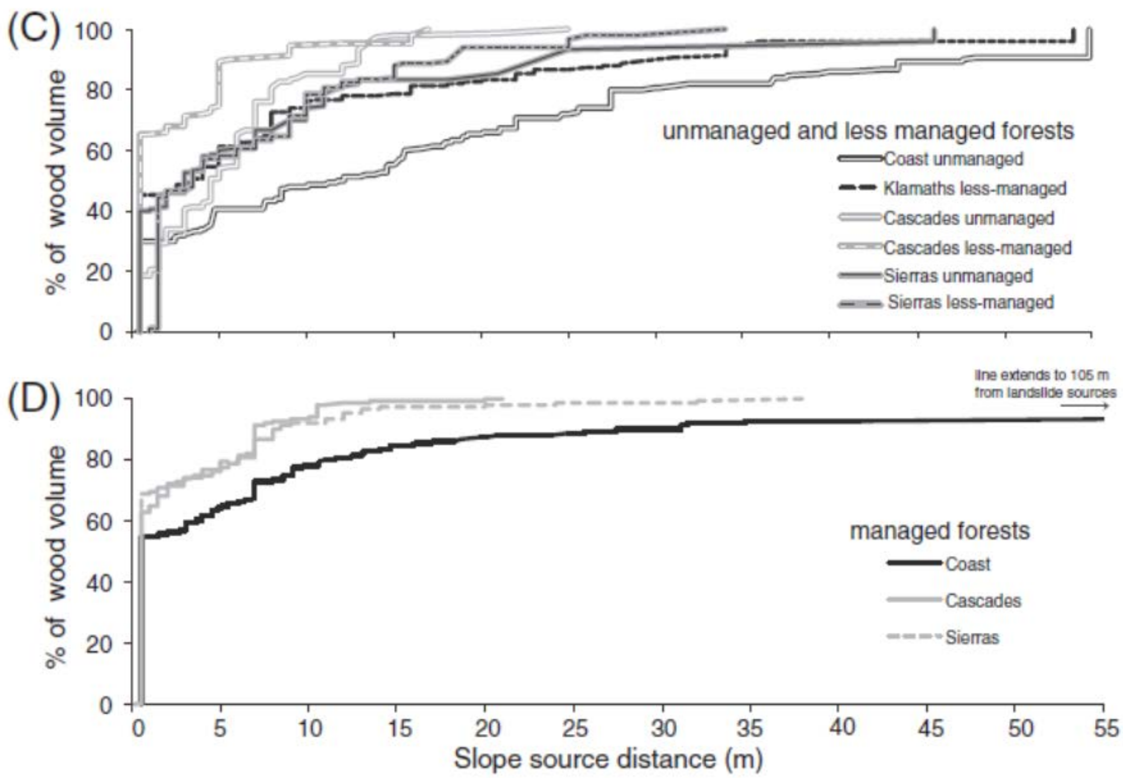

Figure 33 Source Distance Curves for Study Area (Benda and Bigelow 2014)

Meleason et al. (2003) used the simulation model OSU STREAMWOOD to evaluate the potential effects of different riparian thinning scenarios on wood recruitment to streams over time. In one scenario, they modeled the contribution of wood from forest plantations (up to 120 years old in a Douglas-fir – western hemlock forest), beyond no-harvest buffers of varying widths. The results suggest that no-harvest buffers greater than 10 meters (33 feet) from the stream channel contributed minimal amounts of wood volume to streams. In a similar study that modeled effects of no-harvest buffers of 10 meters, as well as effects of single and double entry thinnings with no stream buffer and tree-tipping at various rates, Benda et al (2015) found that a 10-meter buffer maintained 93% of the in-stream wood in comparison to no treatment. This percentage increased and eventually was nullified by tipping up to 12% directly into the streams.

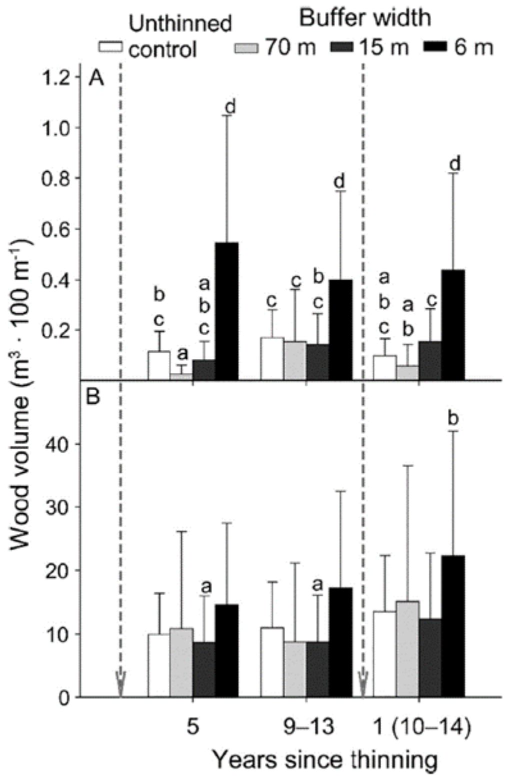

Figure 34 From Burton et al (2016) Effect of wood volume recruitment to small channels by width of no-harvest buffer

In all of the proposed riparian thinning stands, an area near the stream was designated as a no-harvest buffer to protect wood recruitment zone, channel stability and other riparian values. The overall goal for developing wood recruitment zones was to protect 90% of the trees that could potentially be recruited to the stream channel. This level of future wood input is thought to be sufficient to sustain physical complexity and stability required by the ACS Objectives while allowing for treatments to improve vegetation and accelerate the growth of future in-stream wood. This no-harvest buffer ranges in width depending on specific conditions in each unit (i.e. site stability, width and gradient of stream, vegetation characteristics, etc.) and by stream type (i.e. seasonally flowing streams, perennial non-fish bearing streams, and fish bearing streams). Because all perennial waterbodies (Class 1, 2, and 3) have 60-foot minimum shade protection buffers, the wood recruitment zones will also be protected. Based on the research findings, a primary wood recruitment zone of 30 feet from each side of narrow (typically the intermittent class 4) stream channels was defined for young, dense stands within the project area, where bank erosion and tree mortality are the dominant wood recruitment processes and average tree heights range from 56 to 114 feet, with no harvest buffers ranging from 30 feet to 172 feet. Along the wider perennial and fish bearing streams where average tree heights ranged from 70 feet to 114 feet, no-treatment buffers range from 60 feet to 344 feet depending on riparian area conditions.

Given that research has shown that the greatest amount of wood supply comes from 100 feet on either side of perennial stream channels, thinning beyond 60-foot no-treatment buffer (in the secondary shade zone) has some potential to affect large wood supply. Under Alternative 2, future wood recruitment would be affected by thinning within secondary shade zone. Thinning within 30 to 60 feet of intermittent streams would protect 90% of the wood recruitment zone. Thinning outside these buffers has the potential to reduce some intermediate-sized wood recruitment into stream channels. Loss would create an intermediate term, 10 to 30 year, period that intermediate wood would not be recruited into the channel through the natural thinning of the stand. However, due to the height of the trees being thinned (56 to 114 feet), there is a < 5% chance that wood of an appreciable size removed by thinning from outer Riparian Reserves would fall and reach the channel, and most wood supply would still be coming from no-treatment buffers and skips as well as existing sources of large wood within the unmanaged portions of the project area.

No Treatment in Riparian Reserve

Included in Alternative 2, some stands will be left in their current relatively intact condition. The 676 acres of no-treatment portions of the Riparian Reserves were selected where ACSO's are being achieved, are on a close trajectory towards being achieved, or added protection of existing habitats would be needed. These no-treatment areas are either partial buffers within the Reserves or full Riparian Reserves. The Riparian Reserves in all of these units and several others show existing stand and vegetation diversity, sensitive habitat, soil stability issues, temperature sensitivity, or existing quality aquatic habitat so no thinning was recommended within the Riparian Reserves. Information on proposed silvicultural treatments in Riparian Reserves, or non-treatment, can be found in Appendix G.

Streamside Treatments

Several streams were identified during field surveys to have a shortage of large woody material within the channel or floodplain, lack of riparian diversity, and/or opportunity for hardwood release. Selected streams for treatment were chosen for their vegetation characteristics at the subwatershed scale and at the site-specific scale. The large majority of riparian stands along the entire length of the streams in units 6, 100, 190, 430, and 520 are dense plantations lacking structural and species diversity. In these five young plantation units, fall and leave treatment would occur in approximately 20 to 75% of the units' no-harvest buffers along approximately 3.2 miles of streams to reduce densities, open the canopies, increase growth and vigor of remaining trees, and add medium to large wood to forest floor and stream channels (Table 12, page 48). Due to the evidence of historic debris flows through Unit 430, this unit was identified specifically as having a high potential for large wood recruitment via an intermittent stream channel downstream less than ¼ mile to the North Fork Breitenbush River. This very dense monoculture stand has evidence of historical debris flows, with a high potential to serve as source of large wood downstream. Stream habitat in the North Fork Breitenbush River is largely lacking in large wood and this passive treatment would contribute to its restoration. Treatment would entail falling and leaving individual trees scattered along the riparian area or small groups of trees. The integration of directionally falling trees into the stream along with no-harvest buffers in thinned units increases the recruitment of large wood instream on the site scale (Benda et al, 2015) but due to the conservative number of miles proposed for streamside treatment, this is negligible on the watershed scale.

Approximately 4 acres of small near-stream gaps are proposed within units 100, 190, and 520 (Table 12 in chapter 2, page 48). There are several objectives for these treatments including increased light availability for primary productivity and increased deciduous vegetation for allochthonous material (decomposition of organic matter imported from outside the stream). Historic timber harvest and dense conifer revegetation in the project area have resulted in a lack of deciduous vegetation along many streams. Homogenous conifer stands near streams such as these have been shown to impact the food supply and thus the lifecycle of macro-invertebrates (Hoover 2011). In converse, mature and old-growth stands exhibit a mixture of heterotrophic (shaded) and autotrophic (lighted) habitats within stream reaches (Stovall 2009, Warren 2013).

Research and field surveys indicate that near-stream gaps may be appropriate in certain situations:

- drainages with dense conifer canopy (i.e. plantations) where stream productivity may be relatively low
- lower gradient reaches (<10%) that have higher potential to retain and process organic inputs
- streams tightly coupled to biological hotspots
- streams with low sensitivity to thermal loading and erosion
- riparian areas within plant associations that should have a hardwood/deciduous component

Small near-stream gaps would increase light availability to streams by 20 to 30% to increase primary productivity and increase the hardwood component in order to begin to emulate old-growth characteristics. Canopy gaps have been shown to play a major role in providing light to streams within old growth stands and is significantly higher in those reaches than within younger (~60 years old) closed canopy stands (Warren 2013). Some removal of trees out of the gaps may be required in order to allow regeneration of early serial species. However, these trees would be left in the Riparian Reserves for large woody material. Monitoring will be an integral component of this project. All of the proposed near-stream gaps are within young plantations <60 years old.

Other Treatments

Prescribed Fire

Within some of the commercial thinning units and all of the hazardous fuels reduction units, the introduction of low severity fire into patches of Riparian Reserves is anticipated. Fire would be allowed to back into the Reserves and burn in a mosaic pattern rather than requiring a fire line around the Reserves which would potentially result in erosion. At low burn severities, large wood would not be removed from the Reserves. In addition with local differences in soil moisture and relative humidity, the pattern of burning in the Riparian Reserves is expected to resemble a patchwork mosaic of unburned and lightly burned sites. In the unburned portions, the existing understory vegetation, including conifers, would be retained. In lightly burned areas, understory conifers would experience some mortality, but fire adapted species such as willow and other hardwood shrubs would re-sprout and, in some instances, be stimulated into increased growth in response to the disturbance. The net result would be increased plant species and stand structural diversity, with a closer resemblance to historic stand condition than non-thinned plantations. Up to 175 acres of Riparian Reserve in commercial thinning units and 49 acres in hazardous fuels treatment units could be affected under Alternative 2.

Temporary Roads and Landings

Wherever possible, temporary roads would be located on ridge tops, gentle slopes, or would utilize locations previously disturbed by historic logging. Those segments located within the Riparian Reserves would be located well outside of the primary shade zone (approximately 60 to 80 feet) and cross perpendicular to the stream where necessary. Two temporary road stream crossings are proposed on class 3 perennial streams (Units 62 and 64). Crossing locations would be approved by hydrology/fisheries staff during layout and would have temporary culverts installed and removed following harvest.

Operations will minimize the number of landings in Riparian Reserves will be minimized by restricting landings to existing roadbeds wherever possible and locating them a minimum of 100 feet away from any streams. Up to 15 new landings in Riparian Reserves could be located off the existing road prism in addition to the estimated 137 that would be on existing disturbed ground. The maximum effect of new disturbance from temporary roads and landings in Riparian Reserves is approximately 6 acres. Sixteen ground based skid trail stream crossings are proposed to access portions of units. Impacts to large wood are expected to be similar to those of thinning treatments. Typical rates of re-vegetation start occurring within 2 decades from natural regeneration if the disturbed area is not replanted. All temporary roads and landings in Riparian Reserves would be decommissioned after treatment activities are completed following BMP's and additional design elements, including removal of any temporary crossings, sub-soilng the approaches and spreading slash over sub-soiled areas.

Rock Pits

Under Alternative 2, nearby rock sources are needed for use to upgrade roads to hauling standards. Of the nine pits that are proposed to be used for material, only one (Lower Skunk) is located within the Riparian Reserve. Any expansion, additional development, or reclamation of Lower Skunk Pit would occur outside of the Riparian Reserve and be assessed in a separate analysis with development of a Pit Plan.

Alternative 3

Alternative 3 proposes, to treat 587 acres of Riparian Reserve. Effects to riparian conditions would be similar to Alternative 2 with the exception that 184 less acres would be treated. No Riparian Reserves that have stand ages greater than 80 years old would be treated, including meadow restoration in Unit 32a, leaving these reserves remaining in current condition and on a slower trajectory towards achieving ACSO's. Alternative 3 offers a greater opportunity to improve ACSO's in Riparian Reserves on the watershed scale than Alternative 1, but less opportunity than Alternative 2.

Thinning in Riparian Reserves

Approximately 567 acres of Riparian Reserve would be thinned under Alternative 3, with thinning in plantations only (no thinning in fire-regenerated stands). Approximately 184 less acres of Riparian Reserve treatment would occur under Alternative 3. The effects of thinning in Riparian Reserves would be similar to Alternative 2, though with less acres affected. The effects of not thinning the additional 184 acres of Riparian Reserve would represent a 0.7% difference on the watershed scale.

No Treatment in Riparian Reserve

As with Alternative 2, Alternative 3 proposes to leave 480 acres of fire regenerated stands untreated given that ACSOs are either being achieved or are on a trajectory towards being achieved, or additional protection of existing habitats was needed with similar effects as discussed for Alternative 2.

Streamside Treatments

Under Alternative 3, streamside treatments would remain the same as Alternative 2 and have similar effects.

Other Treatments

Prescribed Fire

Post-harvest underburning treatment would occur in 525 fewer acres across units and 50 fewer Riparian Reserve acres under Alternative 3. The number of acres of Riparian Reserve affected by Hazardous Fuels Reduction treatments would remain the same. Effects would be similar as Alternative 2 with slightly less acres treated.

Temporary Roads

Alternative 3 would have about 1.2 miles of temporary roads and up to 15 new landings off-the-existing-road-prism in Riparian Reserves. Distrubance from temporary roads and new landings would amount to approximately 5.5 acres of disturbance, slightly less than Alternative 2. The number of temporary crossings for ground based skidding and hauling would be the same as Alternative 2. Design elements for landings and temporary roads would be the same for both alternatives.

Rock Pits

Use of rock pits and subsequent effects to Riparian Reserves are the same as Alternative 2.

Stream Shade and Temperature

Alternative 1 – No Action

Activities that affect stream-shading vegetation would not occur, and direct, indirect, or cumulative effects of this alternative on stream temperature are not anticipated. Water temperatures in streams in the project area would continue to recover toward more natural levels as riparian vegetation that was disturbed or removed by management activities prior to implementation of the Northwest Forest Plan re-grows and re-establishes streamside shade. No indirect or cumulative effects on stream temperatures due to implementation of this alternative are anticipated.

However, with the increased risk of high severity wildfire, which is carried more easily through dense stands, this may affect water quality in the future. The corresponding loss of vegetation and duff may affect temperatures and microclimates around the edges of the streams and wetlands. Most of the streams and seasonal wet meadows go dry during the summer when temperatures are typically an issue. So increased stream temperature at the current vegetation conditions or after a high-severity fire is not expected in most of the class 4 streams in the project area. Microclimates, however, would be affected after a high-severity fire.

Alternative 2

The system of Riparian Reserves under the ACS provides zones around streams, wetlands, and water bodies that contribute to protecting or restoring the physical, chemical, and biological integrity of these waters, which is the major goal of the Clean Water Act. For all action alternatives, treatments within riparian areas have been designed to comply with the “Northwest Forest Plan Temperature TMDL Implementation Strategies – Evaluation of the adequacy of the Northwest Forest Plan Riparian Reserves to achieve and maintain stream temperature water quality standards” (TMDL 2012).

The Strategies outline how stream shade can be protected to prevent solar radiation from heating streams, providing calculations for determining the effective stream shading based on tree height, bank/hill slope, aspect and location. At a minimum, the Strategies prescribe no-thin buffers to protect stream shade within the primary shade zone, the riparian area adjacent to perennial stream channels that provides stream shade for the period of greatest solar loading. The secondary shade zone, which provides shade in the morning and afternoon, and also located within the first site potential tree may have some thinning allowed up to 50% canopy closure that does not result in any loss of stream shading. For an even-aged site with 60-100 foot tall trees, the approximate primary shade zone ranges from 50-60 feet depending on and increasing with slope. This varies with stream width, aspect, and location. To comply with the stream temperature standards, no-harvest buffers were developed to eliminate management effects. These buffers were developed based in part by calculating the width of primary and secondary shade zones.

Research has shown that in many cases significant changes in stream temperature are not observed with partial no-harvest buffers within the Riparian Reserve width (Levno and Rothacher 1967, Brown and Krygier 1970, Swift and Messer 1971, Macdonald et al. 2003). In several cases, buffer distances less than one site potential tree have been shown to protect water temperature. Typically the primary shade zone is half of the site potential tree height. Gomi et al. (2006) reported maximum daily temperatures in headwater streams did not increase significantly when 30- and 90-foot buffers were applied.

Intermittent (Class 4) streams are dry during the portion of the year when elevated temperatures occur and therefore temperature is not as significant an issue. However, no-harvest buffers of 30 feet which were designed for other resource objectives would provide substantial shade regardless. Much of the stream-influenced microclimate would also be preserved since the gradients are strongest within the first 20-30 feet (Anderson 2007) and a portion of the canopy cover throughout the rest of the Riparian Reserve would be maintained. In all of the units with proposed thinning in Riparian Reserves, conifer densities are high and would benefit from thinning.

No-harvest buffers on Class 3 streams have varying widths developed in part to accelerate species and structural diversity while protecting effective shade. All of the Class 3 streams within the proposed harvest units have a minimum 60-foot no-harvest buffer to retain effective stream shade and terrestrial microclimates (Anderson 2007). It should be noted that "no-harvest" and "no-treatment" differ, whereas in a "no-harvest" buffer, trees may not be commercially cut and milled, but may be cut and felled for other purposes – such as for streamside restoration treatment where specified and stream crossings/equipment access. A "no-treatment" buffer would not have any trees cut or any other active management treatment within the buffered area and includes no-harvest buffers. The majority of perennial streams (Class 1 and 2) are protected with a minimum of a 100-foot no-harvest buffer to retain effective stream shade. Where thermal loading, soil stability, desired stand characteristics, etc. are present; no-harvest buffers are wider to meet ACS objectives. Within the no-harvest buffer of units with streamside treatment (Units 6, 100, 190, 430, and 520) up to 20 acres would have fall and leave thinning and small gaps within the primary shade zone (See Table 10, page 46). The current canopy cover for the proposed streamside treatment units is 80-90%. Gaps would be placed and thinning treatments heavier on the north and east sides of the channels where solar radiation is less.

The meadow restoration in Unit 32a would occur under this alternative, however the Class 4 stream associated with the meadow is currently dry by early summer. Any increased duration of streamflow associated with the treatment, decreased evapotranspiration, and increased groundwater storage would be minimal and not affect downstream water temperatures.

Small openings in old growth stands are common; and localized warming as a result of the proposed gaps are expected to result in similar conditions remaining within the range of natural variability (Warren 2013). Most studies relevant to shade recovery after clear-cut and other "heavy" harvests predict substantial return to pre-harvest levels within 5 to 7 years of treatment (Brown 1970; Feller 1981; Harr 1988). These recovery predictions assume the rapid return of bankside understory vegetation, because canopy shade provided by second-growth forests will require 10 to 20 years (Beschta 1987, Johnson 2000). Canopy openings in these gaps would likewise be transitory and revegetate quickly. In addition to protection for excessive thermal loading, the proposed gaps are in streams flowing through locations where hyporheic exchange can provide additional offsets to warming.

There are sixteen proposed temporary stream crossings as part of Alternative 2 for ground-based equipment to skid logs across to landings. All of these would cross intermittent Class 4 streams (Units 5, 24, 44 62, 64, 110, 220, 470, and 520); No perennial streams would be used for ground-based crossings. Class 4 streams are dry during the summer when water temperature is typically a concern. Historic skid roads will be used where possible. This would allow for already compacted areas to be re-used then properly sub-soiled and re-vegetated in order to reduce overall compaction levels. Based on implementation of the design elements outlined in Chapter 2, which reduce the acres of disturbance due to temporary roads and skid trails as well as field observations during project reconnaissance; a minimal direct effect is anticipated at a localized level within a few feet downstream of the temporary road crossings. No landings would be located in the primary shade zone of streams (approximately 60 -80 feet), though up to 15 new landings encompassing approximately 5 acres total would potentially be located in the secondary shade zones a minimum of 100 feet from the stream channel.

Additionally two perennial stream crossings are proposed in Units 62 and 64 for temporary roads used to haul logs from landings. At the perennial stream crossings, the width of the clearing needed to establish the crossings would not create a detrimental change in temperature or shade because the primary and secondary shade zones of the adjacent riparian area would retain sufficient canopy closure to these narrow streams to provide shade. A few short segments of other temporary roads would enter the outer portion of Riparian Reserves but not cross any streams.

Due to protection of primary and secondary shade zones, water temperatures of streams within the project area would continue to recover toward more natural levels as riparian vegetation re-grows and re-establishes streamside shade. Additionally, many of the treatment units are over-stocked plantations with small diameter riparian trees. Thinning within the secondary shade zone would increase growth of the remaining trees. These treatments would increase the shrub and understory vegetation, which would increase effective shading as well. Small incremental increases in the rate of recovery as a result of implementing Alternative 2 are anticipated to improve conditions over the long term.

Based on implementation of the design elements outlined in Chapter 2 as well as field observations during project reconnaissance; a minimal direct effect is anticipated at a small/localized level only within a few feet downstream of the temporary road crossings. No long-term indirect increases of stream temperature are anticipated within the project area as a result of these alternatives. Incremental increases or a decrease in the rate of recovery as a result of implementation of either action alternative is not anticipated.

Additionally, thinning of dense stands and managing fuel loading helps reduce the risk of high severity wildfire. This in turn reduces the risk of impacts to stream shade, temperature, and microclimate.

Alternative 3

Alternative 3 would have less acres of thinning than Alternative 2, these acres are all outside the primary shade zone and would not have any effect on stream shade and temperature. The meadow restoration in Unit 32a would not occur under this alternative, however the Class 4 stream associated with the meadow is currently dry by early summer. This would not change in this alternative. Overall, the effects to stream shade and temperature are similar to Alternative 2.

Sedimentation and Roads

Alternative 1 – No Action

Rates of road related sediment yield are estimated to remain relatively unchanged under Alternative 1 (No Action). Alternative 1 would not correct existing road erosion problems that result in chronic sedimentation to streams. Landscape delivery of fine sediment, as modified by the road and stream-crossing network, would remain as it is and subject only to scheduled maintenance. Without timber harvest related road maintenance, the existing budgetary trend would result in only the main roads being maintained. Culverts that are not maintained could plug and cause washouts. The resulting sediment plumes could be detrimental to fish and amphibians. Over several decades, these road issues would stabilize as the disturbed areas re-vegetate. However, no project-related storage or decommissioning would occur. Tables 30 and 31 on the following pages provides a comparison of road related sediment delivery to streams between all Alternatives.

Alternative 2

Project activities with potential to affect water quality by increasing sediment delivery to streams are road construction, reconstruction and maintenance, timber haul and log skidding. Road construction can create sediment during pioneering, excavating and development of road prism and placement of crossings. Timber haul can affect sediment delivery when done during wet conditions on non-paved surfaces. Log skidding can create compacted surfaces that create pathways for sediment laden water.

Best Management Practices will be utilized and project design elements are prescribed for each of the following activities to prevent or mitigate these effects.

- No-harvest buffers and equipment exclusion buffers are designated to reduce delivery of sediments generated from harvest practices upslope.
- Trails for log skidding will be designated to prevent flow paths to streams and minimize compaction.
- Road work will be done in the dry season.
- Wet weather haul will be restricted to roads that are structurally sufficient and pre-identified in this project analysis.
- Wet weather haul will occur only during conditions that support proper road use.
- All non-paved roads used for wet weather haul will be rocked with at least 4 inches of aggregate material, with minimum size determined by road slope and proximity to streams.
- On all wet weather haul routes, additional cross-drains leading off onto the forest floor will be constructed approximately 100 feet above stream crossings within 1000 feet of Listed Fish Habitat to minimize direct delivery of road sediments to streams.

Road work associated with the Hwy 46 Project would also include replacement of a number of culverts that are currently in poor condition or inadequately sized to pass 100-year flood flows (Q100). These culverts currently pose an elevated risk of fill failure. Discussions with engineering personnel indicated that an average fill volume is around 250 cubic yards. This material is at risk of entering the streams and potentially generating debris torrents if the existing culverts fail.

However, replacement would require in-stream work in these locations. Work will be done during non-flow periods for intermittent streams, and engineering practices such as sediment barriers and flow bypass would minimize impacts on perennial streams. Flows in perennial streams are expected to be less than 1.0 cubic feet per second when work occurs. Localized effects would occur during the replacement of the culverts and the stream crossings after the first flow and for a limited length downstream. It is not possible to do this work without some sediment delivery, and accurate estimates are not predictable. Depending on weather behavior and other variable factors, sediment yields should fall between 0.5 and 1.5 cubic yards per installation.

Under Alternative 2, approximately 41 stream crossing culverts that are in poor condition or currently undersized would be replaced or upgraded. Table 30 provides a summary of these replacements and the potential amount of fill material that would have a reduced risk of entering streams. It also estimates the amount of sediment produced from the culvert replacements. The maximum estimate of sediment yields from the culvert replacements would be approximately 62 and 54 cubic yards for Alternative 2 and 3, respectively. In comparison, the estimated volume of fill stabilized is 10,250 cubic yards for Alternative 2. Alternative 2 would reduce the long-term potential for runoff effects and culvert failures that may affect Riparian Reserves or water quality to the greatest extent.

Table 30 Approximate Culvert Replacements in Perennial and Intermittent Streams by Alternative

Alternative	Stream Type	Number of Culverts Installed/Replaced/ Removed	Cubic Yards of Fill Stabilized	Sediment Yields from Culvert Replacements (Cubic Yards)
Alternative 1	None	0	0	0
Alternative 2	Perennial	27	6250	13.5 - 41.5
	Intermittent	14	3500	7-21
	Total	41	10,250	20.5 - 61.5
Alternative 3	Perennial	22	5,500	11 - 33
	Intermittent	14	3,500	7 - 21
	Total	36	9,000	18 - 54

An analysis of estimated sediment delivery from roads in the project area was completed using the GRAIP-lite toolset in the NetMap Tools GIS model. The analysis was conducted for each alternative by applying changes in addition of temporary roads, decommissioning of roads, and changes to surface type and road maintenance levels associated with the action alternatives (Table 31). New temporary road construction (5.2 mi), road realignments (0.3), road storage and decommissioning (2.7 mi) and the Short Lake Reroute (0.4 mi) decrease road generated sediment delivery to streams in the project area by 12 cubic yards annually, primarily because of improvements to haul routes (drainage and rocking). The new road construction and reconstructed roads will be graded and up to current standards. In addition to the 16.25 miles of paved roads that would be utilized for wet weather haul, up to 85.4 miles of non-paved roads could be used for wet weather haul; non-paved roads that are used for wet weather haul would meetbe wet weather design specifications, including rocking with four inches of surface rock. Temporary roads used for wet weather haul will also be rocked, though exactly which roads these would be is unknown. As a worst-case scenario, they were all considered native surface in the model input. Wet weather haul will not be permitted on native surface roads.

Table 31 Comparison of GRAIP-lite Modeled Road Sediment Delivery by Alternative

Alternative	Description	Cubic yards of sediment delivered/year
Alternative 1	all existing roads in Hwy 46 + haul routes	95
Alternative 2	Alt 2 Implementation Total	83
	Alt 2 Post sale Total	73
	Alt 2 Total	82
Alternative 3	Alt 3 Implementation Total	82
	Alt 3 Post sale Total	81
	Alt 3 Total	77

Hauling during wet weather conditions would likely lead to road sediment erosion and fine sediment delivery to streams, however, installation of cross-drains approximately 100 feet above stream crossings and rocking the road surface will improve road drainage and minimize sediment delivery to stream channels. Additional cross-drains nor sediment delivery associated with wet versus dry weather hauling based on amount of hauling traffic are not accounted for in this model. No effects are anticipated during dry weather construction, haul and removal when Best Management Practices are used during all operations.

Nearby rock sources are needed for use to upgrade and maintain roads to hauling standards and minimize fine sediment delivery to streams. Nine pits are proposed to be used for material but are generally located well away from streams. The current limits of lower Skunk Pit is located within 100 feet of Skunk Creek, a perennial class 3 stream. Extraction of material from this pit could lead to fine sediment delivery to Skunk Creek, but would be minimized by following BMP's. Any expansion, additional development, or reclamation of Lower Skunk Pit would occur outside of the Riparian Reserve and be assessed in a separate analysis with development of a Pit Plan.

Alternative 3

Thirty-six stream crossing culverts that are currently in poor condition or undersized would be replaced or upgraded (Table 30). The maximum estimate of sediment yields from the culvert replacements would be less than Alternative 2 by approximately 7.5 cubic yards less (54 cubic yards total). However, five culverts that are in need of replacement would not be replaced, with approximately 1,250 cubic yards of fill not stabilized in this Alternative. Alternative 3 would reduce the long-term potential for runoff effects and culvert failures that may affect riparian conditions or water quality but to a lesser extent than Alternative 2.

Fewer miles of new temporary roads and existing spurs would be constructed and re-opened than Alternative 2. There would also be fewer miles of haul routes, and subsequently wet weather haul miles, maintenance/reconstruction, and culvert upgrades than Alternative 2. There would be no difference in number of roads decommissioned or stored, realignments and re-routes, or rock pit use than Alternative 2. Slightly less road-generated sediment would be produced and delivered to streams with Alternative 3 during project implementation (Table 31). However in the mid-to longer term there would be a higher risk of culvert failure and fill release with Alternative 3, because less miles of road would be brought up to standards and fewer culverts upgraded to proper sizing and condition.

Cumulative Effects

The cumulative effects of the proposed project plus the projects listed in the *Past, Present, and Reasonably Foreseeable Actions Relevant to the Cumulative Effects Analysis* (Appendix D) are considered at the local and 6th field subwatershed scale. Effects of a cumulative nature are those effects which independently do not pose a risk to water quality yet, when added together may have some measurable effect on hydrology, riparian conditions or water quality. All recent and planned timber harvest, riparian habitat complexity development, and road improvement and decommissioning projects were and will be designed with similar protection measures, design elements, and Best Management Practices that minimize effects to water quality and aquatic resources.

Alternative 1

Cumulative effects of Alternative 1 would range from no measurable effect to beneficial effects on hydrology, stream channels, water quality, and riparian conditions for approximately 25 years. At that time, stand conditions and large wood recruitment levels could change and would begin to show delayed effects on hydrology, stream channels and water quality. Riparian stand diversity, understory development, and large wood (>36 inch diameter) recruitment in stream channels would be delayed from recovering to desired future conditions. Implementation of the CMLG road drainage improvement project and the North Fork Breitenbush Restoration in the next 5 years would provide some potential improvements to stream flows and water quality; however, an ongoing and longer term lack of road maintenance may cause road drainage structures to fail raising risks to water quality and stream channel routing. Ongoing concerns with road sediment delivery from non FS-system roads in the powerline corridor are anticipated to continue as well as continued fine sediment delivery to the Breitenbush River from the Short Creek slide debris flow. Timber harvest, fire, geology/soils, and social influences on these parameters are anticipated to remain unchanged from the current condition and potential positive effects to the riparian conditions in the diversity and health of the ecosystem would be delayed.

Cumulative Effects for Alternatives 2 and 3

Stream Flows/Disturbance

Breitenbush Hot Springs Resort is the only privately held land in the project area. Although its lands are managed primarily for recreation, impacts to streams may occur with infrastructure in the stream channel and floodplains for drinking water and hydropower generation. The powerline corridor represents a vast swath of federally owned land that is primarily managed by BPA and PGE. Vegetation growth is managed in this corridor to suppress interference with powerlines. A vast network of non-system roads are used to access towers and lines. Numerous stream crossings are associated with these roads, with instances where stream channels have been created or diverted. These effects are anticipated to continue.

The planning subwatersheds are well recovered from an ARP standpoint and cumulative effects for peak flows are not anticipated. It is not anticipated that implementing either action alternative with their accompanying design elements would create an adverse downstream hydrologic effect relating to peak flows. With the protection buffers and restrictions placed on activities adjacent to wet areas and streams it is not anticipated that cumulative effects would be associated with the hydrology of the groundwater dependent areas found within the area.

Additive ground-disturbing activities of the proposed action alternatives are not anticipated to impact stream channel conditions through time with the proposed mitigations and Best Management Practices. Planned restoration of the North Fork Breitenbush River with placement of large wood structures along approximately 5 miles will have a long-term benefit to stream channels on the subwatershed scale. The effects of these individual actions have a cumulative minor effect on the local site scale in the near-term and negligible to beneficial effect on stream channels/disturbance on the sub-watershed scale in the long-term.

Riparian Conditions

The powerline corridor crosses approximately 35 streams in the project area and is maintained in early seral vegetation condition to suppress powerline interference. Riparian areas in this corridor will continue to be managed for early seral condition and continue to have a negative effect on the site scale, but this is and will continue to be minor on the subwatershed scale. In contrast, thinning Riparian Reserves would maintain and improve overstocked forest conditions to meet ACS objectives, and streamside treatments of the proposed action to increase structural and species complexity and diversity would have positive effects at the site scale but little discernable cumulative effects at the subwatershed scale due to the limited scale of treatments. Minor losses wood recruitment within riparian areas in the near-term from thinning outside of no-treatment buffers as part of the proposed action, will be offset for the intermediate to long-term through the accelerated development of larger wood to be recruited in the long term. Each of the projects listed in Appendix D were analyzed for effects to riparian conditions and were found to have negligible effect, minor effect or beneficial effect.

Stream Shade and Temperature

The powerline corridor would continue to be managed in early seral condition, maintaining numerous small segments of minimal shade within in the corridor area. The proposed action would have minor to negligible impacts to shade in the near-term due to use of no-treatment buffers that protect existing shade, leading to no detrimental cumulative effects at the sub-watershed scale. Along with the other recent, ongoing, and likely foreseeable future actions, stream shade would be maintained in the short-term and be maintained or increase slightly in the long-term as tree canopies respond to reduced densities and increased vigor in riparian areas.

Sedimentation and Roads

Short-term effects of the proposed action alternatives on sediment would be associated with designated crossings, road maintenance and road reconstruction, and would be short lived and localized, gone after the first storm event that provides sufficient flow. By utilizing BMPs during winter haul, this activity will also be managed to prevent detrimental sedimentation that could cumulatively affect water quality when haul routes cross multiple streams. However, the long-term beneficial effects of fixing and maintaining roads outweigh the short term negative impacts as part of the with the proposed action and the reasonably foreseeable CMLG Legacy roads project may slightly improve water quality in the long term by improving road drainage and reducing road surface erosion and sediment delivery to streams. Well-maintained roads efficiently drain runoff through properly sized culverts and protect fills from becoming saturated and catastrophically failing. Within the powerline corridor, non-FS powerline access roads that do not currently adhere to best management practices along with a high density of road-stream crossings, would continue to have minor impacts on sedimentation on the site and negligible on the subwatershed scales. In reviewing the reasonably foreseeable future projects found within the project record it is anticipated that the proposed action along with these foreseeable future actions would have negligible to beneficial minor effects in the near to long-term; and would not generate any adverse cumulative effects on sedimentation.

3.5 Fisheries

3.5.1 Summary of Effects Analysis

This analysis found that the Hwy 46 Project "may affect, not likely to adversely affect" Upper Willamette spring Chinook salmon. This is due to the potential for "take" as defined in the ESA. Take is prohibited by the ESA unless it is authorized by the "fisheries" agencies (National Marine Fisheries Service for salmon). In order for the Forest Service to obtain authorization we must conduct consultation with the fish agencies under Section 7 of the ESA. Consultation is anticipated to be completed by May 2018.

Breitenbush River is habitat for spring Chinook salmon and there is the potential to harass, or harm, as a result of the hauling activities. The Forest Service is required to complete consultation before the Record of Decision can be signed for this DEIS. The Forest Service would be required to follow all terms and conditions provided by the fish agencies in their Biological Opinions.

Essential fish habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act is designated in all areas except above impassible dams (Detroit and Big Cliff Dams), and natural migration barriers. The Magnuson-Stevens Fishery Conservation and Management Act reauthorization in 1996 established a new requirement for essential fish habitat that requires Federal agencies to consult with the National Marine Fisheries Service on activities that may adversely affect essential fish habitat. Essential fish habitat for the Pacific coast salmon fishery means those waters and substrate necessary for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to a healthy ecosystem.

The Breitenbush River above Detroit Dam was not considered EFH but since reauthorization of the Magnuson-Stevens Fishery Conservation and Management act the USACE has constructed an adult fish collection facility and is actively transporting Chinook salmon above the dam. Therefore, we consider the Breitenbush River upstream of Detroit Dam to be EFH. This project would not adversely affect EFH because of the no cut buffers we established along ESA fish bearing streams, project design elements, and the implementation of Best Management Practices (BMPs).

The most common salmonid sport fish for which there is habitat on the Detroit Ranger District are spring Chinook salmon, rainbow trout, and coastal cutthroat trout.

The Hwy 46 project will have a neutral effect on LWD at the 5th field watershed scale. Improvements in road condition with implementation of Alternative 2 or 3 will decrease sediment inputs. Riparian structure and composition will improve. There will be no change to Dissolved Oxygen, Chemical Nutrients, Physical Barriers, Substrate Composition, Pool Frequency and Quality, Off Channel habitat, Refugia, Streambank Composition, or Flood plain Connectivity with the implementation of any of the alternatives at the 5th field watershed scale.

The Hwy 46 Project would maintain habitat conditions for aquatic management indicator species in the project area. Therefore, the Hwy 46 Project would not contribute to a negative trend in viability on the Willamette National Forest for these management indicator fish species.

The biological evaluation found that the HWY 46 Project may have beneficial impacts to listed caddisflies. This is due to an improvement in the type of organic matter they consume. That is, a small increase of deciduous leaves due to the small gaps that would be created near streams where we do not expect significant increases in stream temperatures.

Both action alternatives would have similar effects on fish and aquatic insects. No cut buffers were established to provide sources of woody material, and thinning would improve structural and vegetative diversity in the monoculture stands of Douglas-fir in riparian reserves. Gaps in certain plantations would allow more sunlight to reach the stream and increase primary productivity. Eventually hardwoods will colonize these gaps and provide a higher quality of nutritional organic matter to the stream community. These gaps would not be large enough to significantly affect stream temperatures. Fall and leave treatments would provide an immediate source of large woody material to two fish bearing streams that are lacking that habitat element.

3.5.2 Scale of Analysis

The Fisheries section includes a description of the fisheries resource in the project area and assessment of implementation of three project alternatives. This assessment builds on the soil and hydrology analysis of physical parameters and their effects to soil stability and compaction, water quality, beneficial uses of water, and riparian resources. The fisheries discussion further examines effects on water quality, habitat and biological parameters on MIS fish including spring Chinook salmon and trout. Please refer to the hydrology report for project overview.

Regulatory Framework

- Detroit and Big Cliff Reservoirs are managed by the Army Corps of Engineers
- 1990 Willamette National Forest Land and Resource Management Plan Specific direction IV-3, IV-4 as well as 28 separate S&Gs)
- Oregon Dept. of Environmental Quality Memorandum of Understanding (Water Quality Best Management Practices 1998)
- Clean Water Act PL92-500 as amended in 1977 and 1982 (sections 208, 209, 303, 305, 319)
- Oregon Administrative Rules (Chapter 341, Division 41) identifies beneficial uses
- 1994 Northwest Forest Plan Aquatic Conservation Strategy, Tier II watershed, and amends S&Gs
- Breitenbush Watershed Analysis update February 2014.
- 1993 Forest Ecosystem Management Assessment Team Report (FEMAT)
- Federal Water Pollution Control Acts of 1970, 1965, 1956, 1948 and 1972 Amendment of (PL92-500)
- Best Management Practices last published in April 2012 by USFS.
- 2005 Northwest Forest Plan Temperature TMDL Implementation Strategies
- Endangered Species Act (ESA) of 1973
- Magnuson-Stevens Fishery Conservation and Management Act Reauthorization
- Wild and Scenic Rivers Act

3.5.3 Affected Environment

The Hwy 46 project is distributed along the Northern and Southern portions of the Breitenbush River watershed, upstream of the Humbug campground. Primary streams within the project area include the Breitenbush River, South Fork Breitenbush River, North Fork Breitenbush River, East Humbug Creek, Devils Creek, Scorpion Creek, Cultus Creek, Leone Creek, Hill Creek, Mansfield Creek, Short Creek, Skunk Creek, and Roaring Creek. There are two small lakes included in the project are, Leone lake (6.5 acres), and Short Lake (2.3 acres). There are also numerous non-fish bearing streams located in the project area.

A variety of fish species can be found in the Breitenbush watershed.

Table 32 Fish Species of the Breitenbush Watershed

Common Name	Scientific Name

spring Chinook salmon*	*Oncorhynchus tshawytscha*
coastal cutthroat trout*	*Oncorhynchus clarki*
rainbow trout*	*Oncorhynchus mykiss*
mountain whitefish*	*Prosopium williamsoni*
longnose dace	*Rhinichthys cataractae*
speckled dace*	*Rhinichthys osculus*
redside shiner*	*Richardsonius balteatus*
sculpin species*	*Cottus spp.*
brook trout*	*Salvelinus fontinalis*

*Confirmed sighting

Management Indicator Species

The Willamette Forest Plan recognizes anadromous and resident salmonids as economically important species and designates them as management indicator species for riparian habitat and water quality. Salmonids are good indicators because they are predators in the stream ecosystem. This means that they are not only affected by the physical conditions of their habitat but also by the metabolic energy pathways in the watershed from primary production to decomposition.

Coastal cutthroat trout are ubiquitous in the project area. They can be found in small tributaries, in the Breitenbush River, North Fork Breitenbush River and in Short and Leone Lake. Rainbow trout tend to be seen primarily in the Breitenbush River downstream of Breitenbush Campground. This is due primarily to Oregon Department of Fish and Wildlife stocking activities of rainbow trout which ends at Breitenbush campground. Previous timber management in riparian areas has affected aquatic habitat quality by altering the quantity, size and recruitment source of large woody material, which can affect substrate storage, habitat composition (e.g. pools, riffles, off channel habitat) and water temperature.

The combination of habitat condition, and ODFW stocking of non-native rainbow trout is believed to suppress native cutthroat trout abundance in the project area through competition with non-native species.

ESA Listed Species

Spring Chinook salmon migration, spawning and rearing occur in the mainstem Breitenbush and North Fork Breitenbush Rivers within the project area. This species is listed as Threatened under the Endangered Species Act.

Low gradient reaches of the mainstem Breitenbush and North Fork Breitenbush in the project area are used as spawning habitat by spring Chinook salmon. Spawning in these reaches occurs in September and October, with fry emergence about 3 months later.

High water quality in the form of cold water temperature and high habitat quality remaining in the upper sub-basin provides the largest remaining core area for spring Chinook salmon reproduction and rearing in the basin. The project area portion of the sub-basin historically provided greater quantity and quality habitat with a greater level of channel complexity and off-channel area. Previous management activities such as stream cleaning, reduced large wood recruitment potential, and modified flow, sediment and wood routing regimes (as modified by dams and roads), have diminished salmon production in the project area.

Spring Chinook salmon and winter steelhead originally spawned in the North Santiam sub-basin (including the Breitenbush River). The habitat was blocked by Detroit Dam in 1953 and these anadromous species were extirpated from the watershed. Since 2000, ODFW has trapped and hauled adult spring Chinook salmon around the dams to the Breitenbush River and the Upper North Santiam River to naturally spawn. The USACE (United States Army corps of Engineers) and the Oregon Department of Fish and Wildlife (ODFW) have a goal of moving up to 3000 adult spring Chinook salmon upstream of the dam each year.

This trap and haul effort has changed management in the Watershed in a couple of ways. First, it has increased the number of Class 1 anadromous streams in the Watershed. It is assumed that the historically occupied habitat in the Breitenbush River is currently being utilized by both adult and juvenile spring Chinook salmon. Second, the National Marine Fisheries Service (NMFS) recently completed their final listing determinations for 16 Evolutionary Significant Units (ESUs) of West Coast Salmon (70 FR 37160; effective August 29, 2005). The Upper Willamette River Chinook salmon ESU is considered to be threatened under the Endangered Species Act (ESA), confirming their earlier determination (64 FR 14308; effective May 24, 1999). The Upper Willamette River Chinook ESU includes all naturally spawned populations of spring-run Chinook salmon in the Clackamas River and in the Willamette River, and its tributaries, above Willamette Falls, Oregon. Detroit Dam is the upper limit of critical habitat for listed Chinook salmon. The Magnuson-Stevens Fishery Conservation and Management Act lead to the designation of Essential Fish Habitat (EFH) for commercially harvested fish, which includes Chinook salmon on the Willamette National Forest. The National Marine Fisheries Service (NMFS) designation of EFH did not include any streams above Big Cliff dam.

Future actions include the trapping and hauling of Upper Willamette Steelhead and the possible reintroduction of Bull Trout.

Bull trout where once present in the Breitenbush River but no documented record of bull trout exists since the early 1970s and they are considered extirpated from the watershed. The High Cascades portion on the eastern side of the project area contains the youngest volcanic rocks of the Cascade range, mostly Pliocene or Pleistocene in age. Some of the oldest lava flows of the High Cascades appear to have covered the youngest Western Cascade strata. Since then, most volcanic events have generally been confined to the High Cascades proper (Hammond, et al, 1980). Most of the High Cascade volcanic eruptions, which form the broad base of the High Cascade platform, contain basalt flows, flow breccias, and pyroclastic deposits. They represent the early part of the volcanic eruptions, and their ages range from about four to one million years. The youngest and most recent deposits are generally less than one million years in age and include intra-canyon flows, low shield volcano out pouring, and the more pronounced stratacone deposits, like those on Mount Jefferson or Three Fingered Jack (Walker and Ducan, 1989) (Hammond, P. E., et al, 1980).

Aquatic Insects

Three aquatic insects found on the Regional Forester's sensitive species list (SSL) have been documented on the Willamette National Forest. These aquatic insects are all caddisflies and little is known about them. In fact, the common name for all of these caddisflies is "A Caddisfly." A short summary of the distribution and known habitat associations is provided below. For a more detailed discussion on these species, see the Fisheries Biological Evaluation.

Rhyacophila chandleri: In Oregon, this species is documented on Willamette, Deschutes, and Umpqua National Forests. It is documented on the Willamette National Forest as a rare insect on the H.J. Andrews Experimental Forest. The entire *Rhyacophila* genus, whose name is derived from the Greek roots rhyaco (stream or torrent) and philia (fondness), is confined to running water. In the Cascade Mountains of Oregon, this species is associated with very cold, larger spring-fed streams (USDA Forest Service and USDI Bureau of Land Management 2012). Elevations of known populations range from around 1219 to 1700 m (4000 to 5600 ft.) in Oregon. The larval behavior and diet of *R. chandleri* is not known, but probably similar to others in the *Rhyacophila verrula*-group. While most *Rhyacophila* larvae are obligate predators, feeding on aquatic invertebrates, members of the *verrula*-group are unique in having phytophagous diets (i.e. feeding on plant material) consisting largely of filamentous algae, diatoms, detritus, bryophytes, liverworts, and/or other non-animal material (USDA Forest Service and USDI Bureau of Land Management 2011 and 2012).

Rhyacophila leechi: In Oregon, *R. leechi* is documented to occur on the Willamette National Forest and on Bureau of Land Management land in the Medford District. Adults have been collected from springs and cold, spring-fed streams. This species appears to require colder water temperatures than the common and more widely distributed *Rhyacophila verrula*, and is likely confined to smaller, headwater streams and springs (USDA Forest Service and USDI Bureau of Land Management 2011). Oregon sites range in elevation from 440 to 980 m (1444 to 3210 ft.). The larval behavior and diet of *R. leechi* is not known, but probably similar to others in the *Rhyacophila verrula*-group.

Namamyia plutonis: This species of caddisfly occur in the Coast and Cascade Ranges of Oregon and California (USDA Forest Service and USDI Bureau of Land Management 2010). Populations tend to be extremely localized and are patchily distributed. Currently, fewer than 30 locations are known to contain this caddisfly, which occurs in low numbers. *Namamyia plutonis* can be found associated with small streams in densely forested old growth or mature forests, but the majority of the documented occurrences are between 30 and 50 years old. Most species of trichopterans have very specific preferences regarding water temperature, flow, oxygen levels and substrate characteristics.

Sampling for aquatic organisms (macroinvertebrates) has not taken place in the Breitenbush Watershed, however samples were taken on Horn Creek, tributary to the North Santiam River in 2012 and 2013. Samples were taken and members of the genus *Rhyacophila* were found but none of the species found on the sensitive species list (SSL) was documented in those efforts. No members of the genus *Namamyia* were found in any of these samples.

Despite not finding the species on the SSL the Breitenbush Watershed provide the type of habitat that *Rhyacophila* requires for survival (i.e. large spring-fed rivers) so we treat that habitat as potentially occupied. *Namamyia plutonis* tend to be found associated with small streams in densely forested old growth or mature forest watersheds (USDA Forest Service and USDI Bureau of Land Management 2010). We did not sample this type of habitat but it does exist in the project area.

In-stream Habitat

The condition of many in-stream habitat elements contributes to overall aquatic habitat quality. These elements include, but are not limited to:

Stream Temperature	*Large Woody Material*
Dissolved Oxygen/Turbidity	*Pool Frequency and Quality*
Chemicals/Nutrients	*Off-Channel Habitat*
Riparian Structural and Species Diversity	*Refugia*
Physical Barriers	*Streambank Condition*
Substrate Composition	*Floodplain Connectivity*

Stream temperature for most streams in the watershed is functioning properly and shade continues to recover from historic timber harvest. Dissolved oxygen is high, turbidity and fine sediment delivery is relatively low (see exception for Short and Cultus Creeks in Hydrology and soils report), and there is no indication of chemical contamination. The overall lack of deciduous and herbaceous vegetation may be impacting stream ecosystems by limiting productivity. Due to the relatively low carbon:nitrogen ratio, deciduous litterfall is much more readily usable and nutritious to the aquatic foodweb than is conifer litterfall.

Physical barriers exist below the project area in the form of Detroit and Big cliff Dams. In the project area barriers, in the form of impassible or variable pass stream/road culverts, exist in several locations. Most of the barrier culverts exist on small cutthroat inhabited streams. As funding becomes available these barrier culverts are being replaced with AOP (aquatic organism passage) designed crossings. There are four barrier culverts on medium sized streams (Mansfield, Short (2), and Devils creek). Cost estimates for these four crossings is at least $500k+ each. With current funding levels it is unlikely that any of these four crossings will be replaced soon.

In-stream large wood frequency in the Breitenbush River and many tributaries is considered to be below historic levels and not properly functioning, mostly due to the decrease in size of recruited wood and previous management actions that removed large wood from the main river systems. The lack of large wood impacts pool frequency and quality, off-channel habitat, refugia, and floodplain connectivity which are all not functioning properly. Streambank condition is good throughout the watershed due to root strength associated with high vegetative growth. In general, the habitat elements that contribute to quality fish habitat are in a somewhat impaired condition, primarily due to the removal of large woody material. These conditions need to improve in order to maintain and increase native fish populations in the watershed. For a detailed discussion of the project area on each of the elements listed above see the Fisheries Biological Assessment located in the project file.

Planning efforts are currently underway to significantly increase the large wood component in the Breitenbush River and its tributaries.

Table 33 Woody Material Counts for Some Streams in the Project Area

Stream	Reach	Wood/Mile Small/Medium/Large	Wood/Mile Medium/Large Only
Short Creek (2013)	1	27	23
	2	18	11
S. Fk Breitenbush River (2009)	1	28	9
	2	90	26
Mansfield Creek (2013)	1	No Data	No Data
	2	19	4
Hill Creek (2014)	1	46	27
	2	52	14
Leone Creek (2014)	1	52	14
	2	36	23
	3	22	6
Devils Creek (2014)	1	16	7
	2	27	10
	3	35	17
N. Fk Breitenbush River (2009)	1	27	4
	2	36	9
	3	28	9
	4	90	25

Small – are at least 12 inches in diameter at 25 feet from the large end.
Medium – are 24 inches to 36 inches in diameter at 50 feet from the large end.
Large – are greater than 36 inches in diameter at 50 feet from the large end.

Riparian

More information and description of the existing condition for riparian reserves can be found in the hydrology and soils sections of this DEIS. In the project area riparian reserves can be found in variety of conditions from young stands of dense Douglas-fir monocultures (i.e. plantations) to mature and old growth stands with a greater diversity in tree species and light availability to the stream ecosystem. Given the size of the project area, riparian reserves are found along a variety of water bodies including seasonal flowing streams, perennial flowing non-fish bearing streams, fish bearing tributaries and a river (the Breitenbush), small ponds, a large “sag pond” (Short Lake), and Leone Lake.

Recent forest research in the Coast Range and Western Cascades indicates that existing old growth stands developed with natural stand densities of 40 to 60 conifers per acre (Tappeiner et al, 1997; Poage & Tappeiner 2002). There is one plantation in the project area that has 397 trees per acre. Post-harvest thinning densities in riparian reserves would range from a residual approximately 70 trees per acre to approximately 90 trees per acre with the average stand having approximately 84 trees per acre. All riparian reserves where thinning is proposed would have a no cut buffer, except for units 6, 100, 190, 430, and 520 (see Appendix B for specific information on all units) and thinning would maintain 40% canopy cover in the rest of the reserve.

On site assessment of riparian reserves found that nineteen of the proposed unit’s riparian reserves have a good mix of hardwoods in the stand so no treatment was recommended in those areas. These stands appear to be on their way to achieving Aquatic Conservation Strategy objectives without any need of silvicultural activities.

Some riparian reserves in units did not have a good mix of hardwoods in the stand so silvicultural treatment is recommended in those areas. These stands are dense, dark plantations of almost pure Douglas-fir with either very few hardwoods in the riparian reserve or none at all and very little sunlight reaching the forest floor or the stream channels. These conditions were verified using satellite imagery and on the ground field investigations. In some cases thinning is recommended and in a few stands non-commercial “near stream gaps” are proposed. In these quarter acre gaps all trees would be felled and left on site. These sites would be monitored to ensure that hardwood trees colonized the site. We expect that within 6 to 10 years there would be a stand of hardwood trees on the site. If needed, we would plant hardwoods (i.e. vine maple, big leaf maple, and red alder). Units where near stream treatments are recommended are: 6, 100, 190, 430, and 520. These stands range in age from 40 to 48 years old.

Preliminary data collection at H.J. Andrews Experimental Forest in 2013 support the fundamental idea that historically, light regimes in these headwater ecosystems were highly variable with areas of low light where canopies cover the stream and areas of high light associated with canopy gaps. The McKenzie Ranger District worked with Oregon State University researchers to collect observational information on gaps on a tributary to McCrae Creek. This creek is comparable in size to the streams on which we are proposing streamside treatments. Results from this and other streams in the region showed that there are more gaps in the old growth reach and greater light availability to the stream channel compared to the plantation. In their assessments of juvenile trout growth through the summer, they observed greater growth rates in young-of-year cutthroat in the old growth reach as compared to the plantation reach.

On several streams we propose to fall and leave trees in the channel. Table 12, Chapter 2, page 48 summarizes proposed treatments.

Leone, Fox and Hill Creeks are tributaries to the Breitenbush River and are inhabited by coastal cutthroat trout. All three are relatively small streams and relatively steep (5-8% gradient and steeper). Two unnamed tributaries that run through units 430 and 520 respectively, are class three stream channels (perennial, non-fish). In unit 520 the riparian area is a monoculture of Douglas fir with virtually no understory. This tributary drains to the South Fork Breitenbush. The second unnamed tributary running through unit 430 is very steep (>15 %) and shows evidence of episodic debris flows. This tributary drains into the North Fork Breitenbush. Treatment of riparian stands in this unit have two goals. The first is to increase the diversity of the riparian stand. The second goal is to fall trees into this debris prone channel for future LWD deposition in the North Fork Breitenbush River.

Pool frequency and quality, off-channel habitat, refugia, streambank condition, and floodplain connectivity for most streams in the project area are currently classified as not properly functioning. This is due primarily to past management actions that removed wood from streams and past management actions that failed to leave intact riparian buffers.

3.3.4 Environmental Consequences

Direct and Indirect Effects

The management activities proposed have the potential to affect the habitat elements listed above, particularly stream temperature, water quality and quantity, riparian structural and species diversity, and large woody material which creates pools, off-channel habitat, refugia, and floodplain connectivity.

Because salmonids and caddisflies depend on the functioning of these habitat elements, the effects to habitat elements and how they may impact biota are analyzed.

Alternative 1 – No Action

Alternative 1 would result in little or no change to the habitat elements listed above. Landscape delivery of fine sediment, as modified by the road and stream crossing network, would remain as it is and subject only to scheduled maintenance. The No-Action alternative would leave deteriorating roads and culverts untreated, yielding fine sediment similar to current levels. The current levels would remain within the range of conditions necessary to sustain native aquatic biota, but not optimally so. Periodic stream crossing failures may occur at undersized and outdated culverts, potentially delivering large pulses of fine sediment to fish bearing reaches. Culvert failures may induce stresses on resident fish populations, but not at magnitudes that would be expected to extirpate local populations. Depending on proximity to listed fish habitat, particularly spawning habitat, culvert failures could result in take of listed fish. High sediment loads may also impact sensitive caddisfly populations and other native biota.

Current rates of large wood recruitment, provided mostly by stem mortality (from competition, disease, wind and snow downed trees) and bank erosion, would be maintained. Alternative 1 would provide a slightly higher rate of natural in-stream wood recruitment compared to the action alternatives. Where the action alternatives protect about 90% of the wood recruitment zones, the No-Action alternative would protect 100%. In some streams, recruitment trees are of sufficient size to meet ACS Objectives (Appendix E), but in other streams with small diameter riparian stands the aquatic benefit is limited, namely through the reduced ability to store sediment and organic matter and contribute to habitat forming processes (e.g. scour). Though small wood has some value, particularly in the smaller headwater reaches, the longevity of recruited small diameter trees is short-lived, as they break down through abrasion and decomposition more rapidly compared to large trees. Small diameter trees are also more likely to be transported out of the system. In-stream wood abundance is low for most streams in the project area and is largely due to the lack of large enough wood to remain stable in channels. Implementing the No-Action alternative would maintain slower tree growth rates than the action alternatives.

The No-Action alternative would not benefit from thinning to enhance vegetation. Desired riparian conditions – high species and structural diversity with large dead and down wood – would slowly develop over time (several decades) and depend solely on natural thinning events (stem exclusion mortality and disturbance). Without management to increase the abundance of deciduous and herbaceous vegetation in dense, conifer-dominant stands, ecosystem productivity would remain at relatively lower levels. Active restoration of riparian stands that currently do not meet ACS Objectives would not occur. In addition, the currently dense riparian stands would be at greater risk to high severity fire, insect infestation, and disease – all carried more efficiently through overstocked stands.

Alternatives 2 and 3

The Riparian Reserve management strategy was specifically designed to accelerate complex forest structure while protecting and enhancing the habitat elements important to aquatic biota. No-harvest and no-treatment buffers on streams were established to minimize effects to aquatic species and their habitat. Treated stands account for less than 6.0 % of all the Riparian acres in the project area and the volume loss of small and medium wood would be immeasurable at the 6th field scale. Any trees, or parts of trees felled in protection buffers as part of harvest operations would be left on site. There would be no yarding of trees out of the protection buffers. These residual trees left in treated units near streams and untreated stands in the affected watersheds would leave a supply of whole trees as well as small and medium wood available for short-term and long-term recruitment to the stream network. Thinning inside designated riparian reserve units would lead to an increase in understory development, increased plant diversity and trend towards stand characteristics that resemble old growth forests. This prescription would maintain ACSO (Aquatic Conservation Strategy Objectives).

Retention of the larger trees in the riparian units allows for additional potential recruitment, outside of the protection buffers, of future LWD to stream channels in headwater stream areas. This increases the wood component and fish habitat is improved as this wood is transported into lower fish bearing reaches. Wood that does not hold in streams inside the project area would be transported to larger streams and potentially to Detroit Lake. Wood that reached the lake would provide minimal habitat for spring Chinook salmon habitat in Detroit Lake and none in the lower North Santiam River because wood that makes its way to the reservoir is blocked by the dam and removed for boater safety. Historically, wood that was transported from slopes in the project area to the North Santiam River would contribute to fish habitat throughout the North Santiam and Willamette Rivers.

Project design elements in Chapter 2, Table 13 were incorporated into all activities to similarly protect aquatic resources. Due to these project design elements, protection measures, and enhancement treatments, Alternatives 2 and 3 would result in short-term “negligible”, “discountable”, or “insignificant” (official terms used in the Fisheries Biological Assessment) negative effects as well as beneficial effects to the habitat elements listed above. For a detailed discussion of how the project actions affect each habitat element, see the Fisheries Biological Assessment located in the project file.

Thinning outside the primary shade zone and limiting thinning in the secondary shade zone of perennial streams would protect stream shade and temperature within the project area. See the Stream Shade and Temperature Section for details.

Based on hydrologic analysis, changes in flow regimes, including peak flows, are not anticipated from proposed activities. Aggregate Recovery Percentage (ARP) levels, which are used to calculate the potential increase of peak flows, are maintained above recommended values for all alternatives in the affected sub-watersheds even immediately after implementation when the potential for adverse impacts to vegetation would be greatest.

Sediment delivery is expected to increase during project implementation while culverts are being installed and replaced and road maintenance is occurring. There could be a short term (immediately after the first rain of the season) turbidity effect but juvenile and adult salmonids appear to be little affected by ephemerally high concentrations of suspended sediments that occur during most storms and episodes of snow melt (Bjornn and Reiser 1991). Once the project is complete, sediment production rates return to slightly less than pre-project conditions. Either Alternative 2 or 3 would reduce the potential for runoff effects and culvert failures that may affect Riparian Reserves or water quality. See the Sedimentation Section for details. Soil disturbance is likely to occur when trees are felled and yarded with ground based or cable logging systems. Much of this erosion would be localized and is not expected to enter stream channels. Sediment that is transported to stream channels is expected to be minor because the majority of sediment would be trapped within the no-harvest buffers before it reaches the streams. Haul related sediment generation and transportation via ditch lines will be disconnected from stream systems by locating cross drains in areas where sediment can infiltrate through the forest floor prior to stream crossings. The project was designed to minimize the amount of sediment that may enter a stream channel and be transported to fish habitat. Distance of timber harvest activity to fish habitat, the presence of a glacial terrace to facilitate sediment deposition, and in most cases, absence of surface connection between harvest activity and fish habitat further reduces risk of fine sediment transport. All live stream crossings will have new cross drains installed within 100 feet of crossing to disconnect road drainage from live streams. These crossings will be located, with input from the hydrologist, fish biologist, and road engineer to minimize any potential surface connection to waterways. All of the units on the South side of the Breitenbush River (with the exception of unit 80) will have haul out the Boulder Ridge road. This road is paved for 6.7 miles down to HWY 22 in the North Santiam Watershed. Haul along gravel surfaced roads is planned for only one unit (unit 80) adjacent to ESA listed fish habitat. There may be increased sedimentation to suspended sediment and substrate at the site-scale (culvert Stream crossings), but the probability of sediment reaching and affecting fish habitat is discountable due to distance and volume of inputs.

Thinning outside of the primary wood recruitment zone was designed to retain the majority of potential wood (>90%) while achieving desired vegetation characteristics that support productive aquatic communities. The action alternatives may have a slightly lower rate of in-stream wood recruitment than the No-Action alternative, but the benefits to vegetation diversity and accelerated tree growth would be greater. The major wood recruitment process on the Breitenbush River and its tributaries is stream adjacent recruitment. A 2011 research paper determined that 90% of all LWD inputs to stream channels originated within 60 feet (N.T. Johnston, 2011). There are no commercial thinning activities in the action alternatives within 172 feet of ESA-listed fish habitat and 20 units adjacent to other fish-bearing streams with Management Indicator Species (MIS). Of those 20 units, 17 have a minimum 100 foot no-cut/entry buffer. The remaining three units would have fall and leave into the stream channel to improve riparian stand diversity (see discussion on riparian units). The probability that thinning in Riparian Reserves would adversely affect water quality, habitat complexity, sediment storage capacity or floodplain processes in fish–bearing streams is very low. These potential effects on ESA-listed fish, MIS, and sensitive caddisflies are not expected to be measureable for the following reasons:

- Of the streams that do have surface connection to ESA-listed fish habitat, approximately half of them are intercepted by roads. If debris makes it past those roads, the flat glacial terrace acts as a depositional area and stores most of the debris before reaching listed fish habitat.
- Three units adjacent to fish-bearing streams with MIS (Units 6, 100, and 190) will have management occurring in the primary wood recruitment zones. Proposed management actions in these units involve falling and leaving thinned trees in the stream channel.
- Hazardous fuels treatment units are located adjacent to the Breitenbush River, but no treatment is planned to occur within the steam influence zone (0-172 feet). Fire would be allowed to back into riparian zones but is not anticipated to have significant, or measurable impacts (see hydrology report). Therefore, there would be no impacts to ESA-listed fish or MIS or their habitat from these activities.
- Conditions in currently functioning portions of Riparian Reserves would be maintained. In overstocked, conifer-dominant portions lacking structural and species diversity, thinning would occur in upland units with tributary streams to ESA-listed fish habitat and along units with MIS. The desired benefit of thinning in Riparian Reserves is to improve stand structure, vegetation diversity, and accelerate development of large diameter trees to acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy Objectives (Appendix E). Management of these stands would accelerate the ability of Riparian Reserves to provide adequate stream shade, root strength and bank stability, sediment filtration and nutrient cycling, large wood supply to waterbodies and floodplains, organic matter input, and habitat for riparian-dependent wildlife. As this landscape rarely transports the products of disturbance, recruited material has little opportunity to migrate to ESA-listed fish habitat. Improvements in riparian stand diversity are expected to be of greatest benefit to MIS, primarily cutthroat trout.

Cumulative Effects

Alternative 1 – No Action

Alternative 1 would perpetuate the effects of dense forested stands in previously harvested areas. Most of these areas have little to no hardwood vegetation in the riparian reserve. These areas are delivering large amounts of Douglas-fir needle cast to the streams. Douglas-fir needles are not as nutritionally available to the stream community as are hardwood leaves. The hardwood analysis we conducted for all the riparian reserves in the Breitenbush River project area found that 2.0% of the area was hardwood or hardwood shrub. Roads would receive periodic maintenance depending on funding. Stream crossings will continue to degrade over time with an increase potential for stream crossing failure. These crossing failures may adversely impact ESA fish spawning areas, depending on location and magnitude.

Alternatives 2 and 3

Cumulative effects for fish and aquatic insects are analyzed at the site scale and at the watershed scale (i.e. Breitenbush River watershed). Some effects are short term (1-10 years) and others are long term (50-100 years).

All recent and planned timber harvest and hazardous fuels reduction projects were and would be designed with similar protection measures, design elements, and Best Management Practices that minimize effects to water quality and aquatic resources. Each of the past projects listed in Appendix D were analyzed for effects to riparian condition and were found to have no effect, negligible effect, or beneficial effect. The negligible or beneficial effects combined with the minor impacts expected from the Hwy 46 project would not measurably contribute to impaired riparian conditions.

Road work associated with the proposed action will result in reduced sediment inputs to streams and MIS/ESA impacts over the short term (0-5years) and long term (10+ years). Timber haul (dry season and wet season) does have the potential to impact MIS and ESA species and their habitats. See the Biological assessment located in the project file for a more detailed description of impacts associated with hauling activities.

Portland General Electric and Bonneville Power transmission line corridor runs through the project area and crosses approximately 35 streams in the project area. This corridor is maintained in an early-seral condition, reducing shade and potential wood recruitment. This minor amount of affected area combined with the minor impacts expected from the Hwy 46 project would not measurably contribute to increased impaired riparian conditions.

Compliance with the Forest Plan and Other Regulatory Direction

Aquatic Conservation Strategy

See Appendix E for a discussion on compliance with the Aquatic Conservation Strategy objectives and Standards and Guidelines.

Endangered Species Act

Upper Willamette River spring Chinook salmon are listed as threatened on the Endangered Species list. This species occurs in the Breitenbush River. The fisheries biological evaluation is where we analyze effects to listed fish species. This analysis found that the Hwy 46 Project “may affect, not likely to adversely affect” Upper Willamette spring Chinook salmon. In order for the Forest Service to obtain authorization we must conduct consultation with the fish agencies under Section 7 of the ESA.

The Forest Service is required to complete consultation before the Record of Decision can be signed for this DEIS. The Forest Service would be required to follow all terms and conditions provided by the fish agencies in their Biological Opinions.

Magnuson-Stevens Fishery Conservation and Management Act

Essential fish habitat under the Magnuson-Stevens Fishery Conservation and Management Act is designated in all areas except above impassible dams (Big Cliff and Detroit Dams), and natural migration barriers. The Magnuson-Stevens Fishery Conservation and Management Act reauthorization in 1996 established a new requirement for essential fish habitat that requires Federal agencies to consult with the National Marine Fisheries Service on activities that may adversely affect essential fish habitat. Essential fish habitat for the Pacific coast salmon fishery means those waters and substrate necessary for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to a healthy ecosystem. The species designated in the Breitenbush River is spring Chinook salmon.

Technically the Breitenbush River upstream Big Cliff and Detroit Dams is not considered EFH but since reauthorization of the act the USACE has constructed an adult fish collection facility and is actively transporting Chinook salmon above the dam. Therefore, we treat the Breitenbush upstream of Detroit Dam as EFH. This project would not adversely affect EFH because of the no cut buffers we established along EFH fish bearing streams, project design elements, and the implementation of Best Management Practices (BMPs).

Management Indicator Species

The Willamette Forest Plan recognized anadromous and resident salmonids as economically important species and designated them as management indicator species for riparian habitat and water quality. Salmonid fish are good indicators because they are predators in the stream ecosystem. This means that they are not only affected by the physical conditions of their habitat but also by the metabolic energy pathways in the watershed from primary production to decomposition. The most common salmonid sport fish for which we have habitat on the Detroit Ranger District are spring Chinook salmon, rainbow trout, and coastal cutthroat trout.

Management Indicator Fish Viability Statement: The Hwy 46 Project would maintain habitat conditions for aquatic management indicator species in the project area. Therefore, the Hwy 46 Project would not contribute to a negative trend in viability on the Willamette National Forest for these management indicator fish species.

Sensitive Species (Caddisflies)

The biological evaluation found that the Hwy 46 Project may have beneficial impacts to listed caddisflies. This is due to an improvement in the type of organic matter they consume. That is, a small increase of deciduous leaves due to the small gaps that would be created near streams where we do not expect significant increases in stream temperatures

3.6 Wildlife

3.6.1 Summary of Effects Analysis

Alternative 2 would increase early seral habitat in the planning area to 1.46% or 460 acres. Alternative 3 would increase early seral habitat to 1.29% or 405 acres.

Spotted owls are protected from nesting disruption by seasonal restrictions on proposed activities near nest patches. Proposed hazardous fuels treatments in nest patches would be dropped from consideration. Suitable and dispersal habitat is proposed to be removed by the project activities where meadow restoration, wildlife gaps, sugar pine restoration, dominant tree release, quality early seral and one road relocation are would occur. Alternative 2 would remove an estimated 131 acres of suitable habitat and 96 acres of dispersal habitat. Alternative 3 would remove an estimated 5 acres of suitable habitat and 32 acres of dispersal habitat.

Forest Service Regionally Sensitive species are known to exist in the planning area and where located during surveys are protected by seasonal restrictions on project activities. With seasonal restrictions no impacts are expected to occur to regionally sensitive species.

Survey and Manage Species were not located in proposed project activity areas so direct impacts to these species is not expected to occur.

Bald eagle and osprey surveys were conducted with one osprey nest located. Seasonal operating restrictions would protect the osprey nest from disturbance impacts. The nest tree is outside proposed project treatment areas and would not be impacted.

Management indicator species were analyzed with species dependent on early seral habitat identified as limited by lack of habitat. Early seral habitat is proposed to be increased by the proposed project where meadow restoration, wildlife gaps, sugar pine restoration, dominant tree release, quality early seral units would occur.

3.6.2 Affected Environment – Early Seral Habitat for Wildlife

Age class diversity in forest stands is important as some species of animals and plants depend on younger stages of forests for their feeding, nesting, and breeding requirements, whereas other species thrive in middle age or old forests. Early seral habitat (defined as less than 20 years old for this wildlife analysis) is of key importance to an estimated 156 species of wildlife in the central Oregon Cascades.

Historically, early seral habitat in the project area was created from stand-replacing fires and regeneration harvest. Changes in forest management on Federal lands in the past 30 years, including fire suppression and reduced regeneration harvest have resulted in fewer acres of early seral habitat creation. Additionally, fire suppression and reduced regeneration harvest have resulted in a much higher proportion of dense, closed canopy stands. Consequently, there is less structurally rich and diverse quality early seral habitat in the project area than in the past. Currently, early seral habitat within the Hwy 46 project area is limited to powerline corridors, recent stand replacing fires and a few small naturally occurring meadows.

The Hwy 46 project area occurs in eleven planning subdrainages: Humbug, Fox, Scorpion, Short, Mansfield, North Fork Breitenbush, Roaring, South Fork Breitenbush, Devils, Hill, Leone-Cultus and Cliffs. Within these watersheds, approximately 31,136 acres of land are managed by the Forest Service. One private quarter section of approximately 159 acres is managed by Breitenbush Hot Springs Resort and Conference Center. Within the 31,136 acres an estimated 361 acres or 1.15% of the planning area is early seral habitat. The estimate is based on existing natural meadows of 20 acres, powerline of 311 acres and timber harvest less than 20 years of 30 acres. Historically about 9% of the watershed was estimated to be in early seral habitat on the average. See the Forest Vegetation Section for a more detailed analysis of the existing and historical conditions.

3.6.3 Environmental Consequences – Early Seral Habitat for Wildlife

Direct and Indirect Effects

Alternative 1 – No Action

With implementation of Alternative 1, the amount of early seral habitat in the Hwy 46 project area would remain around 1% of the area with the powerline corridor expected to remain in early seral condition indefinitely. Meadows are expected to be overgrown in approximately 30 years. The timber harvest areas are expected to become forested habitat and lose early seral characteristics in approximately 10 years.

Alternative 2

With implementation of Alternative 2, the amount of diverse early seral habitat in the Hwy 46 project area would increase to approximately 1.46%. Early seral habitat would be created by gaps, early seral creation and meadow restoration treatments. The total acres of early seral created by treatments is 99 acres. Of the total analysis area of 31,295 acres, treatments on 99 acres represents 0.31% of the total area. The increase in early seral habitat is expected to be maintained for approximately 30 years when the treated areas will transition into forested habitat.

Alternative 3

With implementation of Alternative 3, the amount of diverse early seral habitat in the Hwy 46 project area would increase to approximately 1.29%. Early seral habitat would be created by gaps and early seral creation. The total acres of early seral created by treatments is 44 acres. Of the total analysis area of 31,295 acres, treatments on 44 acres represents 0.14% of the total area. The increase in early seral habitat is expected to be maintained for approximately 30 years when the treated areas will transition into forested habitat.

Cumulative Effects

Alternatives 1, 2 and 3

There are no additional effects as there are no other projects occurring in the analysis area.

3.6.4 Affected Environment – Northern Spotted Owl (Federally Threatened Species)

The northern spotted owl is a federally threatened species under the Endangered Species Act (ESA) that uses forest habitat in the project area. The effects of the various proposed actions for the Hwy 46 project would be addressed by the Willamette National Forest (2017) and evaluated by the U. S. Fish and Wildlife Service (USFWS) in the 2017 Biological Opinion (B.O.)(USFWS reference xxxxx-2017-x-xxxx). This B.O. would fulfill the Forest Service's legal requirement with respect to Section 7 of ESA for the Hwy 46 project. A summary of the effects of the alternatives on the northern spotted owl is provided in this section. The final EIS would not be signed prior to submission of the 2017 B.A. and receipt of a B.O. from the USFWS.

Consultation on the northern spotted owl was based on current survey information provided by the Detroit Ranger District from surveys completed in 2014-2016 plus historic nest sites. A team of consultation advisory biologists reviewed the proposed project and provided guidance on where surveys were needed. Surveys were conducted to minimize the potential of adverse effects to activity centers either by disruption of nesting or reduction in habitat to below minimum threshold levels. All activities which were planned to occur within spotted owl nest patches were dropped from further consideration. A total of twenty eight current and historic owl sites were consulted on and occur within 1.2 miles of the proposed activities.

Interspecies Competition: The barred owl occurs throughout the Willamette National Forest, including the Hwy 46 project area. Competition with barred owls has been found to be an important threat to northern spotted owls (USFWS 2011). In western Oregon, both species prefer forests older than 120 years of age. The larger and more aggressive barred owls can displace spotted owls where they establish territories (Wiens 2012). Wiens (2012) has recommended retaining conifer forests older than 120 years of age as a method to reduce interspecific competition between the owl species. Where barred owls occur, he has found that spotted owl survival significantly declines as the percent of forests >120 years of age in the general home range drops below 35%.

Guiding documents for northern spotted owl analysis include:

- The Land and Resource Management Plan, Willamette National Forest, as amended, 1990;
- The Record of Decision, for amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl, U.S. Department Of Agriculture, Forest Service and U.S. Department of the Interior, Bureau of Land Management, April 13, 1994; and
- Revised Recovery Plan for the Northern Spotted Owl, June 28, 2011.
- The Biological Assessment of LAA Projects with the Potential to Modify the Habitat and/or Disrupt Northern Spotted Owls – Willamette Planning Province – FY 2016/17 was used to determine effects. A biological assessment and biological opinion which includes this project would need to be completed prior to a final decision notice being signed for this project. The determination expected to be made in the Biological Assessment for the Hwy 46 project, which would be completed and concurrence received from the USFWS prior to the final decision notice is signed, is this project may affect and is not likely to adversely affect spotted owls by disturbance.
- The Biological Opinion would fulfill the Endangered Species Act requirements for consultation with the U.S. Fish and Wildlife Service on project effects to northern spotted owls.

Spotted Owl Recovery Plan (Revised June 28, 2011)

This project is in compliance with the 2011 Revised Recovery Plan actions 6 and 32. Objectives for Hwy 46 include 1) Increase stand health and vigor. 2) Increase structural and species diversity across the landscape, including plant communities in riparian areas. 3) Reduce fuels to provide for public and firefighter safety in the event of a large-scale disturbance.

"Recovery Action 6: In moist forests managed for spotted owl habitat, land managers should implement silvicultural techniques in plantations, overstocked stands and modified younger stands to accelerate the development of structural complexity and biological diversity that will benefit spotted owl recovery."

"Recovery Action 32: Because spotted owl recovery requires well distributed, older and more structurally complex multi-layered conifer forests on Federal and non-federal lands across its range, land managers should work with the Service as described below to maintain and restore such habitat while allowing for other threats, such as fire and insects, to be addressed by restoration management actions. These high-quality spotted owl habitat stands are characterized as having large diameter trees, high amounts of canopy cover, and decadence components such as broken-topped live trees, mistletoe, cavities, large snags, and fallen trees."

Existing Condition

There are 16,024 acres (53%) of suitable spotted owl habitat currently in the planning area. Dispersal habitat of 7993 acres (26%) and 6433 acres (21%) that is non-habitat for spotted owls. Total acres of land analyzed in the planning area are 31,081 acres which for analysis is reduced by areas that are not capable of functioning as habitat in the future such as cliffs, talus, roads, lakes, rivers and private land were estimated. The estimated acres deducted included 159 acres of private land owned by Breitenbush Hot Springs, 311 acres of powerline corridor, 70 acres of cliffs and talus, 30 acres of river and 60 acres of roads. Total acres deducted from non-habitat acres is 630. Total acres capable of growing owl habitat is 30,451 acres.

Harvest during the 1960-1996 time period occurred on approximately 33% of the landscape and these areas are now in mid-seral habitat condition. Matrix land would develop suitable habitat in riparian reserves which is expected to remain intact for long periods of time. Non-riparian matrix land is expected to cycle through periods of no habitat and dispersal habitat as timber harvest occurs. LSR areas are expected to continue increasing in age and stand diversity with no scheduled timber harvest as the objective of LSR is to provide mature forests. CHU areas are designated for the recovery of NSO and guidelines related to this designation would increase suitable owl habitat over time. As LSR and CHU have similar objectives they are both expected to increase in number of acres of suitable NSO habitat over time and maintain large contiguous areas of habitat.

Twenty one known Spotted Owl activity centers are located in the planning area. These activity centers were identified during surveys in 2014, 2015 and 2016. All of the activity centers have proposed project activities occurring within their home ranges. Seven activity centers outside the planning area have home ranges (a circle 1.2 miles in diameter around the activity center) that overlap proposed activities. A total of twenty eight activity centers within 1.2 miles of proposed activities were analyzed.

Challenges to spotted owl conservation exist range-wide, including potential threats from wildfires, barred owl competition, great horned owl predation, West Nile virus and sudden oak death. Range-wide disturbances on the landscape from wildfires and wind storms have affected spotted owl habitat range-wide.

Effects of habitat modification on individual northern spotted owl sites are assessed at three spatial scales: the home range, core area, and nest patch.

Home Range – A home range in the Oregon Cascades Province is a 1.2 mile radius circle (2,955 acres) centered on an activity center (i.e. nest site). It is used by northern spotted owls to obtain cover and food, and for reproduction and rearing of young. Home ranges of multiple northern spotted owl pairs may overlap with habitat shared between adjacent resident northern spotted owl pairs and dispersing northern spotted owls. These areas are important for the survival and productivity as northern spotted owls are non-migratory.

Core Area – Within the home range, the core area (500 acres) is a 0.5 mile radius circle centered on the activity center, representing the area most heavily used during the nesting season (USDI USFWS et al. 2008). The core area is defended by territorial northern spotted owls and generally does not overlap the core areas of other northern spotted owl pairs.

Nest Patch – Within the core area, the nest patch (70 acres) is defined as a 300 meter radius circle around the activity center (USDI USFWS et al. 2008). The two key elements of habitat within a nest patch are: (1) canopy closure of dominant, co-dominant, and intermediate conifer and hardwood trees and (2) the amount of down wood (USDI USFWS et al. 2008). Modification of habitat within this area is considered likely to affect the reproductive success of nesting northern spotted owls and is used in determination of incidental take (USDI USFWS et al. 2008). There are no proposed units that overlap nest patches.

The U.S. Fish and Wildlife Service (USFWS) have determined viability thresholds of 50% suitable habitat in the core area and 40% suitable habitat in the home range, respectively. Suitable habitat levels below these thresholds are thought to compromise the reproductive success of owls (USDI USFWS et al. 2008). Owls may successfully fledge young when suitable habitat drops below these percentages, but the likelihood of this decreases as suitable habitat declines.

3.6.5 Environmental Consequences – Northern Spotted Owl (Federally Threatened Species)

Direct and Indirect Effects

Alternative 1 – No Action

Alternative 1 would maintain stands on their current successional trajectory and would likely delay attainment of multi-story canopy layers and larger diameter trees, snags, and down wood needed for late successional habitat compared to stands thinned under the proposed action alternatives. Due to current closed canopy conditions reducing sunlight to the ground understory development would be delayed for approximately 100 years in untreated stands. The development of suitable owl habitat would occur more slowly in Alternative 1 than in the action alternatives.

Alternative 2

Effects of Habitat Modification: Approximately 2056 acres of dispersal and 833 acres of suitable habitat would be thinned and remain habitat after thinning. Thinning would open the canopy allowing sunlight to reach the forest floor and allow for the development of an understory. Gaps would be created in commercial thinning units with approximately 28 acres of dispersal removed and 20 acres of gaps in suitable removed. Where habitat is removed it will take approximately 30 years for dispersal habitat to regrow and 80 years for foraging habitat to regrow. Dominant tree release would degrade but not remove approximately 6 acres of suitable and 33 acres of dispersal habitat. Sugar pine shelterwood harvest would remove approximately 80 acres of suitable and 10 acres of dispersal habitat. Early seral would remove approximately 35 acres of suitable and 19 acres of dispersal habitat. Road relocation would remove approximately 2 acres of foraging habitat. Hazardous fuel treatment would occur on approximately 167 acres of suitable and 28 acres of dispersal habitat which would remain habitat. Understory habitat enhancement would occur on approximately 30 acres of suitable (foraging) and 108 acres of dispersal habitat which would remain habitat. In alternative 2 approximately 131 acres of suitable habitat and 96 acres of dispersal habitat would be removed. Where habitat is removed it will take approximately 30 years for dispersal habitat to regrow and 80 years for foraging habitat to regrow.

Effects of Habitat Modification on Critical Habitat: Of the proposed treatments approximately 1625 of 2056 acres of dispersal and 829 of 833 acres of suitable habitat would be thinned and remain habitat after thinning in Northern Spotted Owl Critical Habitat (CHU). Gaps would be created in commercial thinning units with approximately 28 acres of dispersal removed and 20 acres in suitable removed in CHU. Where habitat is removed it will take approximately 30 years for dispersal habitat to regrow and 80 years for foraging habitat to regrow. Dominant tree release would degrade but not remove approximately 11 acres of suitable and 55 acres of dispersal in CHU. Sugar pine shelterwood harvest would remove approximately 75 acres of suitable and 3 acres of dispersal habitat in CHU. Early seral and meadow restoration would remove approximately 29 acres of suitable habitat and 17 acres of dispersal habitat. Road relocation would remove approximately 2 acres of foraging habitat. Hazardous fuel treatment would occur on approximately 167 acres of suitable and 28 acres of dispersal habitat which would remain habitat in CHU. Understory habitat enhancement would occur on approximately 30 acres of suitable (foraging) and 80 acres of dispersal habitat which would remain habitat. These treatments are designed to improve stands by encouraging growth of an understory and increasing structural diversity within the stands.

Effects of Habitat Modification on Late Successional Reserve: Of the proposed treatments approximately 656 acres of dispersal and 3 acres of suitable habitat would be thinned and remain habitat after thinning in Late Successional Reserve (LSR). Currently these stands are single storied and lack complexity. Gaps in commercial thinning units would remove approximately 3 acres of dispersal habitat for approximately.40 years. Dominant tree release would degrade but not remove any suitable habitat and approximately 2 acres of dispersal in LSR. Sugar pine shelterwood harvest would not remove suitable or dispersal habitat in LSR. Hazardous fuel treatment would occur on approximately 108 acres of suitable and 28 acres of dispersal habitat which would remain habitat in LSR. Understory habitat enhancement would occur on approximately 28 acres of dispersal habitat which would remain dispersal habitat, no suitable habitat would be affected. LSR quality is expected to be improved by adding structure, increasing overall stand diameter and encouraging growth of an understory.

A few remnant older trees may be present in some planned thinning units and these trees are protected from cutting unless identified as hazard trees, which may be felled for operational purposes, and left in place. All legacy trees from the previous stand (≥) 30 inches dbh) should not be cut in thinning units. In LSR the maximum diameter limit is 20 inches dbh.

Alternative 3

Effects of Habitat Modification: Approximately 1957 acres of dispersal and 247 acres of suitable habitat would be thinned and remain habitat after thinning. Thinning would open the canopy allowing sunlight to reach the forest floor and allow for the development of an understory. Gaps would be created in commercial thinning units with approximately 28 acres of dispersal removed and 3 acres of suitable removed. Where habitat is removed it will take approximately 30 years for dispersal habitat to regrow and 80 years for foraging habitat to regrow. Dominant tree release would degrade but not remove approximately 1 acre of suitable and 59 acres of dispersal habitat. Sugar pine shelterwood harvest would remove no acres of suitable and approximately 5 acres of dispersal habitat. Early seral would remove no acres of suitable habitat and approximately 19 acres of dispersal habitat. Road relocation would remove approximately 2 acres of foraging habitat. Hazardous fuel treatment would occur on approximately 167 acres of suitable and 28 acres of dispersal habitat which would remain habitat. Understory habitat enhancement would occur on approximately 30 acres of suitable (foraging) and 108 acres of dispersal habitat which would remain habitat. In alternative 3 approximately 5 acres of suitable habitat and 33 acres of dispersal habitat would be removed. Where habitat is removed it will take approximately 30 years for dispersal habitat to regrow and 80 years for foraging habitat to regrow.

Effects of Habitat Modification on Critical Habitat: Of the proposed treatments approximately 1594 of 1957 acres of dispersal and 112 of 247 acres of suitable habitat would be thinned and remain habitat after thinning in CHU. Gaps would be created in commercial thinning units with approximately 28 acres of dispersal removed and 3 acres of suitable removed in CHU. Where habitat is removed it will take approximately 30 years for dispersal habitat to regrow and 80 years for foraging habitat to regrow. Dominant tree release would remove but not degrade no acres of suitable and approximately 45 acres of dispersal in CHU. Sugar pine shelterwood harvest would remove no acres of suitable and approximately 2 acres of dispersal habitat in CHU. Early seral would remove no acres of suitable habitat and approximately 19 acres of dispersal habitat. Road relocation would remove approximately 2 acres of foraging habitat in CHU. Hazardous fuel treatment would occur on approximately 167 acres of suitable and 28 acres of dispersal habitat which would remain habitat in CHU. Understory habitat enhancement would occur on approximately 30 acres of suitable (foraging) and 80 acres of dispersal habitat which would remain habitat. These treatments are designed to improve stands by encouraging growth of an understory and increasing structural diversity within the stands.

Effects of Habitat Modification on Late Successional Reserve: Of the proposed treatments approximately 656 of 1957 acres of dispersal and 3 of 247 acres of suitable habitat would be thinned and remain habitat after thinning in Late Successional Reserve (LSR). Gaps would be created in commercial thinning units with approximately 3 acres of dispersal removed, there are no gaps in suitable habitat in LSR. Where habitat is removed it will take approximately 30 years for dispersal habitat to regrow and 80 years for foraging habitat to regrow. Dominant tree release would not remove any acres of suitable, but would degrade approximately 32 acres of dispersal in LSR. Sugar pine shelterwood harvest would not remove suitable or dispersal habitat in LSR. Hazardous fuel treatment would occur on approximately 108 acres of suitable and 28 acres of dispersal habitat which would remain habitat in LSR. Understory habitat enhancement would not occur on suitable (foraging) but would occur on approximately 28 acres of dispersal habitat which would remain dispersal habitat. LSR quality is expected to be improved by adding structure, increasing overall stand diameter and encouraging growth of an understory.

A few remnant older trees may be present in some planned thinning units and these trees are protected from cutting unless identified as hazard trees, which may be felled for operational purposes, and left in place. Most thinning units have no remnant trees or snags.

Variable density thinning adds diversity to the stands which also benefits owls by providing more diverse habitats for prey species.

For more detailed analysis at a province level refer to the biological assessment and letter of concurrence referenced in this document. These documents would need to be completed prior to a final decision being signed for this project.

Spotted Owl Recovery Plan (Revised June 28, 2011)

Alternatives 2 and 3 are in compliance with the 2011 revised recovery plan actions 6 and 32. Treatments in RA32 are limited to hazardous fuel reduction adjacent to the Breitenbush community. Harm is not expected to occur to any nesting spotted owls as activity centers have been located by surveys and seasonal prohibitions on activities would be implemented. Owl home ranges would not have acres reduced by proposed treatments to below minimum viability levels.

Effects of Disturbance from Project Activities

The BA for consultation is being written between the draft and final EIS documents, this project would comply with protection measures which would avoid any actions which would result in a May Affect and Likely to Adversely Affect from disturbance determination. All MA-LAA disturbance activities are prohibited in the Hwy 46 project. Only MA-NLAA or NE disturbance activities are planned to occur in the project. This project proposes activities which are within the disruption distance of known spotted owl activity centers. Activities within the disruption distance of activity centers are prohibited from occurring during the critical nesting period to protect nesting owls. This project does propose activities which are within the disturbance distance of eighteen spotted owl activity centers. The determination made in the Biological Assessment for the Hwy 46 project, which would be completed and concurrence received from the USFWS prior to the final decision notice being signed, this project may affect and is not likely to adversely affect spotted owls by disturbance.

The proposed action includes all processes needed to plan, evaluate, survey, prepare and complete activities including, but not limited to, falling, bucking, helicopter yarding, hauling, road reconstruction; and the interdependent actions of rock source operations, post-harvest burning, fuel reduction treatments and post-harvest project generated firewood sales. Rock pit operations may require blasting, rock crushing, and operation of heavy equipment.

There are no other projects occurring in the planning area which occur within the disruption distance of known spotted owl activity centers.

Cumulative Effects

Alternative 1 – No Action

Alternative 1 would have no direct effects on spotted owl habitat, so there are no cumulative effects to be considered.

Alternatives 2 and 3

No projects on federal land are anticipated which would remove more suitable habitat or reduce the amount of dispersal habitat in the planning area.

The habitat and pre-field review section and existing conditions section for NSO considers all impacts to habitat to date.

Ongoing road maintenance is expected to continue to fall hazard trees adjacent to roads which would continue to reduce the quality of suitable spotted owl habitat in the planning area. Personal use firewood cutting is expected to continue near roadways and is expected to maintain reduced amounts of downed wood and thus lower the quality of suitable habitat adjacent to road corridors.

Dispersal habitat is well connected with suitable habitat in the planning area. Foreseeable actions in conjunction with the effects of implementing Alternative 2 are not expected to compromise the functionality on any NSO home ranges or create barriers to dispersal across the project area.

Determination

Habitat

The Biological Assessment of LAA Projects with the Potential to Modify the Habitat and/or Disrupt Northern Spotted Owls – Willamette Planning Province – FY 2016/17 was used to determine effects. The determination made in the Biological Assessment is for projects similar to Hwy 46, which received concurrence from the USFWS, is this project may affect and is likely to adversely affect spotted owls by habitat modification. A biological assessment and biological opinion which includes this project would need to be completed prior to a final decision notice being signed for this project.

Disturbance

There are no project activities within the disruption distances of known spotted owl activity centers which are proposed to occur during the critical nesting period. Activities would occur during the disturbance period and within a distance which could cause disturbance effect to eighteen known spotted owl activity centers. The determination expected to be made in the Biological Assessment for the Hwy 46 project, which would be completed and concurrence received from the USFWS prior to the final decision notice is signed, is this project may affect and is not likely to adversely affect spotted owls by disturbance.

3.6.6 Affected Environment – Proposed Threatened and Forest Service Sensitive Wildlife

Sensitive species are designated by the Regional Forester as species which have population viability concerns evidenced by: 1) Significant current or predicted downward trends in population numbers or density or 2) Significant current or predicted downward trends in habitat capability that will reduce a species existing distribution. All actions are taken to ensure that management activities do not jeopardize the continued existence of sensitive species or result in an adverse modification of their essential habitat (FSM 2670.3, Region-6 ID 2670-92-1, 1/91). Effects of the alternatives on Forest Service sensitive species are considered in a project Wildlife Biological Evaluation (BE). This environmental impact statement tiers to the analysis in the BE. One threatened, and thirteen sensitive species have habitat or potential suitable habitat in the project area and were analyzed in detail in the project BE. One of these species, the Crater Lake tightcoil snail, is on both the “Sensitive” species list and the “Survey and Manage” species list.

Regulatory Framework

Update of the Regional Forester Special Status Species List, July 21, 2015, provides the list of sensitive species addressed in this analysis.

Analysis Methods

A Biological Evaluation was prepared for this project as part of the wildlife specialist report, and is available in the project file located at the Detroit Ranger District office. This EIS tiers to that analysis and the findings are summarized in the Environmental Consequences of this section.

Existing Condition

Habitat is present in the planning area which could be occupied by the following sensitive species: American peregrine falcon, northern bald eagle, North American wolverine, harlequin duck, fringed Myotis, fisher, Townsend's big-eared bat, Johnson's hairstreak, Crater Lake tightcoil snail and western bumble bee. Detailed information on these sensitive species can be found in the Hwy 46 biological evaluation for wildlife.

Bald eagles are protected by the Bald and Golden Eagle Protection Act which prohibits disruptions to the bald eagle to the point of harm. Bald eagle populations have been increasing on the Detroit Ranger District and as new territories are established shifts in bald eagle use patterns may occur. Periodic monitoring of nesting sites provides information, such as alternative nest locations, needed to protect these areas.

Species Analyzed in Biological Evaluation

American Peregrine Falcon

Preferred nesting sites for peregrines are sheer cliffs 75 feet or more in height having horizontal ledges or small caves. Foraging is associated with a variety of open and forested habitats, however it is most closely associated with riparian settings. One known and two potential nest sites occur in the analysis area. Numerous potential nest sites and occupied territories occur on the Willamette National Forest.

Northern Bald Eagle

Bald eagles use scattered old-growth conifer trees in proximity to open water near rivers, lakes, and reservoirs with plentiful prey. Feed primarily on fish, but will also eat waterfowl and carrion. On the Detroit Ranger District they currently nest at Detroit Reservoir and Marion Lake. Foraging habitat is available primarily on the Breitenbush River in the analysis area.

Harlequin Duck

During nesting (April-June) adults require fast-flowing water with midstream loafing sites nearby, dense shrub or timber/shrub mosaic vegetation on the bank, and an absence of human disturbance. Nest on ground under the shelter of vegetation, rocks, or large woody debris in close proximity to water. Broods prefer low gradient streams with adequate macro-invertebrate abundance. Breeding and foraging known to occur along the Little North Fork of the Santiam River, Humbug Creek, North Fork of the Santiam River, Breitenbush River, Marion Creek, Devils Creek and Blowout Creek on the Detroit Ranger District. The Breitenbush River, Devils Creek and Humbug Creek occur in the planning area.

North American Wolverine (Proposed Threatened)

Found primarily in wilderness or remote country where human activity is limited. High elevation areas appear to be preferred in summer, which may effectively separate wolverines and intensive human disturbance in most areas. In winter wolverines may move to lower elevations that are snowbound and/or have very limited human activity. They are capable of foraging widely (30-40 km) on a daily basis, and do not significantly use young, dense stands of timber or clear-cuts. The majority of activity occurs in large expanses of scattered mature timber, with some use of ecotonal areas such as small timber pockets, and rocky, broken areas of timbered benches. Heavy use of openings in areas with good winter populations of big game is a principal source of carrion which makes up much of the wolverine's diet. They also feed on marmots, snowshoe hares, various rodents, insects, insect larvae, eggs, and berries. Historical sightings on the Detroit Ranger District have occurred over a wide range of habitat types and locations. Sightings have not been reported in approximately 15 years with the last report south of the project area near Marion Forks. The wolverine is proposed threatened by the USFWS. A study was conducted during 2 field seasons (approximately Oct-May 2012-2014 in the Willamette and Deschutes National Forests in the Mt. Jefferson and Mt. Washington Wilderness areas with no wolverines detected.

Sierra Nevada Red Fox

Sierra Nevada red fox is known to occur on Detroit Ranger District near Santiam Pass. This species occurs at high elevations near the crest of the Cascade Mountains. In California they live in open conifer woodlands and mountain meadows near tree line. This species is not expected to occur in the project area as habitat for this species is not present.

Fisher

Considered a riparian associate but found in a wide variety of densely forested habitats at low to mid-elevations. Data suggests they do better in areas with minimized fragmentation of old growth, second-growth, and riparian area and in areas with abundant down and standing woody material important. No sightings of fishers have been recorded on the Detroit Ranger District. A survey was conducted by the USFWS during the winter of 2015-2016 to determine presence of fishers in the Northern Cascades of Oregon. Camera data was collected from survey sites during the summer of 2016 with analysis ongoing. This survey is part of a potential reintroduction of fisher proposal from the USFWS.

Fringed Myotis Bat

Occurs in Oregon, however, habitat use is poorly documented. Three captured in 1971 were associated with young coniferous forest. They are known to use caves, mines, rock crevices, and buildings as both day and night roosts. Little is known about habits in winter. Diet of moths, leafhoppers, lacewings, daddy-longlegs, crickets, flies, true bugs, and spiders. Occurrence has been documented on Detroit Ranger District. (Pat Ormsbee, Willamette N.F.)

Townsend’s Big-Eared Bat

Found throughout Oregon where suitable roosting habitat occurs. Forage preference is mostly moth species. Literature reviews indicate it is highly susceptible to disturbance by humans. Roosts range from caves, cliff-faces, large trees, mines to houses. Townsend’s big-eared bats have been documented on the Detroit Ranger District.

Johnson’s Hairstreak Butterfly

Habitat is conifer forests with dwarf mistletoe. It is thought to fly high in the canopy where dwarf mistletoe grows so is rarely seen from the ground. As mistletoe grows mostly on larger trees mature forest are generally associated with this species. The species ranges from central California to British Columbia. Three sightings have been reported on the Detroit R.D., however, none were in the planning area. Where mature forests are present in the planning area Johnson’s hairstreak butterflies are likely to occur.

Western Bumble Bee

A generalist pollinator species with a wide range in Western North America. Populations and range are decreasing. Populations of the western bumblebee in central California, Oregon Washington and southern British Columbia have mostly disappeared. (USFS fact sheet, http://www.fs.fed.us/r6/sfpnw/issssp/species-index/fauna-invertebrates.shtml). Surveys on the Detroit Ranger district were conducted in 2015 and 2016 in the project area. No western bumble bees were located in the project area.

Crater Lake Tightcoil Snail

This species is associated with areas within 10 meters of perennial wetlands and riparian areas (Duncan et al. 2003).

3.6.7 Environmental Consequences - Proposed Threatened and Forest Service Sensitive Wildlife

Direct and Indirect Effects

Alternative 1 – No Action

There would be no direct effects to any sensitive species in the no action alternative. Without meadow restoration projects habitat for western bumble bees would continue to slowly diminish.

Direct and Indirect Effects

Alternatives 2 and 3

The effects of Alternative 2 on sensitive species are summarized from the project biological evaluation.

American peregrine falcon nesting habitat (cliffs) would not be impacted by proposed activities. Treatments proposed in the primary nest zone of high potential site, Cliffs Creek, would thin habitat in units 70 and 71. Foraging habitat in units 70 and 71 would become more open with better access to prey species. All proposed treatments with potential to disturb nesting falcons at the known site would be restricted January 15 to July 31. Two high potential sites may be impacted by project activities if peregrine pairs occupy a site. Sale contracts contain C-clauses to protect raptors if new pairs are located during project implementation.

Harlequin duck habitat is expected to be disturbed and remain functional where project activities are occurring within 200 feet of the Breitenbush River and Devils Creek. All project activities with potential to impact nesting harlequin ducks are restricted from March 15 to July 15 to avoid disturbance.

The bald eagle is not expected to be impacted by the proposed alternatives. No bald eagles were located during surveys of the planning area.

Wolverine and fisher are both unlikely to occur in the project area and are not expected to be affected by proposed activities.

Fringed Myotis and Townsend's big-eared bat may be impacted if trees which have potential to be used for nursery colonies are felled as hazards during harvest operations. Potential habitat for nursery colonies may exist but have not been located within the project boundaries. Old-growth trees would be retained in harvest units, unless they are determined to be safety hazards. Stands with legacy trees and old-growth stands occur throughout the planning area and adjacent to proposed harvest units. These stands are expected to continue providing roosting and nursery habitat so viability of these bat species is expected to be maintained.

Johnson's hairstreak butterfly has been documented on the Detroit Ranger District but has not been documented in the project area. This species is associated with coniferous forests that have dwarf mistletoe. Potential impacts may occur if old-growth tree habitat, which has potential to also contain dwarf mistletoe, is felled as hazard trees during harvest operations. Any loss of individual old-growth trees in harvest units would have an inconsequential impact on overall habitat availability as suitable individual trees and patches of old growth trees are located in adjacent stands. Alternative 2 would have a minimal impact on Johnson's hairstreak viability in the planning area.

Western bumble bee historically present in the planning area and not located during surveys. Meadow restoration activities are expected to improve potential habitat which may be used in the future if this species recolonizes the planning area.

Crater Lake tightcoil snail is associated with perennially wet areas. Their habitats are unlikely to occur in proposed treatments units and no impacts to individuals are expected from proposed activities.

Determination

The proposed project may adversely impact individuals of proposed, threatened and forest service sensitive species, but is not likely to result in a loss of viability in the planning area or cause a trend to federally listing or a loss of species viability range wide.

Cumulative Effects

All Alternatives

For sensitive species, the cumulative effects analysis area is the project area. On-going hazard tree removal along roads is expected to impact bats and their habitat. No cumulative impacts, in addition to the proposed alternatives, are expected to occur for peregrine falcon, bald eagle, harlequin duck, wolverine, fisher, Johnson's hairstreak butterfly or western bumble bee. When considered together with other activities in the analysis area this project does add to other past, present and reasonably foreseeable activities to produce some cumulative effects to one sensitive species, but only to a small degree and cumulatively, it is not likely to result in a loss of viability in the planning area nor cause a trend to federally listing or a loss of viability range wide for these species.

3.6.8 Affected Environment – Survey and Manage Species

Survey and manage requirements originated in the "Northwest Forest Plan" also known as "The Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl, Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl", April 1994, p. C-4-6. The "survey and manage" standard and guideline will provide benefits to certain species of amphibians, mammals, bryophytes, mollusk, vascular plants, fungi, lichens, and arthropods.

A record of decision and standards and guidelines for amendments to the survey and mange, protection buffer, and other mitigation measures standards and guidelines came out in January of 2001. Various supplements and modifications were made to these documents and a lawsuit resulted in a settlement agreement in 2011.

Regulatory Framework

The 2011 Settlement Agreement in Litigation over the Survey and Manage Mitigation Measure in Conservation Northwest et al. v. Sherman et al., Case No 08-1067-JCC (W.D. Wash.) reset direction. The Court set aside the 2007 RODs, putting into effect the Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (USFS it al. 2001) (2001 ROD). Projects within the range of the northern spotted owl are subject to the Survey and Manage Standards and Guidelines in the 2001 ROD as modified by the 2011 Settlement Agreement.

This project is consistent with the January 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines.

This project utilizes the December 2003 species list. This list incorporates species changes and removals made as a result of the 2001, 2002, and 2003 Annual Species Reviews with the exception of the red tree vole, *Arborimus longicaudus*. For the red tree vole, the Ninth Circuit Court of Appeals in KSWC et al. V. Boody et al., 468 F3d 549 (9th Cir. 2006) vacated the category change and removal of the red tree vole in a portion of its range, and returned the red tree vole to its status as existed in the January 2001 Record of Decision and Standards and Guidelines, which makes the species Category C throughout its range.

In addition, there are 12 species receiving special considerations as directed in the May 13, 2014 Regional Forester letter. We reviewed these species and conducted pre-disturbance surveys and manage known sites for *Megomphix hemphilli*. The other 11 species either do not have habitat in the project area or are covered in the botanical resources section of this EIS.

Exemption from Survey and Manage Pre-Disturbance Surveys

The Settlement Agreement acknowledges and maintains in force the stipulation in previous litigation which exempts four categories of projects. These exemptions removed pre-disturbance surveys and known site management from:

1. Thinning in forest stands younger than 80 years of age;
2. Culvert replacement/removal;
3. Riparian and stream improvement projects;
4. Hazardous fuel treatments applying prescribed fire for noncommercial projects.

Proposed projects in the Hwy 46 project are partially within the parameters of the exemptions from pre-disturbance surveys. Hazardous fuel treatments are removing understory trees less than 7 inches dbh and machine piling, hand piling or chipping/mulching and underburning. Road closures are not impacting habitat and culvert removals are exempt from surveys.

Survey and Manage Pre-Disturbance Surveys

Activities which are not exempt from surveys include thinning harvest units over 80 years old which were surveyed to protocol for survey and manage species. Big game habitat enhancements in the form of large gaps are occurring in proposed thinning units within some stands over 80 years old. Some sugar pine restoration, dominant tree release, early seral habitat creation and meadow restoration is occurring in stands over 80 years of age and were surveyed to protocol standards. No survey and manage species were located during surveys of suitable habitat.

The Survey and Manage tracking form is located in the wildlife report in the project file at the Detroit Ranger District. Details of the project surveys and/or site management are described below.

Oregon Megomphix

This snail occurs at low to moderate elevations, below the zone of seasonally persistent snow pack. *Megomphix* snails are most often found within the mat of decaying vegetation under sword ferns and big-leaf maple trees and near rotten logs. Most occupied sites are on well-shaded slopes and terraces, and many are near streams (Management Recommendations for Terrestrial Mollusk Species: *Megomphix hemphilli*, the Oregon Megomphix, Version 2.0, Applegarth 2000). Oregon Megomphix is in S&M Category “A” North of the south boundary of Linn County, this project is in Marion County, so surveys are required. There are no records of the Oregon Megomphix in the project area. Surveys to protocol standards were conducted where activities are proposed which can disturb habitat below 3000’ elevation in stands over 80 years of age. No Oregon Megomphix were located during surveys.

Red Tree Vole

The standards and guidelines to conduct red tree vole surveys and protect nest sites were developed, along with other habitat protection measures from the Northwest Forest Plan to provide a reasonable assurance of persistence of certain species, such as red tree vole, which were believed to be rare and uncommon across the range of the Northwest Forest Plan at the time it was developed. For vertebrate species, like voles, this persistence objective is consistent with the goals of providing for viable and well-distributed populations under the National Forest Management Act Regulations (Forest Service and BLM 2001:3-4; Forest Service and BLM 1994:43-47).

Pre-disturbance surveys for the red tree vole were conducted in 2014-2016 in all proposed Alternative 2 stands over 80 years of age as required by the Red Tree Vole Survey Protocol Version 3.0 (Forest Service and BLM 2012). Trees were climbed where potential nests were located in units 7, 13 and 40. No red tree vole nests were found. A sample of an old red tree vole nest was dropped off by a member of the public at the Detroit Ranger District with UTM coordinates provided which place the sample collection point in proposed unit 94. Unit 94 is in CHU where all trees greater than 30 inches dbh are retained. The diameter of the sample tree is 48 inches and is a Douglas-fir. The person climbed several large trees around this tree but did not find additional nests. As the nest site was inactive it does not require site management or protection.

Great Gray Owl

Individual great gray owls can be found in a wide variety of habitat types. However, forests appear to be necessary for reproduction in North America (Habeck 1994, Duncan and Hayward 1994). Examples of forest types known to be suitable for great gray owls include: ponderosa pine (*Pinus ponderosa*), lodgepole pine (*Pinus contorta*), tamarack (*Larix occidentalis*), Douglas-fir (*Pseudotsuga menziesii),* grand fir (*Abies grandis*), mixed conifer- hardwood, aspen (*Populus tremuloidus*), and other deciduous tree types. Platt and Goggins (1991) found great gray owl nests on the Willamette National Forest in mature and remnant old-growth Douglas-fir and mixed-conifer habitat. Most nests are located near natural meadows or manmade openings. Bryan and Forsman (1987) found nests in south central Oregon to be less than 980 feet (300m) from the nearest meadow opening. Platt and Goggins (1991) found nests within 660 feet (200m) of a timber-harvest-created opening.

The required habitat characteristics of suitable great gray owl habitat include: (1) large diameter nest trees, (2) forest for roosting cover, and (3) proximity [within 600 feet] to openings that could be used as foraging areas (Survey Protocol for the Great Gray Owl within the range of the Northwest Forest Plan v3.0, January 12, 2004). In some locations on the Willamette National Forest, shelterwood harvesting has been found to be beneficial because it opens up closed forest canopy cover for foraging (Forest Service and Bureau of Land Management 2001). NRIS, the Forest Service web-based wildlife sighting database, currently shows no records of great gray owls in the project area. Two sightings were located in the database on the Detroit Ranger District and are south of the project area approximately 10 miles.

Pre-disturbance survey(s) for Great Gray Owls are not required for the Hwy 46 project because the activities in Alternatives 2 and 3 do not have proximity to natural openings > 10 acres, and pre-disturbance surveys are not required in suitable nesting habitat adjacent to man-made openings at this time (pg. 14, Survey Protocol for the Great Gray Owl within the range of the Northwest Forest Plan v3.0, January 12, 2004).

Crater Lake Tightcoil Snail

Species may be found sparsely distributed throughout Oregon Cascades above 2000' elevation associated with perennially wet environment in mature conifer forests and meadows among vegetation or under rocks and woody debris. Suitable locations within 10 meters of open water generally in areas under snow for extended periods during winter. One documented site occurs on the Willamette N.F. on Middle Fork R.D. A few occurrences have been documented on the Mt Hood, Deschutes, Umpqua, Winema, and Rogue River National Forests. No individuals have been documented on the Detroit R.D.

Pre-disturbance surveys were required for the Hwy 46 project as suitable habitat for Crater Lake tightcoil would be impacted by proposed project activities. No Crater Lake tightcoil snails were located during surveys of the project area.

3.6.9 Environmental Consequences – Survey and Manage Species

All Survey and Manage Species

Direct and Indirect and Cumulative Effects - All Alternatives

No Survey and Manage species were detected during surveys. Direct and indirect effects to potential red tree vole habitat would occur in action alternatives. Cumulative effects to red tree voles are expected to occur where road maintenance activities remove hazard trees which have potential to be suitable habitat.

3.6.10 Affected Environment – Raptors and Colonial Nesting Birds

Regulatory Framework

The Forest Plan directs projects on the forest to manage for raptors and colonial nesting birds. Active roost and nest sites (including rookeries) shall be protected. Timber harvest may be foregone in a primary zone extending up to 500 feet from the nest or roost site. Where activities of significant disturbance and duration are near active roost sites it may be necessary to establish a secondary Restricted Activity Zone outside the primary zone. This secondary zone could range up to 1,000 feet or more from the nest or roost site, depending on the individual situation. Timing or duration of operations may be restricted within the secondary zone.

Analysis Methods

Raptor and colonial bird nest sites have been recorded in the analysis area as a result of past sightings. Field visits to the project area in 2014, 2015 and 2016 did locate active osprey nests. Surveys were not conducted within sale units for raptors.

Existing Condition

Bald eagle potential nesting habitat is present in the project area. No bald eagles were observed in the project area. Osprey nests have been documented in the analysis area within 1000 feet of proposed activities or in locations which would cause disturbance to nesting. Large trees which could be used by nesting raptors or colonial nesting birds such as Vaux's swifts are present in the project area and it is likely some of these trees are used for nesting and roosting.

3.6.11 Environmental Consequences – Raptors and Colonial Nesting Birds

Direct and Indirect Effects

Alternative 1 – No Action

Active roost and nest sites for raptors and colonial nesting birds would not be disturbed. Stands would continue in their current growth trajectory and trees would generally be smaller and provide less desirable nest sites compared to Alternatives 2 and 3.

Direct and Indirect Effects

Alternative 2 and 3

The effect of the two action alternatives on raptors and colonial nesting birds are similar. Active roost and nest sites for ospreys have been identified in the project area within 1000 feet of proposed activities. Seasonal restriction on project activities would protect these nest sites from disturbance. One osprey nest was located adjacent to unit 13, a seasonal restriction on all activities from March 1 – July 31 would protect nesting birds. Nest trees are expected to remain after harvest as potential nest trees are located outside proposed harvest units. Potential nest trees with old growth characteristics within proposed units, if present, would be retained and available for future nesting use as they are protected from harvest. All other proposed activities are not expected to impact raptors and colonially nesting birds. If new nests are located in the future a seasonal restriction on activities which have the potential to disturb nesting birds is recommended and the nest tree is to be protected. The both alternatives as proposed comply with Willamette Forest Plan Standards and Guidelines.

Cumulative Effects

All Alternatives

There are no additional projects occurring in the project area which would cause cumulative impacts to raptors and colonial nesting birds.

3.6.12 Affected Environmental – Management Indicator Species

The implementing regulations for the National Forest Management Act of 1976 (NFMA) require the Forest Service to plan the management of wildlife habitats to "maintain viable populations of existing native and desired non-native vertebrate species in the planning area." Implementing regulations for NFMA further define viable population management. "In order to insure that viable populations will be maintained, habitat must be provided to support at least a minimum number of reproductive individuals and that habitat must be well distributed so that individuals can interact with others in the planning area" (36CFR 219.19). To facilitate management of all these species, NFMA further requires each Forest to identify management indicator species (MIS) through the planning process and to establish objectives to maintain and improve the habitats of these indicator species. Management indicator species represent either featured species or ecological indicators. Featured species are threatened and endangered plant and animal species on federal lists, species that are hunted, fished, or trapped, species of special concern or interest, and species with special habitat needs that may be at risk due to planned management activities. Ecological indicator species were selected because their population and habitat changes indicate potential effects of management activities on other species dependent on selected habitat types or water quality.

The use of Management Indicator Species (MIS) in project planning was established by the 1982 National Forest Management Act planning regulations. Management Indicator Species are species whose response to land management activities can be used to predict the likely response of a wide range of species with similar habitat requirements. Through Region-wide coordination, each Forest identified the minimum habitat distribution and habitat characteristics needed to satisfy the life history needs of management indicator species. Management recommendations to ensure their viability were incorporated into the Willamette Forest Plan (USDA Forest Service, 1990). Management indicator species include spotted owl, bald eagle, deer, elk, peregrine falcon, cavity excavators, pileated woodpecker and marten (Table 35).

The Willamette Forest Plan (1990) provides dedicated areas of mature and old-growth tree habitat to ensure maintenance of viable populations of selected management indicator species that are surrogates for a diversity of species dependent on old-growth habitat. Old growth and mature conifer habitat provides feeding, resting, and breeding areas that are required by northern spotted owl, pileated woodpecker, and marten. These management indicator species represent wildlife associated with late seral stages of forest development. As ecological indicators, these wildlife species represent all species which may be affected by limited amounts, distribution, and quality of mature and old-growth coniferous forests. The Northwest Forest Plan (1994) amended the Willamette Forest Plan. Administratively withdrawn areas that were specified in Forest Plan to benefit martens, pileated woodpeckers, and other late successional species were returned to matrix unless local knowledge indicated other allocations and these standards and guidelines will not meet management objectives for those species. On the Detroit Ranger District some pileated woodpecker and marten habitat areas were retained.

Viability of northern spotted owls is maintained by compliance with the 2011 Revised Spotted Owl Recovery Plan. Viability of peregrine falcons is maintained by compliance with Willamette Forest Plan for protection of raptors and colonial nesting birds. Viability of bald eagles is maintained by compliance with the Bald and Golden Eagle Protection Act as modified at the time they were removed from the threatened and endangered species list and by Willamette Forest Plan protection of raptors and colonially nesting birds. Viability of big game is maintained by management of big game by Oregon Department of Fish and Wildlife under the Black-tailed Deer Management Plan (Nov. 14, 2008) and the Oregon's Elk Management Plan (February 2003). Oregon Department of Fish and Wildlife monitors populations yearly to determine management and harvest levels to maintain viable populations of big game. Cavity excavator populations and pileated woodpeckers are monitored in a variety of ways, as described in Appendix 2 of the DecAID analysis, and viability based on population trends is stable or increasing statewide. Marten are managed for viability by ODFW as furbearers, regulated by Oregon Furbearer Trapping and Hunting Regulations and analyzed yearly with the most recent Oregon Furbearer Program Report published in August 2011.

The effects of the alternatives on northern spotted owl are addressed in a specific section for that species. The impacts of the alternatives on peregrine falcons and bald eagles are addressed in the section on Forest Service Sensitive Species.

Table 34 Wildlife Management Indicator Species for the Willamette National Forest

Indicator Species	Indicator Habitat	Reason Selected in 1990
cavity excavators[1]	dead and decaying trees	ecological indicator, limited habitat
elk	winter range	commonly hunted
deer	winter range	commonly hunted
pileated woodpecker	old growth and mature conifers	ecological indicator, limited habitat
marten	old growth and mature conifers	ecological indicator, limited habitat
northern spotted owl[2]	old growth and mature conifers	ecological indicator, limited habitat, proposed threatened species[2]
bald eagle[3]	old growth conifers near large bodies of water	federally threatened species[3]
peregrine falcon[3]	cliff nesting habitat near abundant prey	federally endangered species[3]

[1]Forest Service (1990) identified the following species in this group: red-breasted nuthatch, northern flicker, hairy woodpecker, downy woodpecker, red-breasted sapsucker, Lewis woodpecker, black-backed woodpecker, and northern three-toed woodpecker.

[2]Became a federally threatened species in June 26, 1990, as the Willamette NF Plan was being finalized.

[3]Bald eagles and peregrine falcons were subsequently delisted and are now Forest Service Sensitive Species.

Cavity Excavators, Pileated Woodpecker, and Deadwood Abundance

Cavity excavator MIS are used as an ecological indicator for the abundance of dead and decaying trees. Pileated woodpeckers are MIS that use snags, but also prefer old and mature forests and occur in the project area. Cavity excavator MIS species that occur or have potential habitat in the proposed Hwy 46 units are red-breasted nuthatch, northern flicker, hairy woodpecker, downy woodpecker, red-breasted sapsucker, Lewis woodpecker, black-backed woodpecker, and northern-three toed woodpecker.

Lewis woodpecker is a Forest Service sensitive species that does not breed on the Detroit Ranger District but regularly occurs along Cascade Mountain ridges in the fall (Marshall et al. 2003, NRIS_Wildlife database). This fall dispersal habitat in not thought to be limiting and the species is not expected to be present in the project BE. The Oregon Cascades-California and the Black Hills populations of black-backed woodpeckers have been petitioned for listing under the Endangered Species Act (USFWS 2013). The black-backed woodpecker responds to large fires on the Willamette National Forest, especially fires near the Cascade Crest in montane mixed conifer forests. The project area has had no recent large fires and populations of this species are thought to not occur in the project area.

None of the other cavity excavator MIS species are federally listed Endangered or Threatened Species, Forest Service Sensitive species, U. S. Fish and Wildlife Service Birds of Conservation Concern (USFWS 2008), or species that are regionally identified as having current viability concerns. Population trends for the species from breeding bird surveys from 1996─2013 indicate stable populations in Oregon for hairy woodpecker, downy woodpecker, Lewis woodpecker, and black-backed woodpecker and increasing population trends for pileated woodpecker and red-breasted sapsucker (Sauer et al. 2014). Breeding bird survey trends are not available for the northern three-toed woodpecker. A decline in northern flicker and red-breasted nuthatch has been detected in Oregon from 1996-2013. Northern flicker is a common resident species that is ubiquitous to most forest habitats in Oregon. They are most abundant in open forest habitat and along forest edges with available large (31 inches dbh or greater) snags (Marshall et al. 2003). The red-breasted nuthatch appears to be fairly common in Oregon and is somewhat flexible to use different forest types. This species is showing a slight population decline due to intensive forest management that reduces the amount of large diameter trees, snags, and structural diversity (Marshall et al. 2003). Despite a recent decline in numbers, both northern flickers and red-breasted nuthatches are well above population levels that would suggest a viability concern.

A collection of information, referred to as DecAID, has been developed by Region 6 to help projects identify the levels of snags and downed logs required to meet wildlife population needs (Forest Service, 2012). At the landscape level, DecAID recommends providing dead wood at levels within the range of historic variability.

Snags

Analysis Methods

Two analysis methods and scales were used to evaluate snags and down wood:

1) A snag model tied to a forest geographic information system layer of vegetation types was used to calculate current conditions in planning subdrainages affected by the project and for determining compliance with Willamette Forest Plan and Northwest Forest Plan Standards and Guidelines. The scale of analysis for the Willamette Forest Plan snag model describes conditions at the planning subdrainage level and is more responsive to project level effects on snag habitat than a larger landscape assessment.

2) DecAID, a web-based advisory tool was used to estimate historic and current snag and down wood levels at a watershed level and reflects a larger landscape reference of snag habitat than the snag model. DecAID contains data showing wildlife use of dead wood and showing amounts and sizes of down wood across the current landscape in managed and unmanaged stands. Vegetation data can help determine the “natural range of variability” for dead wood, which can be used as a proxy for historic range of variability. This provides a method of comparing current and historic levels of snags and downed logs. By managing habitat within historic range of variability it is assumed that adequate habitat will be provided because species survived those levels of habitat in the past to be present today. The further current conditions deviate from the historic range of variability the less likely adequate habitat is being provided to sustain those species using the habitat. Historic range of variability does not replace the standards and guidelines for dead wood in the Willamette Forest Plan.

The DecAID analysis can be found in Appendix F.

Regulatory Framework – Snag Model

Because proposed activities can affect the amount and distribution of snags, the effects of the alternatives on snag abundance were evaluated. The Willamette Forest Plan (WFP) directs snag habitat to be managed at levels capable of providing for at least 40% or greater potential populations of cavity-nesting species (FW-122). To meet the minimum diameter and height requirements to count toward Willamette Forest Plan objectives, a snag shall be greater than 18 inches dbh or the largest size available within the stand being treated and 20 feet tall (FW-128 and FW-130). Snag habitat shall be provided and monitored at the subdrainage level to provide for at least 40% or greater potential populations (WFP 1990). The Willamette Forest Plan, as amended by the 1994 Northwest Forest Plan (Forest Service 1994) (p. C-42), states, "As a minimum, snags are to be retained within the harvest units at levels sufficient to support species of cavity-nesting birds at 40% of potential population levels based on published guidelines and models." (The Willamette Forest Plan required 20 % as a minimum in harvest units, the amendment increased this to 40% in harvest units.) More recent science has invalidated the biological potential model concept (Rose et al. 2001). Until the Willamette Forest Plan is amended, the snag densities related to biological potential remain as minimum standards for snags.

For the Hwy 46 project area, it is estimated that 1.51 large snags/acre would meet the 40% population potential addressed in the Willamette Forest Plan standard. A snag density model tied to a geographic information system layer of forest vegetation size classes was used to calculate the current condition for primary cavity excavator population potential. Because the Forest Plan standard applies only to Forest Service lands, only Forest Service lands within the planning area are considered in this assessment. Due to the forest vegetation layer not being updated in many years the Fox planning subdrainage was analyzed based on current condition from stand exams in proposed treatment areas and field verification of habitat conditions.

Existing Condition

The area analyzed for effects are in the Cliffs, Devils, Fox, Hill, Humbug, Leone-Cultus, Mansfield, North Fork Breitenbush, Roaring, Scorpion, Short, South Fork Breitenbush and Tunnel planning subdrainages.

Table 35 Potential Population Levels in Planning Subdrainages (base year 2016)

Planning subdrainage	Existing condition – percent of subdrainage meeting 40% PPL	Time to reach 40% PPL – no action	Time to reach 40% PPL – Alternatives 2 and 3
Cliffs	59.6%	Already meeting	Already meeting
Devils	47.1%	Already meeting	Already meeting
Fox	65.7	Already meeting	Already meeting
Hill	51.4%	Already meeting	Already meeting
Humbug	51.9%	Already meeting	Already meeting
Leone-Cultus	40.2%	Already meeting	Already meeting
Mansfield	49.2%	Already meeting	Already meeting
North Fork Breitenbush	46.1%	Already meeting	Already meeting
Roaring	66.0%	Already meeting	Already meeting
Scorpion	55.9%	Already meeting	Already meeting
Short	46.4%	Already meeting	Already meeting
South Fork Breitenbush	42.8%	Already meeting	Already meeting
Tunnel	49.4%	Already meeting	Already meeting

All thirteen planning subdrainages are currently meeting the 40% potential population level.

Table 36 Snag Levels by Alternative

Planning subdrainages	Current Condition (Alt#1)	Alt#2	Alt#3
Cliffs	59.6%	59.0%	59.6%
Devils	47.1%	47.1%	47.1%
Fox	65.7	63.0%	65.2%
Hill	51.4%	51.1%	51.1%
Humbug	51.9%	51.9%	51.9%
Leone-Cultus	40.2%	40.2%	40.2%
Mansfield	49.2%	48.8%	48.9%
North Fork Breitenbush	46.1%	45.7%	45.8%
Roaring	66.0%	66.0%	66.0%
Scorpion	55.9%	52.4%	55.9%
Short	46.4%	44.2%	46.1%
South Fork Breitenbush	42.8%	42.8%	42.8%
Tunnel	49.4%	46.8%	49.4%
Willamette Forest Plan S/Gs	>40% of Psub	FW-125	

Mitigation Requirements for Alternative 2

Snags at the rate of 1.5 per acre would be created after harvest and slash treatment in gaps and early seral habitat treatments areas in units 6, 14, 16-18, 21- 24, 28, 32, 35, 47, 59, 63, 180 and 200. After snags are created these units will meet Forest Plan Standards and guidelines for snag habitat.

Mitigation Requirements for Alternative 3

Snags at the rate of 1.5 per acre would be created after harvest and slash treatment in gaps and early seral habitat treatments areas in units 6, 23, 35, 47, 59, 63, 180 and 200. After snags are created these units will meet Forest Plan Standards and guidelines for snag habitat.

Down Wood

Analysis Methods

A Geographic Information System (GIS) analysis was performed to evaluate existing conditions.

Regulatory Framework

The 1994 Northwest Forest Plan amended forest plans within the range of the Northern Spotted Owl. It provided standards for leaving coarse woody debris in regeneration harvest units (p. C-40). Regeneration harvest is proposed as part of the project. On the Willamette National Forest leave 240 linear feet of logs per acres greater than or equal to 20 inches in diameter. Logs less than 20 feet in length cannot be credited toward this total. Decay class 1 and 2 logs can be counted towards these totals. Down logs should reflect the species mix of the original stand.

Existing Condition

Table 37 Down Wood levels by Alternative

Planning subdrainages	**Current Condition (Alt#1)**	**Alt#2**	**Alt#3**
Cliffs	67.0	67.0	67.0
Devils	59.1	59.1	59.1
Fox	74.8	74.1	74.7
Hill	56.2	56.2	56.2
Humbug	58.9	58.9	58.9
Leone-Cultus	45.4	45.4	45.4
Mansfield	55.5	55.5	55.5
North Fork Breitenbush	50.7	50.7	50.7
Roaring	71.9	71.9	71.9
Scorpion	62.3	62.3	62.3
Short	52.3	52.3	52.3
South Fork Breitenbush	47.6	47.6	47.6
Tunnel	57.8	57.8	57.8
Willamette Forest Plan S/Gs	>40% of Psub	FW-125	

Cavity Excavator Potential Population Analysis

Calculations indicate that, on the Willamette National Forest, there is a current snag population potential of about 54% in the Westside Lowland Conifer Hardwood (WLCH) habitat type and 56% in the Montane Mixed Conifer (MMC) habitat type. In the Breitenbush River watershed, the current snag population potential is estimated at about 50% in the Westside Lowland Conifer Hardwood habitat type and 46% in the Montane Mixed Conifer habitat type. The analysis suggests that the Hwy 46 project area is above the minimum snag population potential, but that snag abundance is lower than the average condition across the Forest.

Table 38 Estimated Snag Population Potential for the Westside Lowland Conifer Hardwood and Montane Mixed Conifer Wildlife Habitat Types in the Breitenbush River Watershed and in the Willamette National Forest

Analysis Area	Habitat Type	Current	Historic
Breitenbush River Watershed	WLCH	50%	77%
Willamette National Forest	WLCH	54%	75%
Breitenbush River Watershed	MMC	46%	74%
Willamette National Forest	MMC	56%	74%

DecAID analysis suggests the current snag and down wood levels are below historic levels and above minimum levels for population viability. In addition to the model information two factors should be mentioned. 1) A large fire occurred north of the Breitenbush River and was concentrated in the Western part of the analysis area. There were areas to the east of this concentration that were also burned extending to the forest boundary. The year of origin of the trees growing in the burned area is 1893 which in 2017 makes these trees 124 years old. The burned area is approximately 5,000 acres. Model results will show the burned area to be low in snag and down wood levels when in reality these trees have grown larger and have become mature forests. 2) The Eagle Rock fire south of the Breitenbush River at the western edge of the planning area occurred in 1967. The Eagle Rock stands are close to having large enough trees for commercial thinning. During the planning process it was decided that this area would be deferred into the future. The model would show this area to be low in snags and down wood when in reality it is contributing to smaller diameter material and would soon begin producing larger snags and down wood.

Snags and down wood are prescribed where regeneration harvest is proposed to occur in early seral habitat creation and gaps over one acre. The number of snags and down wood are listed in the Forest Plan Section of the Snags and Down Wood analysis. The number of trees needed to meet forest plan standards and guidelines for down wood and snags will be left in each area treated and would be converted to snags and down wood after harvest and slash treatment are completed. The silvicultural prescription for these treatment areas includes leave trees for snags and down wood. Specific units include 14, 17, 32a, 59, 63 for quality early seral and meadow restoration, units 83, 84, 93, 94, 95, 96 for sugar pine restoration, units 2, 6, 12, 16, 18, 21, 22, 23, 28, 32, 35, 39, 40, 47, 180 and 200 for gaps over 1 acre and sugar pine shelter woods.

Elk and Deer

Elk and deer are Forest management indicator species because they are important big game hunting species in Oregon. The purpose and need elements of this project to increase early seral habitat and to enhance and restore meadows directly address elk and deer habitat needs. Public comments from Oregon Hunters Association and the Rocky Mountain Elk Foundation supported restoring elk and deer populations and improving their foraging conditions especially by using treatments that reduced crown cover below 50%. Comments from Cascadia Wildlands asked that the role of private lands, especially those used for agriculture and forestry, in providing elk and deer habitat be considered.

The project area is in the state-designated Santiam Wildlife Management Unit (WMU) which is a large area that includes the Detroit Ranger District and much of the Sweet Home Ranger District on the Willamette National Forest, the Mt Hood National Forest west of the Cascade Crest, and large tracts of private, State and Bureau of Land Management lands within and to the west of the National Forests. The estimated elk population in this WMU was about 4,000 in 1990 at the beginning of the Willamette Forest Plan, peaked at about 5,000 in 2002, and has since declined to about 3,000. Elk harvests and hunter success peaked in the late 1990s in this WMU and have declined since then. The current estimated elk population of about 3,000 for the Santiam WHU is well below the State Management Objective of 5,200. Also in the Santiam WMU, deer harvests have declined from about 3,400 in 1990 to 1,540 in 2010 while hunter success has declined from 21% to 11% during that time (USDA Forest Service 2011). Reduced forage quality and quantity due to the reduction in clear-cut logging on the Willamette National Forest are important factors in this decline of elk and deer. While private lands, which comprise 37% of the WMU (Oregon Department of Game Regulations-www.dfw.state.or.us), provide valuable big game habitat, the private forestry and agricultural lands cannot fully compensate for a reduction in habitat quality on the National Forest lands as evidenced by the decline in big game populations and harvests. Also the National Forest lands are especially important for providing the public with hunting opportunities that cannot be fully compensated for on private lands where access by the general public is more limited.

An elk nutrition model has been developed that predicts Dietary Digestible Energy (DDE) on the Willamette National Forest (Rowland et al 2013) based on percent canopy cover (lower canopy cover, higher DDE), proportion of hardwoods (more hardwoods, higher DDE), and potential vegetation zone (silver fir/mountain hemlock forest types have higher DDE than western hemlock forests other factors being equal). Cook et al. (2004) found that increased summer forage quality (which DDE represents) improved elk reproduction and survival. An increase in summer and fall elk forage quality can directly increase calf weights prior to winter, overwinter calf survival, pregnancy rates, adult fall fat accumulation, and herd productivity (op cit.). The benefits of increased summer forage quality that have been demonstrated for elk are also expected for deer.

Recently, as part of the Willamette Forest Monitoring Report for 2014-2015, changes in elk forage quality were evaluated across the Forest by running the elk nutritional model using Gradient Nearest Neighbor (GNN) data. GNN data are widely used by the Forest Service for large-scale mapping and habitat trend analysis, including for the 20-year Northwest Forest Plan Monitoring (e.g., Davis et al. 2015, 2016). The years 1993 and 2012 were used as “bookends” to compare changes in elk nutrition on the Forest and in the project area and reflect the year with available GNN data that is closest to Year 1990, the start of the Willamette Forest Plan, and the most recent year with available GNN data, respectively.

The elk nutritional model (Rowland et al. 2013) divides elk forage into six classes ranging from poor to excellent (Table 39).

Table 39 Elk Forage Classes Relative to DDE Values

DDE Class	DDE values
Poor	<2.40
Low-Marginal	≥-2.4 to <2.575
High-Marginal	≥-2.575 to <2.75
Low-Good	≥-2.75 to <2.825
High-Good	≥-2.825 to <2.90
Excellent	≥2.90
*DDE = dietary digestible energy (kcal/g)	

DDE values are estimated from 2 sets of equations for dominant potential vegetation types that are applicable to the Willamette NF (Douglas-fir/Western hemlock-Springfield area and Pacific silver fir/Mountain hemlock), percent canopy cover, and proportion of hardwoods (Rowland et al. 2013). The values are very general in that they do not account for the different plant association within the potential vegetation type, but the model is useful in showing broad changes in nutritional forage values when calculated over large areas like a watershed or Forest. Within the Douglas-fir/western hemlock forest, the model predicts poor nutrition forage values at high canopy cover and low hardwood abundance (e.g., >60% cover and no hardwoods; >75% cover and >20% hardwoods). Using the Westside nutrition model, Douglas-fir/western hemlock forests never reach “good” nutritional quality (i.e., DDE >2.75 kcal/g), but can reach the “high-marginal” forage class at low canopy cover (e.g., <20% cover and no hardwoods; <30% cover and >20% hardwoods).

The silver fir/mountain hemlock series is about a forage class higher than Douglas-fir/western hemlock under similar canopy cover and hardwood percentages. Dense stands lacking hardwoods are predicted to be marginal for elk nutrition. Good forage values occur in stands with moderate canopy and increasing hardwood abundance (e.g., <30% cover and no hardwoods; <50% cover and >20% hardwoods). Excellent forage nutrition is predicted to occur in open stands, typically early seral forests (e.g., 0% canopy cover with no hardwoods; <20% cover and 20% hardwoods).

The acres and percent of the Forest in each forage category is shown below for years 1993 and 2012 (Table 40). During the period 1993 to 2012, there was a roughly 50,000 acre net increase in the amount of poor quality forage areas forest-wide and a decrease in all other elk forage categories (Table 41).

Table 40 Elk Forage Class Distribution 1993 and 2013, Willamette National Forest

	Acres (%) by DDE Class	
DDE Class	**1993**	**2012**
1 - Poor	487,940 (28.1%)	537,520 (31.0%)
2 - Low Marginal	883,000 (50.9%)	870,890 (50.2%)
3 - High Marginal	239,850 (13.8%)	218,370 (12.6%)
4 - Low Good	32,620 (1.9%)	22,650 (1.3%)
5 - High Good	25,690 (1.5%)	22,940 (1.3%)
6 - Excellent	65,620 (3.8%)	62,360 (3.6%)

Table 41 Changes in Elk Forage Distributions 1993 to 2012, Willamette National Forest

DDE Class	**Change in % of Forest**	**Relative % Change**	**Change in Acres**
1 - Poor	2.9	10.2	49,570
2 - Low Marginal	-0.7	-1.4	-12,110
3 - High Marginal	-1.2	-9.0	-21,480
4/5 - Good	-0.8	-23.5	-13,880
6 - Excellent	-0.2	-5.0	-3,265

About 28% of the Forest was estimated to be poor quality forage for elk in 1993. By 2012 this had increased to about 31% of the Forest. The Willamette Forest Plan divided the Forest into about 200 Big Game Emphasis Areas (BGEAs). The BGEAs total 1.79 million acres including private inholdings. Among BGEAs, 177 (88%) had an increase in poor quality forage areas, while 14 (7%) had a decrease. In 1993, about 7.2% of the Forest was good or excellent forage. By 2012, this had declined to 6.2%, a decrease of about 17,100 acres. However, the average net decline is somewhat misleading because several wildfires created large areas of good to excellent forage, while the amount of higher quality forage declined across much of the rest of Forest. Fires include the B&B of 2003 at over 90K acres, Shadow Lake of 2011 at 10k, GS of 2007 at 7k, Puzzle Creek of 2006 at 6k and Lake George of 2006 at 5k acres. Overall, 157 BGEAs (78%) had a decline in acres of good to excellent forage, while 34 (17%) had an increase. Fifty percent above the 1993 forest-wide average was selected as a benchmark for areas with relatively large amounts of high-quality elk forage (i.e. BGEAS with >10.5% in good to excellent forage class). In 1993, 50 (25%) of the BGEAs, exceeded this threshold. By 2012, 19 (9.5%) BGEAs exceeded the threshold. In tracking the individual BGEAs, 40 of the original 50 in 1993 declined below the threshold level by 2012, while 9 BGEAS were added due to fires.

Proposed treatment units occur in nine Big Game Emphasis Areas. However, in the McCoy BGEA, a couple acres of a proposed understory habitat enhancement treatment unit overlapped the edge of the BGEA. Moreover, the proposed understory habitat enhancement treatment would not affect overstory canopy cover or change the model-predicted forage quality in this unit. Because no predicted change would occur to the big game forage values in this BGEA, effects to the McCoy BGEA were not evaluated further. The remaining eight BGEAs where treatments were proposed were combined and used to evaluate the effects of the alternatives on big game habitat. The eight BGEAs total slightly more than 57,000 acres of big game habitat and are referred to as the project analysis area for big game forage in the remainder of this section. The acres in each elk forage class in 1993 and 2012 are displayed in Table 42 for these BGEAs and the changes in DDE classes between 1993 and 2012 are shown in Table 43. About 1.2% of these BGEAs are on non-Forest Service land.

Changes in elk forage quality from 1993 to 2012 in the project analysis area is generally in line with the trends forest-wide. There has been a relatively large decline in high-marginal, good and excellent forage areas and an increase in poor quality forage areas (Table 43). One small difference is that low marginal forage areas increased slightly (1.1% relative change) in the project analysis area compared to a slight decline (-1.4% relative change) forest wide. The decrease in big game forage quality in the project area is in line with the observed declines in deer and elk and the concerns about decreased hunting success expressed by members of the public.

Table 42 Elk Forage Class Distribution in 1993 and 2012 and for Alt 2 and 3 in the Hwy 46 Project

	Acres (%) by DDE Class			
DDE Class	**1993**	**2012**	**Alt 2**	**Alt 3**
1 - Poor	17,940 (31.3%)	20,740 (36.2%)	18,990 (33.2%)	19,560 (34.2%)
2 - Low Marginal	24,840 (43.4%)	25,120 (43.9%)	26,700 (46.6%)	26,220 (45.8%)
3 - High Marginal	9,600 (16.8%)	7,950 (13.9%)	8,110 (14.2%)	8,030 (14.0%)
4 - Low Good	1,410 (2.5%)	1,050 (1.8%)	1,060 (1.8%)	1,050 (1.8%)
5 - High Good	840 (1.5%)	770 (1.3%)	770 (1.3%)	770 (1.3%)
6 - Excellent	2,620 (4.6%)	1,610 (2.8%)	1,610 (2.8%)	1,610 (2.8%)
The big game project analysis area is composed of 8 BGEAs which include Devils, Humbug, Leone-Curtis, North Fork Breitenbush, Roaring, South Fork Breitenbush, Short, and Slide.				

Table 43 Changes in Elk Forage Class Distributions from 1993 to 2012 in the Hwy 46 Project Analysis Area

DDE Class	Change in % of Analysis Area	Relative % Change	Change in Acres
1 - Poor	4.9	15.6	2,800
2 - Low Marginal	0.5	1.1	280
3 - High Marginal	-2.9	-17.2	-1,650
4/5 - Good	-0.7	-18.9	-420
6 - Excellent	-1.8	-38.5	-1,010

Studies have shown that elk avoid open roads that receive regular motorized traffic (Rowland et al. 2004, 2013). Standards and guidelines in the 1990 Willamette Forest Plan established road habitat effectiveness values for each Big Game Emphasis Area that directly translate into desired maximum open road densities for each BGEA. The desired maximum open road densities compared to the current open road density is shown in Table 44. All BGEAs in the project analysis area currently meet the desired open road density.

Table 44 Comparison of MVUM Open Road Density to Forest Plan Elk Road Density Standards and Guideline by Big Game Emphasis Area in the Hwy 46 Project Analysis Area

Big Game Emphasis Area	Forest Plan Elk Emphasis Level	Forest Plan Desired** Maximum Open Road Density for Elk (road miles/sq. mile)	MVUM Open Road Density (road miles/sq. mile)
Devils	Moderate	< 2.9	1.4
Humbug	Moderate	< 2.9	1.7
Leone Curtis	Moderate	< 2.9	2.2
North Fork Breitenbush	Moderate	< 2.9	1.3
Roaring	Moderate	< 2.9	1.6
Short	Moderate	< 2.9	2.1
Slide	Low	< 4.8	2.6
South Fork Breitenbush	Moderate	< 2.9	0.5

*MVUM = Motor Vehicle Use Map which is the Forest Service record of roads on National Forest Lands designated for public vehicle use pursuant to 36 Code of Federal Regulations (CFR) 212.51.

** Willamette Forest-wide Standards and Guidelines FW-151 and FW-153 establish minimum Habitat Effectiveness Values for open roads in Moderate and Low BGEAs. These road habitat effectiveness values directly translated into the maximum desired open road densities (Wisdom et al. 1986) shown in this table.

Because of the low amount of recent clear-cutting on the Forest and the lack of large-scale fires in the project analysis area, cover for elk and deer is abundant and not limiting the populations. Moreover, Cook et al. (1998) found that thermal cover did not enhance elk survival and reproduction and could not compensate for inadequate forage conditions.

Marten

Marten are members of the weasel family that prefer mature and old conifer-dominated forest habitat. They use cavities in snags and logs for denning, resting, and natal sites. Although the Willamette Forest Plan established marten habitat areas, designated as 9c management areas, at strategic locations across the entire forest (USDA Forest Service 1990), recent information suggests marten primarily occur in montane conifer forests above about 4,000 feet elevation (Aubry and Lewis 2003, NRIS_wildlife database). Camera set monitoring on the Willamette NF beginning in 2012 have detected marten at 91% of the stations above 4000 feet elevation (n = 37 stations) and 0% of the stations below that elevation (n = 33 stations) (Willamette NF unpublished wildlife data, Supervisors Office). About 700,000 acres (39%) of the Willamette National Forest are above 4000' elevation and considered marten habitat.

3.6.12 Environmental Consequences – Management Indicator Species Cavity Excavators, Pileated Woodpecker, and Deadwood Abundance

Snags

Direct and Indirect Effects

Alternative 1 – No Action

Existing levels of snags would be maintained. Untreated mature natural stands would continue to produce large diameter snags through natural processes. Younger stands would continue to produce small diameter snags through competition induced mortality. Generally competition induced mortality occurs in the smallest trees which average approximately one half the average stand diameter. The production of snags through natural mortality would be delayed in previously thinned stands as a result of reduced competition and would produce fewer snags than would be expected from unmanaged stands. Snag diameters and numbers would continue to increase over time due to tree growth and mortality. In the future there would continue to be losses of snags from hazard tree cutting adjacent to open roads. Trees in riparian reserves, CHU and LSR would continue to increase diameter over time and would provide snags from natural recruitment.

Alternative 2

Private land in the analysis area is limited to approximately 159 acres in the Breitenbush Hot Springs area. As snags are a hazard in a high use recreation setting they are expected to be removed soon after trees die. Changes as a result of activities on private land in the Hwy 46 planning area would not alter snag levels as only National Forest System land is analyzed. Private land comprises approximately 0.5% of the planning subdrainages analyzed for Hwy 46.

Alternative 2 proposes approximately 2550 acres of commercial thinning which includes gaps and dominant tree release treatments. In stands proposed for commercial thinning, slowing of growth has occurred from overstocking. With thinning, the average diameter of the stand would be increased by removing the smaller trees and the remaining trees would grow faster. Thinning harvest units are not expected to have trees large enough to provide snags of the diameter size needed to meet Forest Plan standards and guidelines. Abundance of smaller snags would be initially reduced by harvest activities and a subsequent reduction in competition mortality in thinned units. Some small diameter snag loss would be offset by larger trees damaged during harvest and from exposure to wind and snow breakage due to thinning.

Alternative 2 proposes approximately 197 acres of regeneration and other final removal harvest. Regeneration harvest and any final removal harvest requires Snags and Down Wood be created after harvest to meet forest plan standard and guideline levels. Meadow restoration considered a final removal and would have snags and down wood requirements. The silvicultural prescription for meadow restoration is to leave 3-5 trees per acre of the largest trees which may become snags after slash treatment. Dominant tree release treatments are limited in size from ¼ - ½ acre and would not lower overall snag levels to below minimum levels to meet forest plan standards and guidelines. Fuel treatments propose thinning and removing trees under 7 inches dbh with under burning of the stands treated. Fuel treatments are occurring in mostly mature forest stands which would be expected to have snags and down wood present. Fuel treatments may reduce snag and down wood levels slightly but are not expected to reduce the affected stands to below levels needed to meet forest plan standards. Understory habitat enhancement is cutting trees under 7 inches dbh and burning piles where needed is not be expected to reduce snags or down wood levels. The proposed road relocation is occurring in previously thinned stands with basically no snags so this activity is not expected to reduce snag levels.

Riparian reserve areas, Late Successional Reserves and Critical Habitat areas for Northern Spotted Owl recovery would produce larger snag diameters for an indefinite period of time.

Commercial thinning of 2550 acres in alternative 2 would reduce future natural recruitment by reducing competition induced mortality and delay snag recruitment. Snag levels would be lower in the thinned stands for approximately 30-60 years based on growth simulation (FVS) model runs. Changes to snags levels in the short term would increase diameter and abundance in regeneration and other final removal harvest on approximately 197 acres. The increase of snags in regeneration and other final removal harvest units would be due to mitigation measures where snags are created to meet forest plan standards and guidelines

Alternative 3

Private land in the analysis area is limited to approximately 159 acres in the Breitenbush Hot Springs area. As snags are a hazard in a high use recreation setting they are expected to be removed soon after trees die. Changes as a result of activities on private land in the Hwy 46 planning area would not alter snag levels as only National Forest System land is analyzed. Private land comprises approximately 0.5% of the planning subdrainages analyzed for Hwy 46.

Alternative 3 proposes 1909 acres of commercial thinning which includes gaps and dominant tree release treatments. In stands proposed for commercial thinning, slowing of growth has occurred from overstocking. With thinning, the average diameter of the stand would be increased by removing the smaller trees and the remaining trees would grow faster. Thinning harvest units are not expected to have trees large enough to provide snags of the diameter size needed to meet Forest Plan standards and guidelines. Abundance of smaller snags would be initially reduced by harvest activities and a subsequent reduction in competition mortality in thinned units. Some small diameter snag loss would be offset by larger trees damaged during harvest and from exposure to wind and snow breakage due to thinning.

Regeneration harvest and any final removal harvest requires Snags and Down Wood be created after harvest to meet forest plan standard and guideline levels. Meadow restoration considered a final removal and would have snags and down wood requirements. The silvicultural prescription for meadow restoration is to leave 3-5 trees per acre of the largest trees which may become snags after slash treatment. Dominant tree release treatments are limited in size from ¼ - ½ acre and would not lower overall snag levels to below minimum levels to meet forest plan standards and guidelines. Fuel treatments propose thinning and removing trees under 7 inches dbh with under burning of the stands treated. Fuel treatments are occurring in mostly mature forest stands which would be expected to have snags and down wood present. Fuel treatments may reduce snag and down wood levels slightly but are not expected to reduce the affected stands to below levels needed to meet forest plan standards. Understory habitat enhancement is cutting trees under 7 inches dbh and burning piles where needed is not be expected to reduce snags or down wood levels. The proposed road relocation is occurring in previously thinned stands with basically no snags so this activity would not be expected to reduce snag levels.

Riparian reserve areas, Late Successional Reserves and Critical Habitat areas for Northern Spotted Owl recovery would produce larger snag diameters for an indefinite period of time.

Commercial thinning in alternative 3 would reduce future natural recruitment by reducing competition induced mortality and delay snag recruitment. Snag levels would be lower in the thinned stands for approximately 30-60 years based on growth simulation (FVS) model runs. Changes to snags levels in the short term would increase diameter and abundance in regeneration and other final removal harvest on approximately 197 acres. The increase of snags in regeneration and other final removal harvest units would be due to mitigation measures where snags are created to meet forest plan standards and guidelines.

Cumulative Effects

The area analyzed for cumulative effects was the Hwy 46 planning area.

Alternative 1

The trend of the analysis area is toward more and larger snags over time as the forests mature, particularly in the Late Successional Reserves, Riparian Reserves and Critical Habitat Areas for Northern Spotted Owl Recovery. Dead wood conditions are expected to improve and provide more and better habitat for dead wood species.

Routine hazard tree felling along roads would continue to reduce snag levels adjacent to roads where these activities occur.

Alternatives 2 and 3

Ongoing road maintenance and the associated falling of hazard trees is expected to continue along roads which are open for use. This ongoing activity when combined with alternatives 2 or 3 would not result in significant impacts to snag levels in the analysis area.

Down Wood

Direct and Indirect Effects

Alternative 1 – No Action

Existing levels of down wood would be maintained. Untreated natural late-successional stands would continue to produce large diameter down wood through natural processes. Stands which are younger than late successional condition would continue to produce small diameter down wood through competition induced mortality. The production of larger diameter down wood through natural mortality would be delayed in previously thinned stands as a result of reduced competition and would produce fewer down wood than would be expected from unmanaged stands. Down wood diameters and numbers would continue to increase over time due to tree growth. In the future there would continue to be losses of down wood from wood cutting adjacent to open roads. Riparian reserve area, CHU and LSR trees would continue to increase in diameter over time and would provide down wood from natural recruitment.

Alternative 2

For proposed activities which would be considered regeneration harvest, meeting northwest forest plan requirements is required. For early seral habitat creation and gaps over 1 acre meeting down wood requirements would be required. As part of the proposed regeneration harvest treatments burning slash is expected to remove most of the existing down wood which would be replaced by created down wood. These acres would have an increase in down wood in a larger size than current natural recruitment is providing. At a minimum 240 lineal feet of logs per acres greater than or equal to 20 inches in diameter, or largest available, would be provided.

In stands proposed for thinning on approximately 2550 acres, slowing of growth has occurred from overstocking and dominant trees are mostly less than 16 inches dbh. Generally competition induced mortality occurs in the smallest trees which average approximately one half the average stand diameter.

Commercial thinning as proposed under all action alternatives would result in an impact on down wood levels within the units. Since thinning captures future mortality and can delay snag recruitment, it can also delay down wood recruitment. It is expected that down wood recruitment for the action alternatives would follow a similar path as described for the snags. Down wood levels would be lower in the thinned portions of stands and there would be a delay in natural recruitment due to reduced competition induced mortality. Alternative 2 would affect approximately 2520 acres, (8%) of the 31,135 acres of Forest Service land within the project planning area.

Hazardous fuel treatment on 169 acres is expected to reduce the smallest diameter down wood component as this treatment consists of thinning live conifer trees less than 7 inches dbh. For the Northwest forest plan standard these trees do not meet minimum diameter requirements. Smaller diameter trees will be analyzed in the DecAID portion of the analysis which does include smaller dead wood. Underburning and slash treatment has potential to remove down wood. Slash treatment and underburning may also kill trees which would become down wood in the future. Fuel treatments are not expected to alter planning subdrainage down wood levels when averaged across the area. Not all down wood is expected to be removed by hazardous fuel reduction treatment.

Understory habitat enhancement on 155 acres has a similar treatment as hazardous fuel treatments without underburning of slash. Trees under 7 inches diameter are proposed to be cut to assist in the enhancement of understory shrubs. Some pile burning may occur which is not expected to remove a significant amount of down wood.

During harvesting any legacy trees felled for safety reasons would be left on site providing large down wood. Removing snags which are along traveled roads is commonly done for public safety which reduces the number of snags which may become down wood.

Smaller down wood diameter levels would be initially reduced by harvest activities and the reduction of competition mortality. Trees would be damaged during harvest and from exposure to wind and snow breakage after thinning. Trees killed are expected to become down wood in an estimated 25 to 35 years.

Mitigation Requirements

Down wood would be created after harvest and slash treatment in gaps over 1 acre and early seral habitat treatment areas at the rate of 3 trees felled per acre of the largest available in units 6, 14, 16-18, 21- 24, 28, 32, 35, 47, 59, 63, 180 and 200. After down wood creation of 3 trees per acre these units will meet Forest Plan Standards and guidelines for dead wood.

Alternative 3

In stands proposed for thinning on approximately 1888 acres, slowing of growth has occurred from overstocking and dominant trees are mostly less than 16 inches dbh. Generally competition induced mortality occurs in the smallest trees which average approximately one half the average stand diameter.

Alternative 3 would affect 1888 acres, (6%) of the 31,135 acres of Forest Service land within the project planning area.

Hazardous fuel treatment on 169 acres is expected to reduce the smallest diameter down wood component as this treatment consists of thinning live conifer trees less than 7 inches dbh. For the Northwest forest plan standard these trees do not meet minimum diameter requirements. Smaller diameter trees will be analyzed in the DecAID portion of the analysis which does include smaller dead wood. Underburning and slash treatment has potential to remove down wood. Slash treatment and underburning may also kill trees which would become down wood in the future. Fuel treatments are not expected to alter planning subdrainage down wood levels when averaged across the area. Not all down wood is expected to be removed by hazardous fuel reduction treatment.

Understory Habitat Enhancement on 155 acres has a similar treatment as hazardous fuel treatments without underburning of slash. Trees under 7 inches diameter are proposed to be cut to assist in the enhancement of understory shrubs. Some pile burning may occur which is not expected to remove a significant amount of down wood.

During harvesting any legacy trees felled for safety reasons would be left on site providing large down wood. Removing snags which are along traveled roads is commonly done for public safety which reduces the number of snags which may become down wood.

Smaller down wood diameter levels would be initially reduced by harvest activities and the reduction of competition mortality. Trees would be damaged during harvest and from exposure to wind and snow breakage after thinning. Trees killed are expected to become down wood in an estimated 25 to 35 years.

Sugar Pine restoration would occur on 4 acres in alternative 3.

Mitigation Requirements

Down wood would be created after harvest and slash treatment in gaps over 1 acre and early seral habitat treatment areas at the rate of 3 trees per acre felled of the largest available in units 6, 23, 35, 47, 59, 63, 180 and 200. After down wood creation of 3 trees per acre these units will meet Forest Plan Standards and Guidelines for dead wood.

Cumulative Effects

Alternatives 2 and 3

Hazard tree removal along roads would continue to reduce down wood levels in areas where these activities occur. Firewood cutting along roadways open to the public reduces down wood levels adjacent to roads.

As harvest has not occurred in the planning area for many years most stands are producing down wood through natural recruitment.

Elk and Deer

Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

Alternative 1 would maintain the current low quality big game forage levels in the project area and would have no effect on open road densities or big game cover. As such, Alternative 1 would have no direct, indirect, or cumulative effects to big game.

Alternative 2

Alternative 2 proposes vegetation treatments on about 3,206 acres or about 5.6% of the eight BGEAs that comprise the big game project analysis area. The current canopy cover and proportion of hardwoods in each treatment unit were estimated from stand exam data and observations made during field reconnaissance. Estimated changes in canopy cover were determined from stand simulations and it was assumed that the proportion of hardwoods remained the same, post-treatment. Changes in elk nutrition were then calculated for each treatment unit.

About 2,884 acres of commercial thinning, meadow restoration, sugar pine restoration, and quality early seral treatments (5.0% of the analysis area) would lower overstory canopy cover to a degree that would result in a model-predicted increase in forage quality. The understory enhancement treatments and fuel treatments would not measurably change overstory cover or predicted elk forage quality.

About 1,747 acres of poor quality foraging areas would be converted to low-marginal (1,575 acres), high-marginal (164 acres) or good (8 acres) foraging habitat (Table 45). The small amount of good quality foraging habitat that is produced is because the treatments which substantially reduce the canopy are mostly in the western hemlock habitat type which the nutritional model predicts can only achieve the high-marginal forage class.

Assuming the canopy will grow back at a rate of about 2% per year (Chan et al. 2006, Wilson and Puettmann 2007), the improvement in forage from the thinning treatments is expected to last about 10 years on the average. Six harvest units totaling 56 acres, where canopy is reduced below 30%, should increase big game forage for about 20 years assuming full stocking with planting.

Table 45 Changes in Elk Forage Class Distributions in the Hwy 46 Project Analysis Area Due to Alternative 2

DDE Class	Change in % of Analysis Area	Relative % Change*	Change in Acres
1 - Poor	-3.0	-8.4	-1747
2 - Low Marginal	2.7	6.3	1575
3 - High Marginal	0.3	2.1	164
4/5 - Good	0.01	0.4	8
6 - Excellent	0	0	0
*Relative % change is calculated by comparing to the 2012 model output (Table 4).			

The reduction in poor nutritional habitat and the increase in marginal quality habitat could result in a small temporary increase in elk and deer populations in Alternative 2, depending on other factors such as weather, disease and predation. Because there would be essentially no change in good and excellent forage habitat, no large increase in big game populations or harvest levels are expected as a result of this alternative alone. The increase in habitat quality improvement from highest to lowest by BGEA is Short (1,495 acres), North Fork Breitenbush (404 acres), Devils (363 acres), Leone Curtis (326 acres), South Fork Breitenbush (154 acres), Slide (63 acres), Humbug (44 acres), and Roaring (35 acres).

Alternative 2 would have no long-term changes in roads open to the public for motorized use. There would be a reduction in elk and deer use within and adjacent to the treatment units during the time that logging, yarding, and under-burning was occurring, but elk and deer are expected to return to the area soon after activities ceased. Effects of disturbance would be temporary. Security and thermal cover values would remain high and would not be a limiting factor on the populations.

Alternative 3

Alternative 3 proposes vegetation treatments on about 2,407 acres or about 4.2% of the eight BGEAs that comprise the big game project analysis area. About 2,085 acres of commercial thinning, sugar pine restoration, and quality early seral treatments (3.6% of the analysis area) would lower overstory canopy cover and/or increase hardwood abundance to a degree that would result in a model-predicted increase in forage quality. The understory enhancement treatments and fuel treatments would not measurably change overstory cover or predicted elk forage quality.

About 1,179 acres of poor quality foraging areas would be converted to low-marginal (1,096 acres) or high-marginal (83 acres) foraging habitat (Table 46). No good or excellent forage habitat is expected to be created by nutritional model.

Assuming the canopy will grow back at a rate of about 2% per year, the improvement in forage from the thinning treatments is expected to last about 10 years on the average. Two harvest units totaling 16 acres, where canopy is reduced below 30%, should increase big game forage for about 20 year assuming full stocking with planting.

Table 46 Changes in Elk Forage Class Distributions Due to Alternative 3

DDE Class	Change in % of Analysis Area	Relative % Change*	Change in Acres
1 - Poor	-2.0	-5.7	-1179
2 - Low Marginal	1.9	4.4	1096
3 - High Marginal	0.1	1.0	83
4/5 - Good	0	0	0
6 - Excellent	0	0	0
*Relative % change is calculated by comparing to the 2012 model output (Table 4).			

The reduction in poor nutritional habitat and the increase in marginal quality habitat could result in a small temporary increase in elk and deer populations in Alternative 3 compared to the no-action alternative, but less than would be observed in Alternative 2. The increase in habitat quality improvement in Alternative 3 is the same as Alternative 2 for all BGEAs except Short. Alternative 3 would improve about 696 acres of big game foraging habitat in the Short BGEA.

Similar to Alternative 2, Alternative 3 would result in no long-term changes in motorized roads open to the public and security and thermal cover would remain at high levels that would not limit elk and deer populations. In both, action alternatives, deer and elk are expected to continue to be limited by the availability of high quality forage habitat.

Cumulative Effects

The Hwy 46 big game analysis area is comprised of 8 BGEAs totaling about 57,000 acres. The baseline condition was set at 2012 when the last GNN coverage was available to calculate elk forage values from the nutritional model. No stand replacement fires have occurred in the analysis area since that time. There are no other ongoing or reasonably foreseeable activities on National Forest System lands in the big game analysis area that would meaningfully improve forage habitat for deer and elk.

Approximately 1.2% of the big game analysis area is comprised of non-Forest Service lands. Some of these are managed for timber production and are expected to provide early seral habitat when they are periodically clear-cut. Of the private land within the analysis area, only the Breitenbush Resort and Conference Center (approximately 159 acres) is within the project area and is not managed for timber production. Because the non-Forest Service lands are mostly in the Douglas-fir/Western hemlock series they should temporarily provide areas of high-marginal DDE forage when they are logged.

Determination

Alternative 1 – No Action

No improvement of elk forage would occur on Forest Service lands. Barring natural disturbances such as fire, previously logged area would continue to regenerate and forage would decline in the few open plantations that remain. Future clear-cutting on private lands would have a small effect on improving big game populations because it comprises about less than 1% of the area. Overall the amount of area that in poor nutritional quality is expected to increase and deer and elk populations are expected to remain at the reduced levels.

Alternatives 2 and 3

Excluding natural disturbances that cannot be predicted, Alternatives 2 and 3 would account for about 98% and 97%, respectively, of the reasonably foreseeable actions on Forest Service lands that would result in a temporary improvement in big game forage. It is not possible to accurately predict future deer and elk populations due to the numerous factors that affect them. However, because of the expected reduction in areas with poor nutritional quality, there may be a small temporary increase in deer and elk populations in the analysis area under the action alternatives with the greatest effect likely in Alternative 2.

Marten

Within the 69,327-acre Breitenbush River watershed, about 19,516 acres are above 4000 feet elevation on the Willamette NF and considered marten habitat. Both action alternatives have proposed treatment units in these habitat so effects to marten are analyzed further. Two 9c marten habitat management areas occur in the Breitenbush River watershed. However, both are below 4000 elevation and no treatments are proposed in them. Therefore, this project would have no effect on 9c marten management areas.

Direct and Indirect Effects

Alternative 1 - No Action

Alternative 1 would maintain the current forest habitat. Barring stand-replacement natural disturbances, forests would continue to develop large diameter trees, large snags, and large downed logs as the stands progress into old growth. The structural features that marten prefer would continue to increase over time. No short-term increase in berry production is expected to occur in stands that comprise Units 54, 82, 89, and 92. Unit 32a would continue to develop into marten habitat as the fire-created meadow continues to develop into a forest stand.

Alternative 2

Alternative 2 proposes about 358 acres of treatments at or above 4000’ elevation, which is about 1.8% of the estimated marten area on the Willamette NF in the Breitenbush River watershed.

One hundred and fifty five acres of the treatments (Units 54, 82, 89, 92, and 560) are for understory habitat enhancement. This treatment would non-commercially thin conifers less than 7 inches dbh and would maintain berry production in the understory of 110 acres of older forests and 45 acres of plantation (Unit 560). Berries are important foods for marten (Verts and Carraway1998). Thus, this treatment is likely to have a short-term benefit on marten habitat, especially in the older forest stands.

One hundred and eight acres of plantations (Units 55, 543, and 540) and 84 acres of natural stands (Units 32 and 97) would be commercially thinned in marten habitat. The plantations would be thinned to about 44-66% canopy cover and the natural stands would be thinned to about 53-54% canopy cover. Marten continue to use partially harvested stands, particularly if canopy is maintained above 40%. (Thompson et al. 2012). Therefore the commercial thinning treatments are expected to degrade marten habitat rather than remove it. Negative effects from thinning include loss of future snags and down wood that could provide resting and denning sites and habitat for prey. Longer-term, positive benefits from thinning include larger tree size, better developed canopies, and multi-layered stands.

Eight acres of meadow restoration (Unit 32a) are proposed in marten habitat. The cutting and removal of most of the conifers in the fire-created meadow would set back the development of this site into marten habitat in order to maintain high-quality meadow habitat for a variety of species.

Shirk et al. (2012) evaluated marten home ranges using a 990-meter radius scale (i.e. 760-acre circle). Given the arrangement and size of the proposed units, Alternative 2 would degrade about 4.5% to 12.5% of the habitat in three potential marten home ranges. This level of impact is not expected to result in a loss of functional home ranges for marten, but shifting of use within territories and minor changes to the size of the territory to compensate for the impacts on the habitat would likely occur. Understory habitat enhancement in older stands may slightly benefit marten habitat in two potential home ranges.

Alternative 3

Alternative 3 proposes about 263 acres of treatments at or above 4000' elevation, which is about 1.3% of the estimated marten area on the Willamette NF in the Breitenbush River watershed.

The effects of treatments on marten habitat are the same as Alternative 2 for understory habitat enhancement and for commercial thinning in plantations. Alternative 3 would have no meadow restoration or commercial thinning in natural stands in marten habitat.

Using a 990-meter radius scale (i.e. 760-acre circle) to analyze for effects to marten at the home range scale (Shirk et al. 2012), Alternative 3 would degrade 4.5% and 7.9% of the habitat in two potential marten home ranges. This level of impact is not expected to result in a loss of functional home ranges for marten for this alternative. Understory habitat enhancement in older stands may slightly benefit marten habitat in two potential home ranges.

Cumulative Effects

There are no other ongoing or reasonably foreseeable actions on National Forest System lands in the Breitenbush River watershed that would meaningfully alter marten habitat. None of the non-FS lands in the watershed are above 4000 foot elevation. Thus future activities on private lands are not expected to have any impact on marten habitat in the watershed.

Considering direct, indirect and cumulative effects, both action alternatives would maintain the viability of marten in the Breitenbush River watershed. Marten habitat in the watershed is directly connected to marten habitat in adjacent watersheds on the Willamette and Mt Hood National Forests. No barriers to movement of marten along the Cascades would occur as a result of any of the Hwy 46 alternatives. Viable populations of marten are expected to continue to persist across the Willamette National Forest in the montane mixed conifer habitat zone.

Determination

The Hwy 46 project would affect marten habitat in less than 1% of the area with an increase over time expected in other unharvested land use allocations. Therefore, Hwy 46 would not contribute to a negative trend in viability on the Willamette National Forest for marten as habitat for this species is expected to increase over time.

3.6.13 Affected Environment – Migratory Birds

Migratory birds are protected under the Migratory Bird Treaty Act of 1918 (16 U. S.C. 703-704). The U.S. Fish and Wildlife Service is the lead federal agency for managing and conserving migratory birds in the United States. However, under Executive Order (EO) 13186, all federal agencies are charged with the conservation and protection of migratory birds. A Memorandum of Understanding (MOU 2008) between the Forest Service and U.S. Fish and Wildlife Service requires, during NEPA planning, that the FS, to the extent practical, evaluate and balance long-term benefits of projects to migratory birds against any short- or long-term adverse effects. It also requires the FS to consider approaches, to the extent practical, for identifying and minimizing take of migratory birds that is incidental to otherwise lawful activities. Region 6 has compiled some information to assist biologists in disclosing effects to avian species during NEPA planning (Forest Service and Bureau of Land Management 2013). Effects to FS sensitive birds, federally ESA listed birds, and birds that are Management Indicator Species have been addressed above. Four additional migratory bird species that have been identified by USFWS as Species of Conservation Concern in the Northern Pacific Forest (USFWS 2008) and that have habitat in the proposed treatment units are addressed in this section. These four species are northern goshawk, Rufous hummingbird, olive-sided flycatcher, and purple finch.

An emerging concern for migratory birds in the Pacific Northwest is declining early-successional forest habitat (Swanson et al. 2010). Early seral conifer habitat is important habitat for many migratory bird species, including three of the above Species of Conservation Concern (Altman and Hagar 2007). In particular, there is a lack of complex early seral habitat, which is early successional forests with abundant and diverse shrub understory composition, high abundance of large diameter snags and downed logs, and substantial green tree retention. While private logging lands may create early seral habitat, large diameter snags, downed logs and live leave trees are rarely retained in any quantity, and shrub and forb understory species may be suppressed by herbicide treatments.

3.6.14 Environmental Consequences – Migratory Birds

Direct and Indirect Effects

Alternative 1 – No Action

Alternative 1would have no direct effect on migratory bird habitat and would not increase habitat for early-seral species. The Hwy 46 units would continue to develop towards old growth forest conditions, resulting in improved nesting and foraging habitat for northern goshawks and other species that prefer this habitat.

Alternative 2

Alternative 2 would remove about 197 acres of forest which would become early seral habitat. Early seral habitat would be created by meadow restoration, wildlife gaps, dominant tree release, sugar pine restoration and quality early seral habitat creation. Early seral habitat benefits rufous hummingbirds, purple finch and olive-sided flycatchers.

Older forests provide habitat for bird species like the northern goshawk, which prefer older conifer forests. The analysis area currently provides foraging and potential nesting areas for goshawks. No goshawks have been reported from any of the proposed Hwy 46 units. Mitigation measures would protect any raptor nests that are incidentally found in the harvest units during layout or implementation.

Alternative 2 would be consistent with the Migratory Bird Treaty MOU. Early seral habitat is limiting populations of species dependent on this habitat type and this project is increasing early seral habitat. Designs features to retain large live trees over 30 inches dbh, create snags, and fall trees for dead wood sources would provide structural features migratory birds would use.

Migratory birds which favor shrub habitat in early seral conifer stands, such as the Rufous hummingbird and purple finch, would benefit for about 20 years or until dense conifer regrowth reestablishes in the units. Species, such as olive-sided flycatcher, which favor forest openings with large snags, would likely benefit for as long as the snags remain, which could be 30 or more years.

Alternative 3

Alternative 3 would remove about 54 acres of forest which would become early seral habitat. Early seral habitat would be created by wildlife gaps, dominant tree release, sugar pine restoration and quality early seral habitat creation. Early seral habitat benefits Rufous hummingbirds, purple finch and olive-sided flycatchers.

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Cumulative Effects

No other projects in the analysis area are creating early seral habitat so no cumulative effects would occur in the analysis area.

3.7 Botany and Invasive Plants

3.7.1 Summary of Effects Analysis

There will be minimal adverse effects on botanical resources from proposed actions. No Regional Forester's sensitive species occur within areas where ground disturbance will occur. All rare survey and manage species will be buffered. Some habitat for uncommon survey and manage species (*Sparassis crispa* and *Peltigera pacifica*) will be adversely affected by actions proposed in action alternatives. However, these actions will not cause a loss of viability for any of the species within the watershed. Special non-forested habitats would be protected with differing methods: wet habitats will be protected within riparian reserves while drier habitats will be protected from direct disturbance. Increases in habitat for invasive plant species are expected (9% increase under Alternative 2 and 6.4% increase under Alternative 3), especially since much of the project area is near powerline corridors. Project design elements would be used to mitigate some increases in populations of invasive plants due to ground disturbance; weed increases will be minimized to the extent possible.

3.7.2 Scale of Analysis

The area analyzed for cumulative effects for sensitive and survey and manage species and special habitats include the sub-watersheds where the projects occur: Upper Breitenbush River, North Fork Breitenbush River, South Fork Breitenbush River, Lower Breitenbush River, Humbug Creek and small portions Boulder Creek-N. Santiam River, East Fork Collawash River and Cub Creek subwatersheds. This spatial analysis area was chosen because the area is ecologically similar, spatially connected and likely contains habitat for rare plants similar to those suspected to be in the Hwy 46 Project. The scale of analysis for all invasive weed species is the project area including all highways and roads leading into the units used by logging equipment.

3.7.3 Affected Environment – Sensitive Botanical Species

Regulatory Framework

Sensitive botanical species are addressed in the Forest Service Manual (FSM) 2670 and Forestwide Standard and Guidelines 156-161 and Amendment 158 to the Willamette Land and Resource Management Plan (USDA, 1990). Protection of federally listed Threatened and Endangered species is mandated by the Endangered Species Act. No federally listed Threatened or Endangered, nor suitable habitats for these listed plants are known to occur in the project area. Sensitive species are protected by USDA Forest Service regulations and manual direction (FMS 2672.4).

Forest management activities that may impact populations of or alter habitat for TESP (threatened, endangered, sensitive, or proposed) species require a Biological Evaluation (FSM 2671.44) be completed.

The Biological Evaluation process (FSM 2672.43) is used to assist in determining the possible effects the proposed management activities have on species listed or proposed to be listed by the U.S. Fish and Wildlife Service and species listed as sensitive by the USDA Forest Service, Region 6.

There are 93 species on the Regional Forester's 2011 Sensitive Plant List documented or suspected to occur on the Willamette National Forest. All species were evaluated for inclusion in the survey list for this project.

Current Condition

A prefield review is conducted prior to surveys to determine whether species of concern and their habitats are documented in the project area. The review for this project uncovered four Regional Forester's Sensitive and three Strategic species documented within the project area (Figure 1). Sensitive species within project area include *Bridgeoporus nobilissimus, Cortinarius barlowensis, Eucephalus gormanii,* and *Romanzoffia thompsonii*. In addition, three Regional Forester's Strategic species, *Chrysomphalina grossula, Albatrellus dispanus* and *Plagiothecium piliferum,* are located within the project area. No populations are found within proposed timber harvest or restoration areas.

There are 3 known sites of *Bridgeoporus nobilissimus,* the noble polypore fungus, on the Detroit Ranger District. One site is within the project area and was documented in 2012. Fruiting bodies occur on large, dying and dead noble fir and Pacific silver fir in late-successional old-growth forests and on remnant stumps and snags in young and mature second-growth forests in the Pacific silver fir and western hemlock zones in western Washington and Oregon (Lebo, 2007).

Cortinarius barlowensis is a fungus species widely distributed in western Oregon and Washington. It has been found in western Cascades Provinces of both Oregon and Washington, and Washington's coastal provinces. There approximately 35 sites of this species throughout the Pacific Northwest. There is one documented site on the Willamette NF and it is on a CVS (Current Vegetation Survey) plot within the project area but outside of any units.

Eucephalus gormanii is a sensitive species considered very rare and endemic. It is a sub-alpine aster that is only found on cliffs and open rocky areas in the vicinity of the Oregon Cascade Mountains. It is a small aster, growing 4-12 inches tall, glandular, sessile leaves that are erect, crowded and overlapping up the stem. Ten to 12 ray flowers are white to pinkish surrounding the base of yellow disk flowers. Three populations of *E. gormanii* are along ridges and ridge saddles in the project area.

Romanzoffia thompsonii is a regional endemic found only in the northwestern Oregon Cascades. It is a very small, ephemeral plant that grows in seepy rock gardens on rock outcrops. It is rather common within its range where high quality habitat exists. There are four known populations in the project area but none within units.

Chrysomphalina grossula is an Oregon strategic fungus species. This taxon is a presumed ectomycorrhizal former. Sporocarps are solitary to gregarious in coastal to montane coniferous forest and fruits in autumn. This species is widely distributed in western Oregon and Washington. It has been found in western Cascades Provinces of both Oregon and Washington, and Washington's coastal provinces. There approximately 35 sites of this species throughout the Pacific Northwest. It is the only population on Willamette NF and found in an established campground within the project area.

Albatrellus dispanus is a wood decaying shelf fungus that is rare in Oregon. It has a large (foot wide) yellow fruiting body with multiple stalks and heads. It is found on the Mt. Hood and Willamette National Forests in the western Cascades. One population is found in the project area.

Plagiothecium piliferum occurs on trees trunks, especially red alder, along moist humid cliffs and on rocks along streams. This is a Regional Forester's strategic moss. Oregon Natural Heritage Information Center reports *P. piliferum* from Clackamas, Douglas, Linn, Benton, and Tillamook Counties within the Coast Range and west Cascade Ecoregions. It is found on Umpqua NF and Salem, Eugene and Medford BLM Districts. Two populations are in the project area and are the only populations known from the Willamette NF. One population is found in the project area.

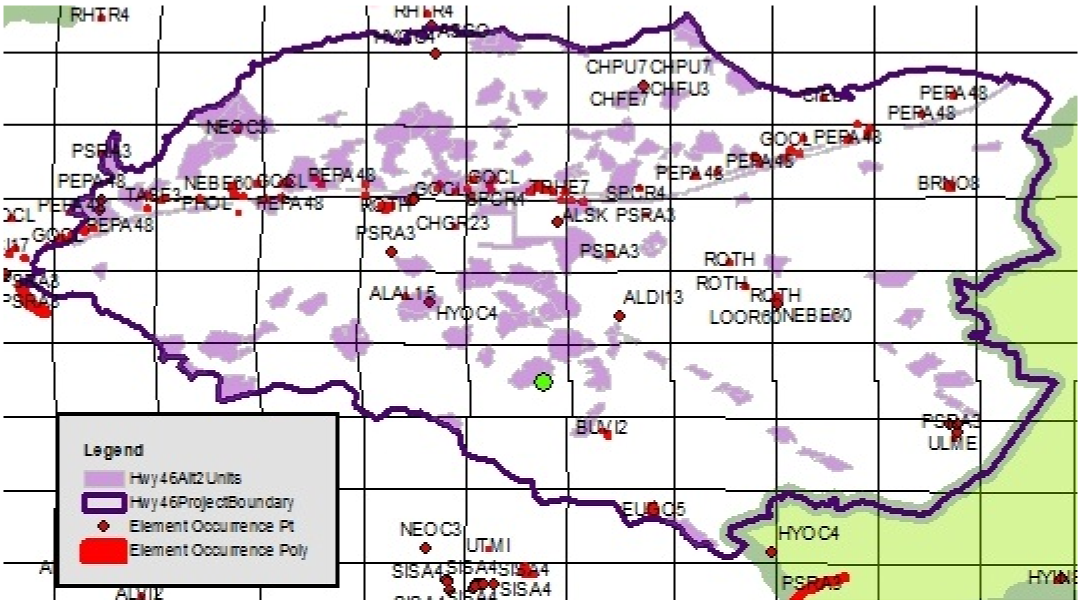


Figure 35 Sensitive and Survey and Manage Species documented within the project area

Field surveys used the intuitive-control method (meander through forested stands, complete inspection of high probability habitat) were conducted June through September of 2013, 2014 and 2015. All surveys were conducted by Forest Service employees. Additional information regarding sensitive plants was available from surveys conducted by contractors in 2011 for the Cascade Crossing transmission line project.

Ninety-three Region 6 sensitive plant, lichen and fungal species were evaluated to determine if they or their habitat would be impacted by this project. Habitat exists for 73 of the 93 species. Of the 73 species, 16 are fungi for which single year, single season surveys are considered impractical because they fruit inconsistently (VanNorman, et. al, 2008, p. 4). Surveys were done for the remaining 57 species. The Biological Evaluation for Hwy 46 EIS in the Project File.

The project area is a well shaded western hemlock/Douglas fir forest with some steep terrain including high cliffs, many seasonal stream drainages and many wetlands. Vascular plant diversity is primarily found in non-forested habitats such as rock outcrops and wetlands. Lichen and bryophyte diversity was moderate with many different types of habitats- a few exposed dry rocky outcrops, dry meadows, many moist rock gardens and wet meadows, some skunk cabbage swamps, seeps and ponds and well shaded, late successional forests. There is ample conifer habitat for rare fungi in the project area. The list of habitats and sensitive species surveyed is in the project file.

3.7.4 Environmental Consequences – Sensitive Botanical Species

Direct and Indirect Effects

Alternative 1 – No Action

Under Alternative 1, No-action, no direct effects are anticipated because no sensitive species would be disturbed by project activities.

Failure to implement the proposed action could affect sensitive plant species if it resulted in a fire that burned out of the range of natural or historical variability. It is hard to predict the magnitude of such a fire but fuel loadings and fire danger are predicted to increase as a result of self-thinning of mid-seral stands without fuels reduction (see Fuels Report, Alternative 1 No Action). A very hot fire could extirpate known sensitive species by killing all the hosts for mycorrhizal fungi and incinerating the upper organic layers where the mycelia or fungal body resides in the soil (Bruns, 2002).

There could also be indirect effects on fungi because of reduced species diversity in the younger Douglas fir monoculture plantations that are uniform in composition. Because stands would not be thinned, allowing diverse understory species to thrive, they would undergo a slow decline before presumably opening up enough to provide habitat and species diversity. Nonvascular plant diversity is correlated with species diversity and structure (Lesica et al, 1991).

Alternative 2

There are several sensitive species documented within the project area but none found within units. There will be no direct or indirect effect on sensitive vascular plants, lichens or bryophytes. However, since single year surveys were deemed infeasible for fungi, there could be effects to these species.

It is possible that individual sites of fungi may be negatively affected in the short term directly by host tree removal, physical disturbance, soil compaction, and the disruption of mycelial networks (Lippert and Huff, 2014) in timber harvest operations. Twelve of the 16 sensitive fungi species are mycorrhizal and could experience the loss of hosts. The probability of host loss will be higher in the regeneration harvest units. However, affected populations will most likely rebound over the short term in thinned units (10-40 years) as mycelia recolonize remaining trees.

Indirect effects to fungi include short-term loss of moisture retention capabilities due to the drying effect of overstory shade removal, and the reduction of water storage with the disturbance or removal of forest floor organic material and large wood (Lippert and Huff, 2014). Loss of large woody material and host trees also represents a reduction of available nutrients and possible inoculum source for future fungal regeneration and expansion (Amaranthus and Perry, 1994).

Regeneration harvest has the potential to affect sensitive fungus habitat. Late seral forest remnants produced substantially more truffles than the clear-cuts surrounding them (Clarkson and Mills, 1994). Clarkson also notes that hypogeous sporocarps are largely absent from young, slowly regenerating clear-cuts. Several interacting explanations probably account for observations of truffles being virtually absent in clear-cuts. First, decreased soil moisture on cutover areas may depress truffle production. Clear-cutting and burning exacerbate soil desiccation during the Northwest’s summer drought. There is a related reduction or loss of the organic layer in the soil following clear-cutting and burning. Low truffle abundance in clear-cuts may also be attributed to reduced spore dispersal. Depressed truffle production may reflect the loss of plant hosts in clear-cuts.

Early seral (regeneration harvest prescription) units will have a minimum of 15% of green tree retention. Green-tree retention may enhance seedling nutrition and survival through maintenance of mycorrhizal inoculum on site. Fungal diversity is maintained at higher levels in retention areas than in clear-cuts. Retained trees will provide some legacy of fungal diversity during the development of the next stand (Luoma et. al, 2006). Luoma and Eberhart (2005) found that even though green-tree retention can preserve ectomycorrhizal diversity, sporocarp production and ectomycorrhizal species richness was significantly reduced at all levels of harvest.

Prescribed fire and pile burns can affect mycelial networks through scorching of the soil, reduction of downed wood refugia and disrupt the nutrient cycling and soil chemistry (Emerson and Huff, 2014). Adverse effects to mycelia are largely dependent on fire severity. Severity is normally less in spring when soil moisture content is higher. Prescribed burning can be beneficial to host trees in the long term as it reduces the chances for catastrophic fire when forested stands are heavily stocked and there is a lot of fine ladder fuel. Patchy burns favor fungi.

The 877 acres of skips in stands, either as Green Tree Retention areas or as buffers should help maintain fungal diversity in the planning area. Research shows that both clumped and isolated leave trees benefit fungal diversity in a recovering landscape (Lippert and Huff, 2014).

No direct or indirect effects are expected to rare fungi from young tree removal in meadows or understory/fuels thinning treatments. Pruning trees should not adversely affect host trees, any soil layers or downed wood necessary for fungal survival.

Alternative 3

The direct and indirect effects to sensitive fungi from actions proposed in Alternative 3 would be the same as the effects on sensitive species in the proposed action, but with less acres of habitat affected. No fire regenerated stands will be thinned so there will be 650 less acres of fungal hosts removed. Associated activities that affect soil compaction such as yarding (527 less acres), road construction (3 acres less) and fuels treatments (202 less acres pile burn and 525 less acres underburn) will be reduced accordingly.

Cumulative Effects

Alternative 1

There will be no cumulative effects on sensitive species for the No Action Alternative.

Alternative 2

The temporal scale for this analysis is 60 years because this likely represents the time period in which adequate data is available for known occurrences within the areas as well as time periods for re-establishment if impacted in the past. This increases the likelihood of such species existing in project area stream drainages.

There could be cumulative effects on sensitive fungi habitat from loss of host trees or chances to habitat from timber management, road construction and fuels treatments in the project area. The bulk of the impact is assumed to be from timber harvest activities. Within the planning sub drainages, a total of 13,065 acres have been harvested in the past (Table 47). This means that 42% of the area has been managed for timber production. This alternative proposes to harvest 8.3% of the project area, 75% of these acres have been previously harvested.

Table 47 Percent of Watershed within Project Area

Sub-watershed	Total Acres	Acres W/in Project area	% Acres W/In Project area	% acres of watershed within Project area
Upper Breitenbush River	20,395	19,743	96%	63%
North Fork Breitenbush River	16,255	5,204	32%	17%
South Fork Breitenbush River	13,082	5,994	46%	19%
Lower Breitenbush River	9203	113	1%	<1%
Humbug Creek	10,392	213	2%	<1%
Miner over lap of 3 others	50,030	28	<1%	<1%
Total	**119,357**	**31,295**	**=26%***	**=100%**

*represents the total percent of sub-watersheds acres within sale area

Alternative 3

Similar to Alternative 2, there could be cumulative effects on sensitive fungi habitat such as loss of host trees, soil compaction and loss of duff layer from timber management, road maintenance and construction and prescribed burning in the project area. This alternative proposes to harvest 6% of the project area, although all of these acres have been previously harvested.

3.7.5 Affected Environment – Survey and Manage Botanical Species

Regulatory Framework

The Northwest Forest Plan, Record of Decision (USDA and USDI, 2001) designated special management of just over 300 “survey and manage” species to reduce or eliminate effects of management actions on these old-growth associated species whose persistence is not assured through the system of reserved lands. The Northwest Forest Plan requires surveys for projects that could alter habitat for survey and manage species and management of populations if they are found.

On December 17, 2009, the U.S. District Court for the Western District of Washington issued an order in Conservation Northwest, et al. v. Sherman, et al., No. 08-1067-JCC (W.D. Wash.), granting Plaintiffs’ motion for partial summary judgment and finding NEPA violations in the Final Supplemental to the 2004 Supplemental Environmental Impact Statement to Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines (USDA and USDI, June 2007). In response, parties entered into settlement negotiations in April 2010, and the Court filed approval of the resulting Settlement Agreement on July 6, 2011. Projects that are within the range of the northern spotted owl are subject to the survey and management standards and guidelines in the 2001 ROD, as modified by the 2011 Settlement Agreement.

The 2011 Settlement Agreement states, “For projects with signed Records of Decision, Decision Notices, or Decision Memoranda from December 17, 2009, through September 30, 2012, the Agencies will use either of the following Survey and Manage species lists: (a). The list of Survey and Manage species in the 2001 ROD (Table 1-1, Standards and Guidelines, pages 41-51) or (b) the list of Survey and Manage species and associated species mitigation, Attachment 1 to the Settlement Agreement.” In addition, the Survey and Manage Tracking forms which include Botany Species Survey and Site Management Summary will be completed for each project. These completed tracking forms can be found in the project file.

The Hwy 46 Project applies a 2006 Exemption from a stipulation entered by the court in litigation regarding Survey and Manage species and the 2004 Record of Decision related to Survey and Manage Mitigation Measure in Northwest Ecosystem Alliance v. Rey, No. 04-844-MJP (W.D. Wash., Oct. 10, 2006). Previously, in 2006, the District Court (Judge Pechman) invalidated the agencies' 2004 RODs eliminating Survey and Manage due to NEPA violations. Following the District Court's 2006 ruling, parties to the litigation entered into a stipulation exempting certain categories of activities from the Survey and Manage standards and guidelines, including both pre-disturbance surveys and known site management. Also known as the Pechman Exemptions, the Court's Order from October 11, 2006 directs:

> *"Defendants shall not authorize, allow, or permit to continue any logging or other ground-disturbing activities on projects to which the 2004 ROD applied unless such activities are in compliance with the 2001 ROD (as the 2001 ROD was amended or modified as of March 21, 2004), except that this order will not apply to:*
>
> *a) Thinning projects in stands younger than 80 years old:*
> *b) Replacing culverts on roads that are in use and part of the road system, and removing culverts if the road is temporary or to be decommissioned;*
> *c) Riparian and stream improvement projects where the riparian work is riparian planting, obtaining material for placing in-stream, and road or trail decommissioning; and where the stream improvement work is the placement large wood, channel and floodplain reconstruction, or removal of channel diversions; and*
> *d) The portions of project involving hazardous fuel treatments where prescribed fire is applied. Any portion of a hazardous fuel treatment project involving commercial logging will remain subject to the survey and management requirements except for thinning of stands younger than 80 years old under subparagraph a. of this paragraph."*

Per the 2011 Settlement Agreement, the 2006 Pechman Exemptions remain in force:

> *"The provisions stipulated to by the parties and ordered by the court in Northwest Ecosystem Alliance v. Rey, No. 04-844-MJP (W.D. Wash. Oct. 10, 2006), shall remain in force. None of the following terms or conditions in this Settlement Agreement modifies in any way the October 2006 provisions stipulated to by the parties and ordered by the court in Northwest Ecosystem Alliance v. Rey, No. 04-844-MJP (W.D. Wash. Oct. 10, 2006)."*

Hwy 46 Project meets Exemption A in some of the project area where there is no regeneration harvest and thinning only in stands less than 80 years old.

This project used the January 2001 ROD standards and guidelines and the associated January 2001 species list, and the four categories of projects exempt from the Survey and Manage standards and guidelines as stipulated by Judge Pechman (October 11, 2006 Pechman exemptions). The Pechman exemption used was a relief from survey for stands under 80 years of age.

For stands greater than 80 years of age or for stands that surveys are triggered if there is suitable habitat for target species and if the proposed project is habitat-disturbing. Thirty four stands were greater than 80 years of age and four stands were to be regeneration harvested and required predisturbance surveys.

Predisturbance surveys were completed for these areas in 2013, 2014 and in 2015. The survey protocols used were intuitive controlled as suggested in survey protocols developed for bryophytes, lichens, fungi and vascular plant species groups.

Current Condition

There are 19 species and 91 sites of survey and manage species are documented within the project area (the complete list is located in the project file). Many of these species are found at multiple sites, especially the uncommon species. Thirty-one of these sites are within proposed project units. Most of these species were documented during the proposed Cascade Crossing project in 2011 and 2012. One of these species is category F and does not require site management. Protective measures are not required by Northwest Forest Plan Record of Decision (F). No further discussion is needed for these this species.

If found within a unit, the rest of the categorized species may require some type of protective measure to maintain species viability. Exceptions to this include one Category E lichen species, *Peltigera pacifica* and a Category E fungus, *Sparassis crispa*.

There are 17 sites of *Peltigera pacifica* within units and 18 known sites outside of units within the project area. Only the units have been surveyed, so there are likely many more populations within the project area. Because this species is found to be common and well-distributed within the project area and forestwide (there are 164 documented populations across the forest currently in our database), no protective measures will be prescribed besides avoidance when possible.

Sparassis crispa is a common fungus prized as an edible. There are 5 known sites in the project area, 4 of which are in units. There are 14 other sites across the Forest and because it is a rather common species it is likely underreported. No protective measures will be prescribed for these fungi besides avoidance of host trees where possible.

Of the remaining 13 Manage Known Sites species (Categories A, B and E), 6 species have no sites within proposed project units and 6 have had sites dropped from the unit due to buffers for other sensitive or survey and manage species. The remaining species-*Pseudocyphellaria rainierensis* populations that are found in units have been prescribed 100 foot buffers for protection.

Pseudocyphellaria rainierensis is a leafy epiphytic lichen that grows in the canopy of older conifer stands in the Pacific Northwest. In the project area, it's found in units 24 and 83 that are between 105 and 120 years of age. This species is often associated with riparian areas as it requires a cool, moist habitats. According to the Conservation Assessment (Stein, 2013), the major threats to the survival of the species are loss of host trees and changes in microclimate such as temperature, humidity and radiation. Because unit 24 is prescribed to be thinned, a 100 foot buffer was prescribed. Unit 83 is a sugar pine restoration unit. Thirty-three of the 107 acres are to be a shelterwood cut and should require a larger buffer for maintenance of microclimate. However, the population is adjacent to a riparian buffer which will provide the needed microclimate, so a 100 foot buffer was also prescribed for this population. The Conservation Assessment also recommend preventing fire in *Pseudocyphellaria* habitat and buffer to maintain old growth habitat features and integrity.

The last Survey and Manage Category is D, uncommon species where we need to manage high priority sites. Two species will be buffered in this category due to the fact that they have limited distributions within the watershed and the Forest: *Chalciporus piperatus* and *Rhizopogon truncatus*.

Chalciporus piperatus is an uncommon survey and manage bolete mushroom. It is mycorrhizal, meaning that it has a symbiotic relationship with tree roots in the vicinity of its fruiting body. It is dependent on host trees for carbohydrates and in turn provides micronutrients to the trees. This species is found from the Canadian border down to the Californian border but its distribution is patchy. There are eight populations on the Willamette NF, 3 of which are found in the project area. Populations are found in units 13 and 24. Management recommendations suggest considering placement of retention areas around populations to maintain connections and viability (Huff et al., 2013, p. 21). Because both of these are thinning units where trees will be left in the stand and microclimate not completely altered, a 100 foot buffer was prescribed around each population to maintain the microclimate and host trees.

Rhizopogon truncates is a mycorrhizal truffle fungus that forms symbiotic connections with fine roots of host trees in the vicinity of its fruiting body. This species is scattered around western Oregon, with over 150 locations, mostly in southwest Oregon. Populations become fewer and sparser as one goes north to the Mt. Hood and east to the Deschutes NF. There are 3 populations of this species in the project area and only 7 on the Willamette NF. Management recommendations suggest considering placement of retention areas around populations to maintain connections and viability (Huff et al., 2013, p. 155). One population of *Rhizopogon truncatus* is found in unit 83. Because the prescription for this stand is a shelterwood cut, the resulting understory will be open and temperature and humidity regimes changed. To maintain the host trees and microclimate, a tree height buffer was recommended. However, because the population is very near the proposed road in unit 83, a 50 foot buffer was prescribed around the fruiting body to maintain host and adjacent trees as suggested in regional Management Recommendations.

3.7.6 Environmental Consequences – Survey and Manage Botanical Species

Direct and Indirect Effects

Alternative 1 – No Action

No direct effects are anticipated because no survey and manage species would be disturbed by project activities

Indirect effects to survey and manage species would be similar to sensitive species. Stand replacing fires in overstocked plantations with heavy natural fuel loadings could spread to adjacent older stands. This could alter old-growth stands necessary for species survival, removing both hosts, microclimate necessary for species survival and eliminating the source of propagules over the long term.

If plantations remain unmanaged, it will take longer for stands to grow into potential habitat for survey and manage species.

Alternative 2

Many parts of the proposed project will cause disturbance to the landscape as Alternative 2 proposes 2732 acres of commercial thinning and 45 acres of regeneration harvest. Some of the thinning units will have gaps which are like regeneration harvest in terms of tree removal. Harvest will cause soil disturbance and compaction. Opening and constructing roads to haul the timber will also disturb soil and cause compaction. Post-harvest treatment of fuels will add some disturbance to the soil.

There are several survey and manage species are known to occur within project units. All survey and manage species sites where there will be ground disturbing activity that require protective measures (Categories A, B and E) will have protective buffers if they are truly rare within the project area. Two populations of *Pseudocyphellaria rainierensis* will have a 100 foot buffer to maintain habitat and microclimate. Two populations of *Calciporus piperatus* will also have a 100 foot buffer to maintain host trees and microclimate. One population of *Rhizopogon truncatus* will have a 50 foot buffer to maintain host trees. All buffers are expected to maintain the species and habitat features required for their persistence.

An analysis of *Peltigera pacifica*, and *Sparassis crispa* shows that the buffering of populations within units is not necessary for the persistence of the species within the planning area.

Silvicultural prescriptions for this alternative would increase stand complexity over the long term by opening the canopy to allow more light within the understory which would increase a higher diversity in understory vegetation, especially in the young plantations. This would convert dense, stem exclusion stands into potential future late successional habitat. This could be beneficial for survey and manage species over the long term. Benefits to survey and manage species and their habitats in older fire-regenerated stands is less clear as many of these stands are starting to show structure and are stands where the true old-growth associates are located.

Alternative 3

Effects to survey and manage species will be less under this Alternative. Two units that are to be buffered for survey and manage species, unit 83 (*Pseudocyphellaria rainierensis* and *Rhizopogon truncatus*) and unit 13 (*Calciporus piperatus*) will not be harvested. This would maintain unaltered habitat throughout the units for these species, providing the best chance for long-term species survival as these are old-growth associated species.

One of the four units with *Sparassis crispa* and four of the eleven units with *Peltigera pacifica* (units 13, 28, 31, 83) will not be harvested under this alternative. These species were not prescribed buffers due to their abundance but it is recommended that populations be avoided. These populations will have a higher probability of persistence under this alternative.

This alternative will, as with Alternative 2, increase stand complexity, in dense overstocked plantations. This will benefit survey and manage species over the long term.

Cumulative Effects

Alternative 1

There will be no cumulative effects resulting from the No Action alternative.

Alternative 2 and 3

The temporal scale for this analysis is 60 years because this likely represents the time period in which adequate data is available for known occurrences within the areas as well as time periods for re-establishment if impacted in the past. This increases the likelihood of such species existing in project area stream drainages.

Cumulative effects, loss of hosts and quality habitat for rare fungi, on survey and manage species within project area for the proposed action will be limited to the stands where survey and manage species will not be buffered which is 599 acres or 2% of the watershed. Within the planning sub drainages, a total of 13,065 acres have been harvested in the past; 40.2% of the habitat has been modified. This project proposes to add another 1% habitat modification for survey and manage species (half of the acres proposed for modification are plantations and would already be counted) for Alternative 2 and no cumulative effect for Alternative 3.

3.7.7 Affected Environment – Special Habitats

Special habitats are unique non-forested and rare forested habitats that occur on the Willamette NF. The Willamette LRMP (USDA, 1980) contains a standard and guideline FW-211 that states that these habitats, due to their contribution to the plant and animal biodiversity on the forest, need to be maintained or enhanced. In order to manage for these special habitats, the Special Habitat Management Guide was developed for inventory and maintenance of habitats across the Willamette Forest (Lippert et al., 2010).

There are many special habitats within the project area. These include dry, wet and mesic meadows, skunk cabbage swamps, rocky outcrops and moist rock gardens and talus slopes (Table 48). The most common type of habitat documented throughout the project units were skunk cabbage swamps, in some cases several per unit. All unit portions containing special habitats were buffered for protection using riparian buffers or specially designed buffers. Wetland habitats are scattered throughout the project area and have many roads that access them; therefore threats of weed infestations are high.

Table 48 Special Habitats in the Hwy 46 Project Area

Habitat Type	Units	Prescription
Spring/Swamp	5,19,21,22,23,34,35,45,47,52,55,64,69,73,74,75,83 94, 100,110,130,140,160,170,190,200,220,250, 270,280,300,320,410,440,490,510	25-100 foot buffers or riparian buffer
Mesic meadow	32, 48, 53	100 foot buffer; Special treatment in unit 32 (see below)
Rock outcrop	3,33, 51, 83	Avoid direct disturbance
Talus	32, 530	Avoid direct disturbance
Dry meadow	54	Avoid direct disturbance
Moist rock garden	96	Buffer from gaps, avoid direct disturbance
Dry rock garden	420	Within riparian buffer

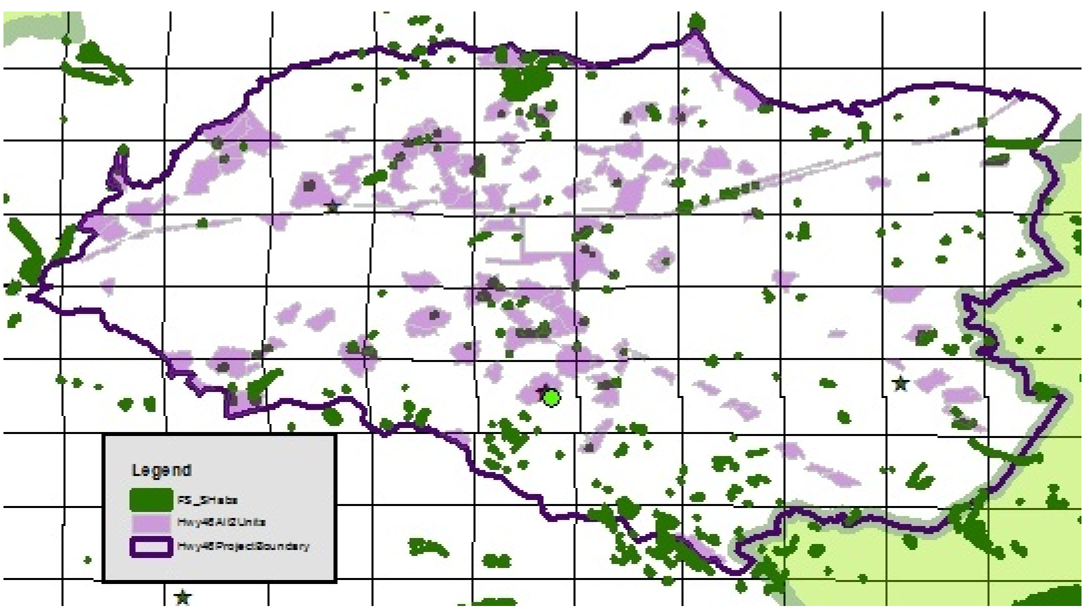


Figure 36 Special Habitats

3.7.8 Environmental Consequences – Special Habitats

Direct and Indirect Effects

Alternative 1 – No Action

Encroaching trees in or surrounding the drier meadow habitats would continue to grow, and tree populations will expand causing a loss of mesic meadow habitat on the landscape. Natural increases in fuel loadings in heavily stocked plantations could increase the potential that wildfires would adversely affect some habitats.

Alternative 2

The only special habitat in the project area that will be directly affected is the meadow in unit 32a. The direct effect will be to remove young trees encroaching from the forest edge and tree islands in the meadow center, the aim of which is to maintain the area as a meadow with species useful for wildlife forage. Indirect effects will be the opening of the canopy and restoration of the hydrologic regime. Both of these things should increase understory species diversity, providing additional habitat for wildlife species. Effects of treatment are expected to have a beneficial effect on the meadow for at least the next 10 years.

The rest of the special habitats within the project area will be buffered or avoided through directional felling and skidding outside the habitat. Indirect effects could include harvest or fire activities which have the potential to introduce invasive species that could spread to special habitats. Design elements call for an additional 100 foot buffer from roads to prevent weed encroachment from roads. These actions should protect all special habitats from management actions.

Alternative 3

There will be no direct effects to special habitats under this alternative because there will be no meadow restoration and all other habitats will be buffered. There could be indirect effects from increases in weeds in units adjacent to special habitats but design elements should limit weed encroachment.

Cumulative Effects

There will be no cumulative effects for the Alternative 1-No Action or Alternative 3.

There will be a small cumulative effect, maintaining the species composition, spatial extent and hydrology of the meadow, to special habitats from Alternative 2- Proposed Action. The area of analysis for cumulative effects are the individual special habitats within the project area. Past timber harvest, road construction and associated activities on public and private lands have adversely affected special habitats by introducing invasive weeds and building roads through them. Given the protective measures of this action, cumulative effects are anticipated for only the 8 acres of meadow restoration in unit 32a, a very small portion of the watershed.

3.7.9 Affected Environment - Invasive Plants

Regulatory Framework

Invasive plants are addressed in the Final EIS for Pacific Northwest Region Invasive Plant Program, Preventing and Managing Invasive Plants (USDA, 2005);

Amendment 259 to the Willamette Land and Resource Management Plan (USDA, 1990); and the Willamette National Forest Integrated Weed Management Plan (USDA, 2007). The following documents guide the treatment of competing and unwanted vegetation in the Pacific Northwest:

- Guide to Noxious Weed Prevention Practices (2001)
- Executive Order 13112 (February 3, 1999)
- Noxious Weed Control and Eradication Act (2004)
- Willamette National Forest Noxious Weed Prevention Guidelines (2005)

Current Condition

Thirteen invasive weed species are documented in the project area (Figure 37). The most serious weed infestations in the project area are new invader species: spotted, meadow and diffuse knapweed (*Centaurea maculosa*, *jacea* and *diffusa*). There is also one population of false brome, *Brachypodium sylvaticum*, in the project area. One population of cheatgrass, *Bromus tectorum*, is found along the powerline corridor. New invaders are priority for treatment on the Forest because there is a chance to eradicate populations.

Other well established species include Scotch broom (*Cytisus scoparius*), tansy ragwort (*Senecio jacobaea*), Himalayan and evergreen blackberry (*Rubus armeniacus* and *laciniatus*), reed canary grass (*Phalaris arundinacea*), St. John's wort (*Hypericum perforatum*), oxeye daisy (*Leucanthemum vulgare*), foxglove (*Digitalis purpurea*) and Canadian and bull thistles (*Cirsium arvense* and *C. vulgare*). The strategy for established infestations is to contain existing populations except where they are causing unacceptable environmental damage such as meadows or wetlands.

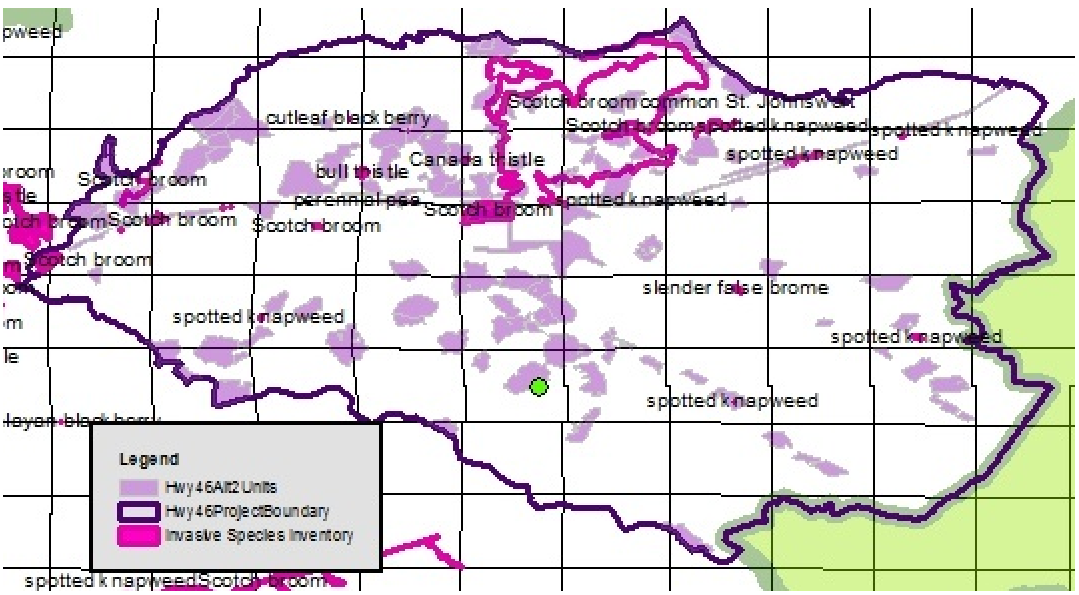


Figure 37 Weed infestations

Populations of spotted and meadow knapweed, tansy ragwort, scotch broom, bull and Canada thistles are found along Highway 46 within the project area. Scotch broom was documented along most roads and within or related to all units. Spotted, diffuse and meadow knapweed are documented in units 7, 9, 44, 62, 64, 74, 370 and 540. All of these populations were documented prior to project inception. No new populations were found during plant surveys in 2013 and 2014.

Scotch broom has been treated along the Highway 22 and several roads in the project area in order to contain the spread. An area north of the Breitenbush community, where the highway parallels the powerline corridor for a mile has been treated by Portland General Electric (PGE), Bonneville Power Administration (BPA) and by the Forest Service. The Breitenbush community has also manually controlled Scotch broom populations on their property in the past; current practices are unknown. Knapweed populations are currently being treated in the project area, as most are found along powerline corridors.

3.7.10 Environmental Consequences – Invasive Species

Direct and Indirect Effects

Alternative 1 – No Action

No areas would be disturbed by thinning or fuels reduction projects in the No Action alternative; there will be no project-based machinery to spread of invasive plants in the project area creating potential habitat for new weed infestations.

There could be indirect effects from the No Action alternative. Roads leading into the forest and project area are used by forest visitors; unclean vehicles have a potential to introduce weed seed, especially along roads and in dispersed recreation areas when the weather is wetter and mud sticks to tires and undercarriages. In addition, increased intensity of fire due to higher fuel loads and more ladder fuels from unthinned stands could result in greater numbers of acres of invasive weed habitat being produced by wildfire.

New invader species will continue to get treatment regardless of alternative. Existing infestations will be treated as funds allow.

Alternatives 2 and 3

Direct effects of timber harvest and hazardous fuels reduction on weed introduction and persistence are due to a combination of soil disturbance and transport of seed into disturbed areas from silvicultural prescription, harvest methods and logging systems, road maintenance and construction and pile burning. Risk ratings are a way that risk of invasion by invasive weed populations can be explained, quantified and compared between alternatives. Elements of the proposed project that can create habitat for invasive plants are listed and quantified by alternative (Table 49).

Table 49 Acres Affected by Weeds (in Acres)

Project element	Proposed Action	Alternative 2
Thinning Acres total	2549	1909
Gaps	130	90
Shelterwoods	94	9
Early Seral/Regeneration	45	16
Landings	580	464
Roads, new and existing	9.3	6.3
RISK RATING	High	Moderate/High

In the action alternatives, the areas that would be opened up to light and disturbance would be most at risk, e.g., roads, landings and silvicultural prescriptions that open up the habitat-gaps, shelterwoods and early seral. These areas are subject to ground disturbance and exposure to vehicles and equipment that may bring seed in, especially gaps adjacent to powerline corridors that will be constantly kept in a disturbed condition. Ground based yarding opens up more habitat than helicopter or skyline (suspension) yarding. Areas that are piled and burned typically create a nice seedbed for weeds as the hot central areas are usually burned to mineral soil.

Risk ratings were higher for Alternative 2 than 3, largely based on the increased numbers of acres of all the weed habitat producing activities associated with them. Probability of creating habitat for weeds is highest in the early seral stands and in gaps where there is little competing vegetation for weeds after harvest. Both action alternatives have a high probability of creating weed habitat.

Risk of weed invasion decreases in areas where temporary roads and landings are closed, rehabilitated, and seeded with genetically local, native plant species. In addition, the requirement for cleaning equipment before it comes onto the Forest will help reduce the possibility of introducing weed seed on logging equipment.

To address the issue of movement of weeds from main roads and powerline corridors, there is a project design criterion that states all gaps should be at least 200 feet from all temporary roads. Temporary roads and landings and will be burned and seeded in order to avoid the spread of invasive species.

Cumulative Effects

There will be no cumulative effects for Alternative 1-No Action.

The area analyzed for cumulative effects for the Action Alternatives is the project area and project area road system (31295 acres). Cumulative effects consist mainly of disturbance caused by the harvest activities (commercial thin, gaps, early seral harvest and shelterwoods) and road construction.

The cumulative effect of creation of habitat for more weed invasion for Alternative 2- Proposed action includes disturbance contributed by harvest activities of 2818 acres and more than 9.3 miles of roads (65 acres) potentially used for access= 2883 acres disturbed. This is an effect on 9.2% of the watershed.

The cumulative effect of Alternative 3 includes disturbance contributed by harvest activities of 2033 acres plus habitat created by building or reopening 6.3 miles of roads (44 acres)= 2077 acres disturbed. This is an effect on 6.4% of the watershed.

Some factors will ameliorate the effects of this large scale weed habitat creation. Project design elements such as requirements for washing of equipment and seeding of bare ground are meant to prevent infestations. It is estimated that this can reduce the abundance of weeds by up to 50%. Annual treatments and monitoring of new sites will continue before and after the project. Early detection of new populations that spring up is critical to containment and will save a great deal of time and money.

Project design elements including pretreatment of invasive species that will be done before logging activities begin using congressional appropriated funds. Monitoring roadside disturbed areas for new infestations will also occur on an annual basis. This would reduce overall cumulative affects within the planning watershed.

3.8 Transportation

3.8.1 Summary of Effects Analysis

Approximately 232 miles of roads were analyzed within the Hwy 46 planning area. Haul routes are identified as suitable for all season haul where structural strength is sufficient or can be restored with maintenance/reconstruction.
Alternative 2 recommends reconstruction/maintenance work on approximately 108.0 miles. Alternative 2 also recommends storage of 1.37 miles and decommissioning of 1.99 miles.
Alternative 3 recommends reconstruction/maintenance work on about 98.2 miles. Alternative 3 also recommends storage of 1.37 miles and decommissioning of 1.99 miles.
Five roads have been identified for road realignment within the planned transportation system.

3.8.2 Scale of Analysis

The Willamette National Forest completed a roads analysis in 2003. The Willamette National Forest Roads Analysis met the requirements of roads analysis at the Forest level.

A travel analysis was conducted for this project as a guide for managing the National Forest System (NFS) roads in the Hwy 46 Project planning area. Field work occurred during 2014 to 2016. A travel and road management plan (the plan) was developed as a result of the analysis and details current road status such as open and stored roads, road conditions, stream culvert location and conditions, road maintenance levels, and road access and travel management classifications. Data spreadsheets display this information and all documented information resides in the transportation analysis file. The plan proposes management recommendations for roads within the transportation analysis area. The travel analysis and plan considered such road-related items as safety, risk to resources, future expected use, public and private access, emergency access, and maintenance costs.

The 2003 Willamette National Forest Road Analysis selected a set of key forest roads. These Key Forest Roads “should be operated and maintained to standards consistent with its Road Maintenance Objective. The public will be encouraged to use the system of Key Forest Roads for access into and through the Forest.” (USDA, 2003).

3.8.3 Affected Environment

The road system on the Detroit Ranger District was built during the past 60 years primarily for timber harvests and recreational use. These roads were built with a variety of maintenance objectives and construction techniques. As timber-harvest related road use has declined, so have the funds to maintain them, resulting in poor and deteriorating conditions. The roads in this planning area have a wide range of needs to maintain user safety and structural resilience and to prevent negative impacts to other resources. There has been limited commercial activity within this planning area in the past 20 years which has provided insufficient road maintenance or reconstruction on the transportation network. Roads in the planning area are becoming overgrown with brush, have nonfunctioning ditches, and have surface irregularities. In addition many culverts are near the end of their design life (25-30 years) and are in need of replacement.

Primary access to the Hwy 46 planning area is provided by key roads on Table 50. These primary access roads have asphalt or aggregate surfacing. All other Non-Key roads tributary to these major access roads are single lane aggregate or native surfaced roads with turnouts which have been built and maintained primarily for timber harvest activities and powerline access. These roads are either termed collector or local roads. Many local roads have been closed seasonally or year-round for wildlife or administrative purpose. Most system roads designated for haul in the Hwy 46 planning area have had some surface and drainage maintenance from previous activities. The open road density for the planning area is currently at 2.91 miles per square mile.

Table 50 Key Forest Roads

Road Number	Key Forest Road	Objective Maintenance. Level
2231000	Yes	3 – Suitable for Passenger Cars
2231840	Yes	2 – High clearance vehicles
2231890	Yes	3 – Suitable for Passenger Cars
2231893	Yes	3 – Suitable for Passenger Cars
2231896	Yes	3 – Suitable for Passenger Cars
2233000	Yes	2 – High clearance vehicles
2233000	Yes	3 – Suitable for Passenger Cars
4600000	Yes	5 – High Degree of User Comfort
4600030	Yes	2 – High clearance vehicles
4600033	Yes	2 – High clearance vehicles
4600040	Yes	2 – High clearance vehicles
4600050	Yes	2 – High clearance vehicles
4600075	Yes	3 – Suitable for Passenger Cars
4685000	Yes	3 – Suitable for Passenger Cars
4685330	Yes	3 – Suitable for Passenger Cars
4688000	Yes	2 – High clearance vehicles
4688240	Yes	2 – High clearance vehicles
4696000	Yes	3 – Suitable for Passenger Cars
4698000	Yes	3 – Suitable for Passenger Cars

Approximately 16% of the roads used for haul also access private land holdings in the planning area mainly for recreational and administrative use. There are no miles of road within a Cooperative Road Maintenance Agreement designation and no likely future haul from private land holdings. There is currently a road use permit in effect along Hwy 46 and FSR 2231000 to allow access for the Breitenbush Community.

A travel analysis was completed on the road systems within the Hwy 46 planning area to determine the intended purpose, design elements and operation and maintenance criteria for each road segment using an interdisciplinary process and by using the Willamette Road Investment Strategy. The Willamette Road Investment Strategy (RIS) (2015) was an effort used to identify risks to resources posed by roads, identify priorities for maintaining motorized access and to explore opportunities to manage roads differently, aided by feedback from the public and community outreach. The RIS recommended roads be either Remain Closed (RC), Analyze for Closure (AC), Analyze for Decommissioning (AD), Defer Recommendation for later analysis (DR), and Remain Open (RO). The RIS also identified many forest roads as Priority Roads (PR). The Road Status table in Appendix H show the RIS recommendations and the Hwy 46 IDT decisions for Alternatives 2 and 3. The recommendations of this effort were used, along with input and recommendations from Resource Specialists, to write a Road Management Objective (RMO) for each road within the planning area. The RIS will be updated based upon the additional in-depth analysis completed in the Hwy 46 EIS analysis and documented in the RMOs. The RMOs will guide future travel management decisions.

The RIS was a Travel Analysis Report (TAR) recommending the minimum road system that protects resources and provided access for forest management and public motorized use (Travel Management Rule 36 CFR 212). Approximately 232 miles of road were analyzed within the Hwy 46 planning area. About 1.37 miles of road are recommended for storage and 1.99 miles for decommissioning as shown in Table 2. Any storage and decommissioning work on roads used for haul routes will be done post timber sale activities. All roads proposed for decommissioning have been identified as roads that are no longer needed for management activities in the foreseeable future. All roads proposed for storage are currently brushed in and not drivable. Roads proposed for decommissioning and storage will not be accessible to motorized vehicles.

3.8.4 Environmental Consequences

Direct, Indirect and Cumulative Effects

Alternative 1 - No Action

Alternative 1 (No Action) would result in the following effects:

- The current road management objectives to keep the existing key forest roads open in the project area would continue. The ability to effectively implement these road management objectives will be reduced due to no additional road maintenance or reconstruction from timber harvest.
- While currently suitable for noncommercial traffic, with no immediate threat of failure from non-commercial use, forest roads would continue to deteriorate because funding is lacking to properly maintain the roads.
- Road maintenance and repair would continue on a prioritization basis within existing budgets, addressing some of the more critical maintenance items.
- At some point, all or portions of forest roads would become unsuitable for administrative and public uses, resulting in reduced access, loss of capital investments, and adverse impacts to aquatic resources from road failures.
- Non-key roads would continue to grow closed and become less accessible for vehicle use, including high-clearance vehicles.
- No roads would be decommissioned, increasing the potential for damage to resources and roads due to lack of maintenance.
- No culverts in stream channels would be replaced or upgraded.
- Driving conditions would continue to decline, increasing safety hazards; drivers would not be able to clearly locate road turnouts or safe-stopping areas when dealing with oncoming traffic on single-lane roads.

Alternative 2 and 3

Given the beneficial effects from road maintenance and reconstruction, Alternatives 2 and 3 would result in a cumulative beneficial effect to user safety. All action alternatives would provide road maintenance or reconstruction on all haul routes. The incremental cumulative effect of all action alternatives would be to reduce the miles of roads available for motorized access and decrease the impacts to aquatic resources. There would be a reduction in motorized vehicle access, but minimal impact to recreational use. Following consideration of the incremental impacts of the project, when added to past, present, and reasonably foreseeable future actions in the planning area, it is determined that there are primarily minor beneficial and no meaningful adverse cumulative impacts to the transportation system associated with any of the action alternatives. The Forest Service does not anticipate any future timber sale or public works projects to be conducted within the Hwy 46 planning area that could result in adverse conditions to timber sale haul or other activities associated with this planning effort.

Road repair and maintenance as proposed under Alternatives 2 and 3 would result in the following effects:

- About 108.0 miles (Alt.2) and 98.2 miles (Alt. 3) of forest roads would be repaired and maintained to improve structural strength and road surfaces to a level that would support commercial timber haul, safely accommodate mixed commercial and noncommercial use, and meet the desired condition.
- Safer driving conditions would be achieved through roadside clearing, which improves sight distances on key roads associated with commercial haul, and through road repair.
- Some of the safety concerns associated with mixed commercial and public traffic would be addressed by temporarily closing key roads to all public traffic or rerouting traffic to alternative routes such as proposed haul down FSR 2231 instead of out Hwy 46 to protect values of the Breitenbush community and other forest users in the Breitenbush watershed. Rerouting of logging traffic requires road realignments, see table 51 below.
- Replacement of live stream culverts and failing ditch relief culverts would protect resources and capital investment in the road. Live stream culverts identified for replacement or removal have been identified and documented in the plan. Placement of additional ditch relief culverts would be designed to disconnect ditch line water from live stream channels by diverting runoff onto vegetated natural ground. Run off would also be diverted away from fill slopes to improve fill stability and reduce risks of fill failure. This would benefit water quality and potential fish habitat for the duration of the improvement.

Table 51 Road Realignments

Road Realignments	Length	Decommissioned Length	Access to Units	Notes
2231850	0.1	-	180, 220, 250, 260, 290	New angled approach will be constructed at the intersection of road 2231000 to align haul vehicles south on road 2231000 to facilitate haul to Hwy 22. Clearing of less than 0.5 acres needed. Haul to Hwy 22 required to protect noise quality near Hwy 46 and Breitenbush community.
2231870	0.1	-	240, 260, 280, 290, 300, 310, 320, 340, 350, 360, 370, 380, 390, 400	New angled approach will be constructed at the intersection of road 2231000 to align haul vehicles south on road 2231000 to facilitate haul to Hwy 22. Clearing of less than 0.5 acres needed. Haul to Hwy 22 required to protect noise quality near Hwy 46 and Breitenbush community.
4600012	0.18	0.18	45, 47, 64	Reroute to the south near MP 0.5 to avoid steep grade. Clearing of less than 0.5 acres needed.
4688000	0.22	-	97	Extend end of road to access landing.
4600059	0.31	0.30	-	Short Lake Reroute. To be completed after sale.

Decommissioning non-key forest roads, as proposed under Alternatives 2 and 3 would result in the following effects:

- About 1.99 miles of existing non-key forest roads would be decommissioned. These roads are determined to be no longer needed for management activities, closed to all vehicle traffic, and taken off the Forest's road inventory.
- Road treatments may include removing stream crossings, waterbarring road surfaces, removing unstable side-cast material, and closing entrances with barricades, such as earthen berms, boulders, or guardrails or some combination thereof. These actions would improve stability of the road prism.
- Decommissioned roads are barricaded and motorized vehicle traffic is prohibited. Stabilizing the road reduces the risk of road failure, reduces risks to water quality and allows the area once occupied by the road bed to return to a more natural state.

Storing non-key forest roads, as proposed under Alternative 2 and 3, would result in the following effects:

- About 1.37 miles of non-key roads would be stored. Vehicle access would be precluded on stored roads, with access only allowed under emergency circumstances. Storing these roads would reduce the backlog of maintenance needs within the analysis area. Stored roads would be maintained during times when they are reopened to implement future projects.
- Road storage could add to the cost of post-harvest stand treatments and monitoring, depending on the timing of storages. Where possible, road storage would be timed to minimize these effects.
- Stored roads are water barred and if necessary have culverts removed. These activities stabilize the road prism until the road is needed. Prohibiting motorized vehicle traffic would contribute to protection of resources and preserving the road for future use.

Public motorized vehicle access is reduced under Alternatives 2 and 3. Open roads drop from approximately 73% to approximately 72% of road miles in the project area. The 170 miles that would remain open are primarily key roads in maintenance levels 2 and 3. Alternatives 2 and 3 both respond to the National roads policy identified in the introduction of this document directing forest to identify and implement a minimum road system. Alternatives 2 and 3 meet the proposed minimum road system in the Hwy 46 planning area. With the implementation of roads storage and decommissioning work, the open road density for the planning area will decrease to 2.85 miles per square mile based on the alternative selected.

Temporary Spur Roads

Alternative 2 and 3 require construction and reconstruction of temporary spur roads. Alternative 2 would have approximately 9.3 miles and Alternative 3 would have approximately 6.3 miles of temporary roads built within the project area.

Under Alternatives 2 and 3, the following effects are expected from building temporary roads:

- Temporary roads would generally be limited to commercial use; these roads may provide opportunities for limited, short-term public use, such as firewood gathering and special forest products.
- Temporary road locations typically do not connect with streams, minimizing effects to hydrology. These criteria serve to minimize the disturbance of riparian areas. Stream crossings would be avoided where possible during the construction of all temporary roads.

3.9 Heritage

3.9.1 Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects for Heritage Resources includes the units proposed for treatment, road construction, landings, meadow restoration and hazardous fuel activities within the Hwy 46 Project. All of these ground disturbing activities have the potential to affect the integrity of cultural resources. An archaeological survey of the Hwy 46 project was conducted in order to comply with Section 106 of the National Historic Preservation Act (NHPA) and other relevant laws and regulations. A systematic surface pedestrian search is the principal manner for implementing the mandated goals.

3.9.2 Assessment Methodology

The field survey of the Hwy 46 Project was performed by five crew members, utilized on different days, during the summers of 2013, 2014 and 2015. Pedestrian transects spaced at 15 to 20 meter intervals followed a specific orientation based on factors that included the shapes of units and landforms and the possible presence material remains and features left behind by Indian or Euro-Americans. These material remains and features are called cultural sites. The objective of the Hwy 46 cultural resource survey was to identify all cultural sites within the project's area of potential effect (APE) with the goal of protecting them from ground disturbing activities. One-by-one meter shovel scrapes made with entrenching tools exposed mineral soil every 20 to 30 meters in areas where dense vegetation limited ground visibility. Bearing orientations were followed to the best of abilities, but adjustments in orientation, spacing intervals, and shovel scrape spacing were made in order to avoid dangerous or unreasonable conditions (e.g., exceptionally steep slopes or impenetrable vegetation).

Under the Hwy 46 Project a total of 1653 acres were surveyed consisting of 935 high probability acres and 618 low probability acres. Fourteen previously known cultural sites and isolated finds were monitored during completion of the Hwy 46 Project surveys and three new cultural sites and six isolated finds were identified and recorded during fieldwork. A total of sixteen recorded cultural sites within the Hwy 46 Project area considered potentially eligible to the National Register of Historic Places (NRHP) and must be protected from project activities or evaluated to determine eligibility to the NRHP. No other known cultural sites would be affected by the proposed project actions.

3.9.3 Affected Environment

The prehistory and history of the Breitenbush drainage have previously been summarized in Prehistoric Land-Use Patterns In the North Santiam Sub-basin on the Western Slopes of the Oregon Cascade Range (Kelly 2001), the Cultural Resource Overview for the Willamette National Forest, Western Oregon (Minor and Pecor 1977) the ten-year update of the above overview (Minor 1987), Archaeology of Oregon (2nd Edition) (Aikens 1986), the Breitenbush Watershed Analysis (and numerous other publications). These documents provide some detail of ethnographic and historic background for this report.

Cultural History

Ethnographic research indicates that highly mobile prehistoric and early historic Indian groups, probably the Molala, Kalapuya, and their ancestors used the western Cascade Mountains for the main purposes of seasonal hunting, fishing, and plant gathering. Ethnographic evidence also suggests that the Molala Indians were indigenous to the area and lived during the winter along low elevation streams, accessing the uplands during the summer and fall to hunt game and gather berries and other important plant resources. The Molala are linguistically related to Willamette Valley groups, but are thought to be composed of montane-based bands who were living in the western Oregon Cascades during the historic period.

Most of what is known of the Molala comes from two of the three subgroups into which they are generally split: the Northern Molala located in the vicinity of Mount Hood's drainage systems and the Southern Molala located west of the Klamath Lake area. Little is known of the third group, referred to as the Upper Santiam/Santiam band of Molala, who are thought to have inhabited Linn and Lane counties in the areas between the northern and southern groups. The Molala are also often culturally grouped with the

Kalapuya who were based in the Willamette Valley, but probably made seasonal forays to the Cascades for large game and berries.

Unfortunately, Indian contact with trappers, missionaries, military expeditions and settlers also brought them into contact with European diseases such as smallpox and influenza, which decimated their populations. By the mid -1800s many of the remaining Molala and Kalapuya were removed to the Grand Ronde Reservation in western Oregon after the signing of the Dayton and Molala Treaties of 1855. Other Molala shifted to the Siletz Reservation along the Oregon coast, the Klamath Reservation to the south and to the Warm Springs Reservation in eastern Oregon where they were absorbed into the Confederated Tribes of Warm Springs. Today, the Willamette National Forest works closely with our Tribal Partners insuring the protection of cultural resources.

Pre-contact Indian use in the area is reflected in the cultural material they left behind including but not limited to chipped obsidian lithic scatters and obsidian lithic isolates, representing tool use, modification, or manufacture related to hunting and gathering. These sites are protected through avoidance from project activities.

Historic era

Breitenbush Hot Springs
In the late 1840s, John Breitenbush, a local trapper, was the first white person to visit the Breitenbush hot springs via a trail from Detroit. He supposedly acquired knowledge of the springs through his association with the Native American Indians. In the ensuing years, trappers and hunters frequented the area during trips into the Breitenbush drainage. In circa 1873, John Minto and Henry States lead an expedition up the North Fork of the Santiam River attempting to find an easy route over the Cascades. On this trip they met up with John Breitenbush at the main tributary to the North Santiam and later named this tributary after him.

In 1874, another trail into the Breitenbush Hot Springs was constructed from Idanha following Native American routes. In 1897, John Hollingsworth started operating pack trains carrying visitors and their overnight bags into the springs. Access to the remote area was by trail until wagon road was constructed in the late 1920s. Bringing people into the newly established resort was the intent for constructing the wagon road.

In 1911 Mark S. Skiff, from Salem, Oregon applied for a special use permit with the Forest Service to occupy about three acres of land to construct a hotel, sanitarium, and several other buildings along with water rights to three mineral springs along the Breitenbush River. In 1913, a final permit was issued granting him rights to construct the above buildings for his proposed summer resort business. Skiff was the first person to develop the Lower Breitenbush Hot Springs Resort located on land administered by the Forest Service. In 1921, it cost 5 dollars per week to stay in a cabin and 3 dollars per week to stay in a tent. These at best were temporary accommodations. Then in 1923, the hot springs resort was officially established. Over the next several decades' accommodations improved. Thirty five cabins, a store, outhouses, a foot bridge spanning the Breitenbush River, a hot springs containment and hydroelectric development with associated dam, sluice and powerhouse provide the major modifications needed for resort operations. Then in 1979, the Forest Service closed the resort for unacceptable human waste disposal systems, an unsafe foot bridge across the Breitenbush River leading to the bath house, and general deteriorated condition so the bathhouse and pools, store and several of the cabins.

In 1980 the Forest Service issued a new special use permit to an individual who had plans to reconstruct and operate a new resort. Over the next 15 years, this new permit holder made little to no progress with the exception of demolition of most of the structures (some went to the Private Breitenbush Hot Springs owners). By the mid-1990s the Forest Service did not renew the permit due to a lack of development required under the special use permit.

Summer Recreation Residence Tracts
The Breitenbush and Devils Creek Recreation Residence tracts are located within the project area. The Devils creek tract was platted in 1929 and the summer homes constructed between 1945 and 2007 (Carter 2007). The Breitenbush tract was originally platted in 1929 and 1933 but construction of the privately owned buildings did not start until the 1950s. Most of these summer homes were constructed in the 1950s and 1970s (Carter 2007).

The recreation residence tract development was in response to the broader Forest Service plan to bring the public to the forest and provide them with recreational opportunities (Carter 2007). The residences were located and platted by the Forest Service and the individuals lots were then leased to private citizens who constructed a cabin at their own expense. The layout of each tract and the size and design of the cabin followed guidelines set forth within the Region 6 Forest Handbooks.

Both of these tracts and their individual building were evaluated to determine National Register of Historic Places significance. The Breitenbush Summer homes and the Devil Creek tracts were both found not eligible for listing on the National Register because too many of the structures had not yet reached the age threshold for eligibility.

Early 1900s Railroad Logging
Railroad logging on the Detroit Ranger District began prior to the creation of the national forest. Hammond Lumber Company, under the use of the Homestead and the Timber and Stone Acts (Rakestraw 1991) acquired a sizeable holding both within the Santiam National Forest and just outside its boundary. The period between 1894 and 1907 Hammond Lumber Company bought the Oregon Pacific Railroad (aka, Southern Pacific Railroad). In 1910 the regional office sent William B. Osborne Jr. to the Detroit area to conduct a reconnaissance. Osborne found 20 townships that held large timber values in old growth forests that were deteriorating (Rakestraw 1991). The Breitenbush River offered a good route to access the timber. To extract the logs, Hammond constructed many miles of grade and track up the Breitenbush River branching off the main line at the Santiam River. Many arterial branches of the railroad were constructed up French, Canyon and the Humbug Creek drainages. Many of the routes have been formally recorded in the field. The railroad grades reflect the single use of retrieving the wood and abandoning the grades. The technology employed during this time included ground based logging which utilized a steam donkey placed adjacent to the railroad tracks with winch lines 300-500 feet long. The logs would have been dragged on the ground to the tracks and loaded on the train. Several logging camps were located along the railroad line and included Camp 9, Camp 11, Camp 15 (within Idanha), Camp 5, Camp 7 and Camp 17 (present day Detroit) during the Hammond Lumber logging days. All of which have disappeared either under the reservoir or town development (Detroit).

Approximately, 23,000 acres were logged off and burned along the North Santiam River and its tributaries within and outside of National Forest Land (T10S, T9S, and R. 3E, 4E, 5E and 6E). Hammond Lumber Company owned 20,500 of this acreage. About 680 of these acres were logged by Hammond under a Timber Sale contract on National Forest land and the rest logged on other private inholdings. This logging took place from Mill City up to Idanha. About ¼ of the acreage was subsequently grass seed over an eighteen year period with the sole purpose of selling the land for grazing and farming along the North Santiam River. Hammond Lumber Company was not favorable towards reforestation. They felt that their lands were more valuable to them post-harvest as grazing lands. It was also their opinion that reforestation was the responsibility of the Federal or State government on their lands not on private lands.

In 1922, contact between the Forest Service (Forest Supervisor C.C. Hall and Assistant Forester C.J. Buck) and Hammond Lumber Company began communications regarding the exchange of Hammond Lumber Company lands under the provisions of the March 20, 1922 Act 42 Stat. 465). Hammond Lumber Company was offering up lands within Township 10 South, Ranger 5 East Sections 1, 2, 3, 7-16, 18 and 22) and Township 10 South, Range 6 East Section 18, 21, and 22. After several years of communication via letters, the Secretary of Agriculture approved the Hammond lumber company exchange through a night wire telegram dated February 21, 1930. In exchange for Hammond lands, the right to cut and remove an equal value of timber from about 62 acres within T.9S, R5E, and Section 21 was requested. A letter dated April 6, 1931 from the Assistant Regional Forester Horton states that the Department of Interior notified the Secretary of Agriculture that the “exchange application of the Hammond lumber Co. was approved and that title to the offered land as accepted by the government.” Hammond had also fulfilled his requirement to remove the timber that was granted under this exchange. In 1934, Mr. Olin, the General Manager of the Hammond Lumber Company, expressed interest in a second land exchange for lands in the French Creek area during a meeting with the local district ranger, Ranger Elliot. The ranger documented this request in a letter dated January 24, 1943 to the Forest Supervisor, P. A. Thompson. The Hammond Lumber Company was offering 800 acres of lands within Township 9 South, Range 5 East, Sections 21, 25, 26, 27, and 28, in exchange for timber on unsurveyed lands from Township 20 South, Range 4 East, Sections 6 and 7. The official application for the land exchanged was filed on December 10, 1934, as application 021720. Fred W. Johnson, Commissioner, sent a letter to the register in Roseburg, Oregon dated September 10, 1934 that outlined the completion of the second land exchange of the Hammond Lumber Company.

Administrative Use
Historic administrative use of the project area appears mainly in the form of trails which functioned as part of the communication network in the early days of the Forest Service. In the 1930s, with the inception of the CCC program, the trail system expanded across the district linking newly constructed guard stations and lookouts and expanding communications with the installation of miles of telephone line. Eventually some of the trails were replaced with roads and some of the trails fell off the system because they were no longer needed for administrative use. A few of these early trails include: Roaring Creek, South Breitenbush, Rapidan, and Mansfield Trail.

Timber harvest in the Hwy 46 project area began in the early 1900s. From 1817 to 1959 timber harvest and fires in the project area accounted for close to 800 acres of stand replacing disturbance. For Hwy 46 many of the stands were originally clear-cut harvested in the 1960s through the early 1980s but continued into the 1990s. For most of these units, the original timber harvest occurred prior to the President signing Executive Order 11593 and implementation of Section 106 of the National Historic Preservation Act (NHPA) of 1966 (amended in 1976, 1980, and 1992). During this period prior to the mid to late 1970s, the Forest Service was not required to hire professional archaeologist to conduct cultural resource surveys. Thus few sites were known on the forest.

3.7.4 Environmental Consequences

Direct and Indirect Effects

Alternative 1 – No Action

Implementation of the no action alternative would not directly nor indirectly affect cultural resources since there would be no change to the integrity of cultural resource sites. However, the no action would protect any undiscovered cultural sites that were not found during the survey for Hwy 46.

Alternative 2

Timber harvest, new and temporary road construction, ground base and skyline yarding and post-harvest fuel treatment contribute to ground disturbance. Ground disturbance can affect the surface and subsurface integrity of an archaeological site and thus its significance to the National Register of Historic Places. Since appropriate and approved surveys have been conducted and cultural site protection measures are already in place (see Design Elements Chapter 2 Table 13), the potential direct effects to all other potentially eligible sites would be in the form of inadvertent damage to the integrity of the cultural resources which were not discovered during initial survey. Any sites uncovered during implementation of the project would require all earth-disturbing activities in the vicinity of the find to be suspended, in accordance with federal regulations, and the zone archaeologist notified to evaluate the discovery and recommend subsequent courses of action. Therefore, contract clause BT6.24 (or its equivalent) must be included in all project prospecti and contracts. The contract clause outlines the procedures to follow in the event cultural resources are discovered during timber sale operations.

Alternative 3

Implementation of Alternative 3 would result in ground disturbance on 33 less miles of road maintenance on haul routes, 2.2 miles less of new temporary new road construction; and 793 less acres of timber harvest. Post-harvest activities include 525 less acres of underburning slash and associated fire line construction.

Based on these numbers, Alternative 3 would result in less ground disturbance from harvest thinning activities, thus less potential for inadvertent damage to the integrity of cultural resources which were not discovered during initial survey. Since appropriate and approved surveys and cultural site protection measures are already in place (see Design Elements Chapter 2), the potential direct effects to all other potentially eligible sites would be in the form of inadvertent damage to the integrity of the cultural resources which were not discovered during initial survey. Any sites uncovered during implementation of the project would require all earth-disturbing activities in the vicinity of the find to be suspended, in accordance with federal regulations, and the zone archaeologist notified to evaluate the discovery and recommend subsequent courses of action. Therefore, contract clause BT6.24 must be included in all project prospecti and contracts. The contract clause outlines the procedures to follow in the event cultural resources are discovered during timber sale operations.

Therefore, no adverse effects are anticipated from either Alternative 2 or 3 due to the avoidance of known cultural resources and the application of timber sale contract clause BT6.24.

Cumulative Effects

Alternative 1

Based on a review of the past, present and foreseeable projects listed in Appendix C, none overlap in time and space that would cause cumulative effects to the known cultural sites from any of the proposed actions under the Hwy 46 Project. Appropriate and approved surveys and cultural site protection measures are already in place for this project (see Design Elements Chapter 2, avoidance clause).

Alternative 2 and 3

Based on a review of the past, present and foreseeable projects listed in Appendix C, none overlap in time and space that would cause cumulative effects to the known cultural sites from any of the proposed actions under the Hwy 46 Project. Appropriate and approved surveys and cultural site protection measures are already in place for this project (see Design Elements Chapter 2, avoidance clause).

3.10 Scenic Quality

3.10.1 Summary of Effects Analysis

Alternative 1 would have no adverse effects on scenic quality because no harvest treatments would occur under this alternative. This alternative would also fail to reap positive effects to scenery that would occur as a direct result or benefit of the proposed actions.

Alternatives 2 and 3 would not have negative long term effects to scenic quality. Views from Gold Butte, Fox Creek group campground, various points within the Breitenbush viewshed corridor, and along Highway 46 would be slightly altered, but changes would be difficult to discern from naturally occurring variation in the landscape. The proposed actions would provide benefits to visuals along the powerline corridor and would enhance the view of Mt. Jefferson from the West Cascades National Scenic Byway. The proposed actions would not have any long term adverse effects to visually sensitive management areas, and proposed treatments would be consistent with standards and guidelines set by the Forest Plan.

3.10.2 Scale of Analysis

The geographic scale used to assess direct, indirect, and cumulative effects for scenic quality are the areas encompassed by the Breitenbush viewshed as well as recreation features, travelways, and other areas with scenic designations found in the project area.

3.10.3 Affected Environment

Valued Landscape Character

The Hwy 46 project area encompasses the Breitenbush viewshed corridor. This viewshed is an important scenic asset as it surrounds the Breitenbush Hot Springs Retreat and Conference Center and includes travel corridors that are considered sensitive to scenic quality. The stretch of Highway 46 that falls within the project area has two scenic designations: the West Cascades National Scenic Byway and the Cascading Rivers State Scenic Bikeway. Sections of the South Breitenbush Gorge (designated National Recreation Trail), South Breitenbush, Triangulation, Mansfield, and Crag trails as well as developed and undeveloped recreation sites fall within the project boundary. Segments of the Breitenbush River and South Fork Breitenbush River, which are eligible for Wild & Scenic River designation, are within the project area and the Mt. Jefferson Wilderness borders the project area on the east.

Douglas-fir and western hemlock dominate the overstory cover of the project area, which is quite densely vegetated in many parts. Rolling hills as well as fairly steep topography adds variation to the landscape and provides potential for scenic views. The project area is highly valued for its scenery by recreation visitors, through-drivers, and Breitenbush guests and community members.

Visual Management System

The Visual Management System (VMS) is the primary means for planning and managing the Willamette National Forest’s scenic resources. The VMS was used to inventory and categorize landscape zones of relative scenic importance in the Forest Plan. The zones are based on attractiveness, proximity to travelways and use areas, and the concern Forest users have for scenic quality. These zones are assigned one of five Visual Quality Objectives (VQOs) that represent relative degrees of acceptable alterations of the natural landscape (USDA Forest Service 1977). The VMS methodology was created during an era and with the assumption that silvicultural treatments would be primarily regeneration harvest (clear-cuts). This inherent assumption in the methodology adds complexity to using the system when interpreting and evaluating modern commercial thinning treatments.

The VQOs for the Hwy 46 project area include preservation, retention, partial retention, modification, and maximum modification (USDA Forest Service 1990). These VQOs are illustrated in Figures 38 and 39 and described in detail in Table 52

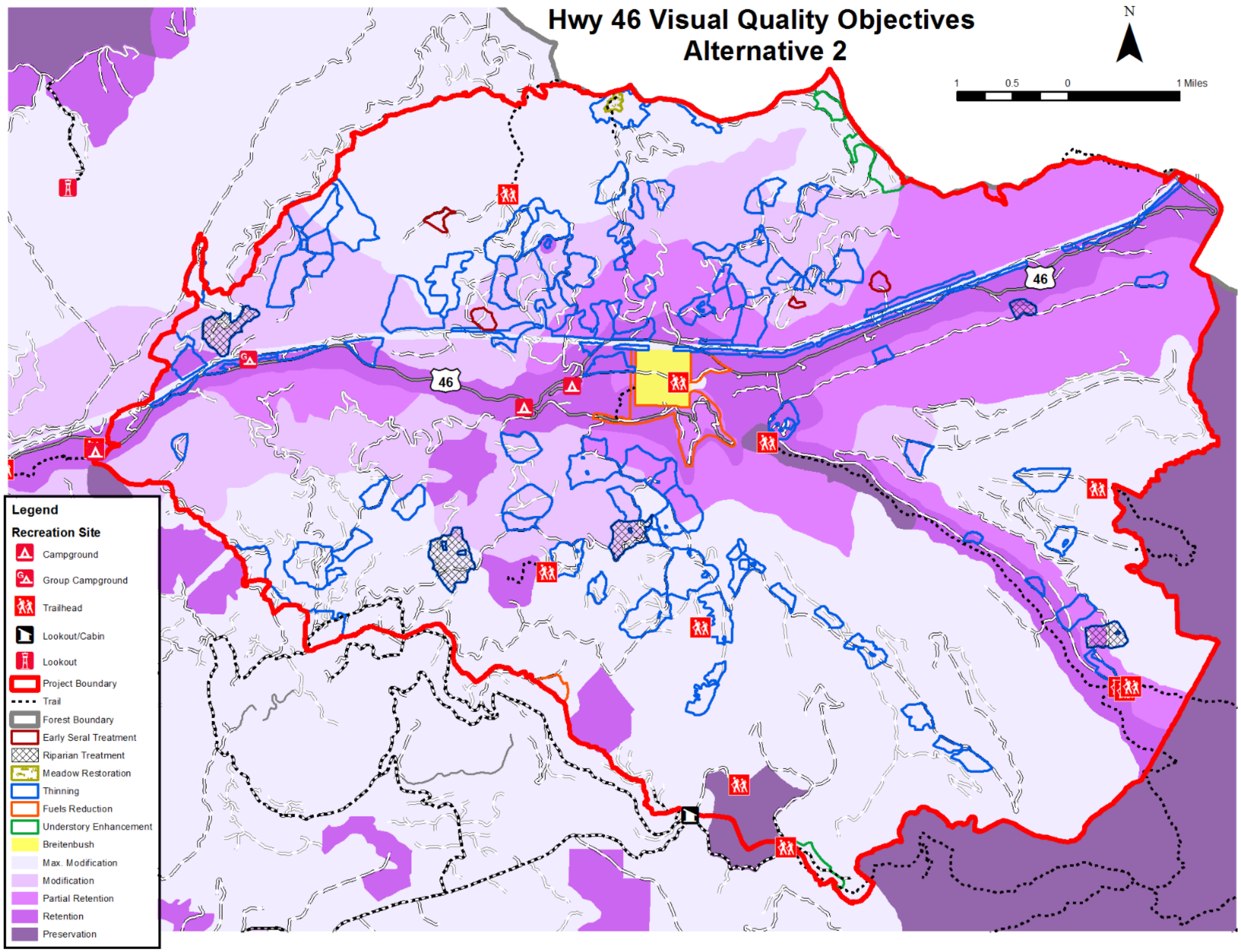


Figure 38 Alternative 2 VQOs

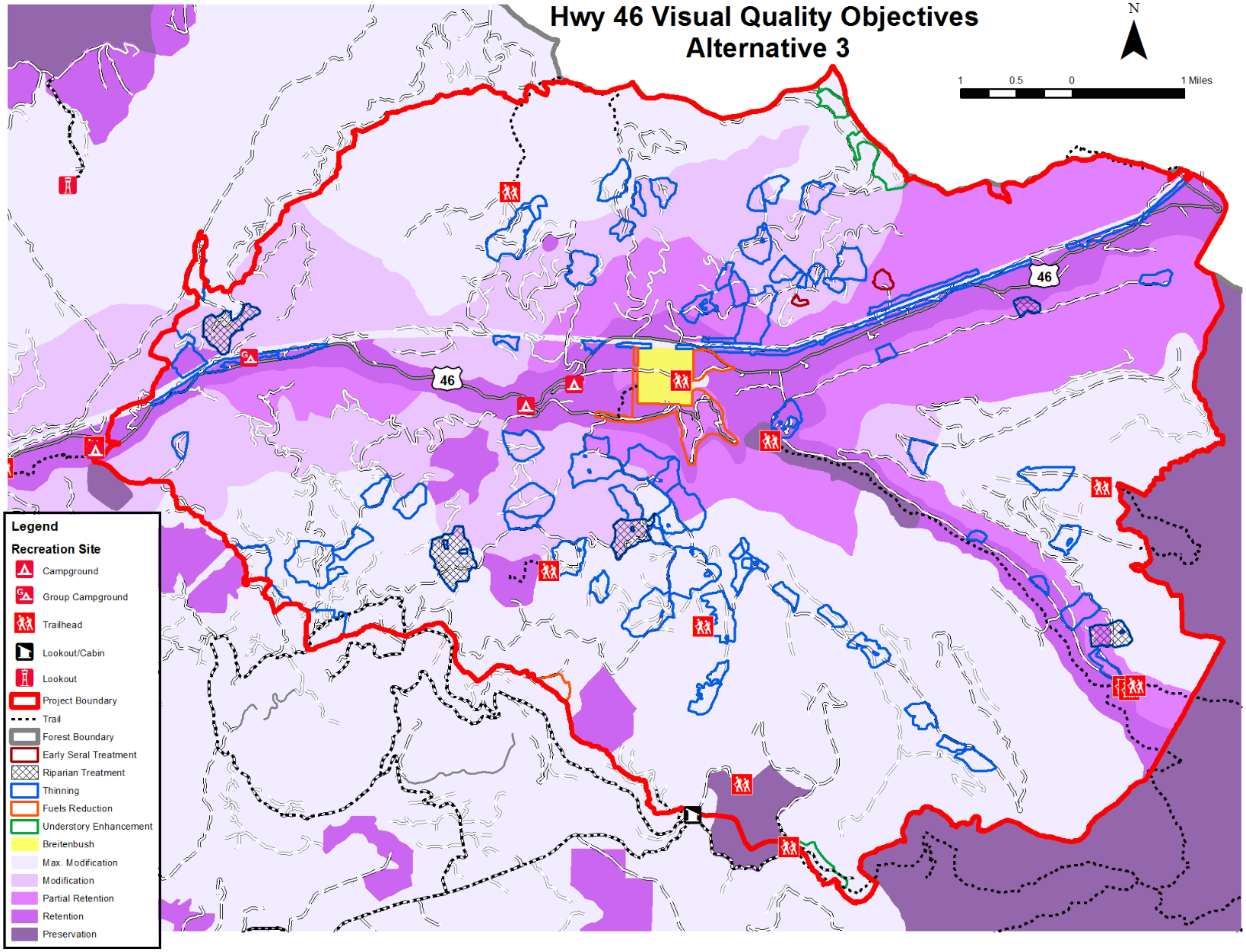


Figure 39 Alternative 3 VQOs

Scenery Management System

The Scenery Management System (SMS) is an updated methodology (1996) used by the Forest Service to provide a visual impact assessment of effects to the scenic resources. This method aims to integrate social impacts to recreation visitors with physical impacts to the visitor experience. SMS objectives are described in terms of Scenic Integrity Levels, which describe existing conditions and the degree to which the landscape is perceived as visually intact or complete (USDA Forest Service 1996).

While the current Forest Plan is tiered to the VMS method, the SMS has also been used in this analysis to facilitate the change in methodology. Table 52 describes the five VMS/SMS categories, associated SMS/Scenic Integrity Level categories, and the proposed treatment acres in each category for alternatives 2 and 3.

Table 52 VMS/SMS Objectives and Proposed Treatments

Visual Quality Objective (VQO) (VMS)	Scenic Integrity Level (SMS)	Proposed Treatment Acres in Alternative 2	Proposed Treatment Acres in Alternative 3
Preservation: Provides for ecological change only	**Very High:** Landscape character is intact with only minute if any deviations. The existing landscape character and sense of place is expressed at the highest possible level		
Retention: In general, human activities are not evident to the casual forest visitor	**High:** Landscape character appears intact. Deviations may be present but must repeat the form, line, color, texture, and pattern common to the landscape character so completely that and at such a scale that they are not evident	Fuels Reduction (98 acres), Visual Enhancement (1/3 acre), Commercial Thinning (321 acres)	Fuels Reduction (98 acres), Visual Enhancement (1/3 acre), Commercial Thinning (223 acres)
Partial Retention: In general, human activities may be evident but must remain subordinate to the characteristic landscape	**Moderate:** Landscape character appears slightly altered. Noticeable deviations must remain visually subordinate to the landscape character being viewed	Early Seral (14 acres), Fuels Reduction (101 acres), Visual Enhancement (1 acre), Understory Habitat Enhancement (< 1 acre), Commercial Thinning (479 acres)	Early Seral (14 acres), Fuels Reduction (101 acres), Visual Enhancement (< 1 acre), Commercial Thinning (391 acres)
Modification: Human activities may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture, and appear as natural occurrence when	**Low:** Landscape character appears moderately altered. Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes or architectural styles outside the landscape	Early Seral (25 acres), Understory Habitat Enhancement (3 acres), Commercial Thinning (1,153 acres)	Early Seral (5 acres), Commercial Thinning (731 acres)

Visual Quality Objective (VQO) **(VMS)**	**Scenic Integrity Level** **(SMS)**	**Proposed Treatment Acres in Alternative 2**	**Proposed Treatment Acres in Alternative 3**
viewed in foreground or middle-ground distances	being viewed. They should not only appear as valued character outside the landscape being viewed but compatible or complimentary to the character within.		
Maximum Modification: Human activity may dominate the characteristic landscape but should appear as a natural occurrence when viewed as background.	**Very Low:** Landscape character appears heavily altered. Deviations may strongly dominate the valued landscape character.	Early Seral (15 acres), Fuels Reduction (24 acres), Understory Habitat Enhancement (106 acres), Meadow Restoration (15 acres), Commercial Thinning (1,658 acres)	Fuels Reduction (24 acres), Meadow Restoration (4 acres), Commercial Thinning (1,281 acres)

3.10.4 Environmental Consequences

Direct and Indirect Effects

Alternative 1 - No Action

Alternative 1 would have no direct or indirect effects on scenic quality in the project area, and all VQOs would remain consistent with Forest Plan direction. Scenic quality in the project area would be unaffected by management activities because no treatments are proposed under this alternative. Natural processes would continue unimpeded by management actions, and benefits to scenery prescribed by visual enhancement gaps, vista openings, and improved views into the forest would not be realized.

Alternatives 2 and 3

Proposed treatments in alternatives 2 and 3 fall well within allowable scenic quality ranges set by the Forest Plan. Additional assessments of valued viewpoints within and around the project area show that impacts to scenery would be minimal and short-term, or unapparent to the casual forest visitor. Visual enhancement gaps and thinning along transportation corridors would provide benefits to the scenery around the project area by opening views into the forest, providing variation, and softening the appearance of harsh cut lines along the powerline corridor.

Scenic Viewsheds

When considering the visual impact of vegetation management activities within the Breitenbush viewshed corridor, it is important to consider the distance at which different parts of the landscape are viewed. The Forest Plan outlines management areas that are specific to viewshed corridors and divides them by distance zones from which the areas would be viewed. Table 53 illustrates the allowable areas of disturbance and minimum height for stand recovery within the scenic management areas. At the time the Forest Plan was written, “disturbances” were considered large scale or cumulative vegetative disturbances such as regeneration harvest, fire, or road construction over the landscape. Management activities such as commercial thinning, understory habitat enhancement, fuels reduction, and riparian treatments in alternatives 2 and 3 would not be considered “disturbances.” Early seral treatments and sugar pine restoration (shelterwoods) are considered “disturbances” for the purpose of visual assessment.

Table 53 Viewshed Thresholds

Management Area	Total Allowable Disturbed Area (%)	Alt. 2 Disturbed Area (%)	Alt. 3 Disturbed Area (%)	Recovered Stand Height (ft.)
11a- Scenic, Modification, Middleground	24	<1	<1	4.5
11c- Scenic, Partial Retention, Middleground	20	<1	<1	15-20
11f- Scenic, Retention, Foreground	10	<1	<1	15-20

Early seral creation is proposed for 24 acres in alternative 2 and 5 acres in alternative 3 that fall within the 5,353 acres of the Scenic-Modification Middleground (11a) management area. Sugar pine restoration is proposed for 34 acres in alternative 2 and 2 acres in alterative 3 within the 11a management area. Both alternatives are well below the percentage threshold of allowable disturbed area set for Modification Middleground.

The Scenic-Partial Retention Middleground (11c) management area makes up 2,385 acres of the project area. This management area contains 14 acres of proposed early seral treatment in both alternatives 2 and 3 and 5 acres of proposed sugar pine restoration in alternative 2. The combined treatment acreages are below the threshold set for disturbance in this management area.

The Scenic-Retention Foreground (11f) management area makes up 1,259 acres of the project area. Sugar pine restoration is proposed for 3 acres that fall within this management area in alternatives 2 and 3. Again, this acreage is well below the allowable disturbed area threshold.

Scenic-Retention Foreground is found primarily around main travelways and the Breitenbush community in the project area. The Forest Plan indicates that for treatments within this management area stumps should be cut to four inches on the high side, cut trees or leave trees should be marked on the side away from road only, and slash piles should be chunked. In order to maintain the economic viability of the proposed vegetation management and reflect the modern management techniques proposed, this design feature will be used for a 100 ft. buffer on either side of the roadway for units in this management area. It is possible, but unlikely, that visitors may see cut sides of stumps past the 100 ft. buffer along main travelways with sloped sides in the project area. Visual impacts would be further reduced by limited viewing duration given the speed of travel.

Wild and Scenic River Eligibility

In order to maintain eligibility for Wild and Scenic River designation for the Breitenbush and South Fork Breitenbush rivers, a ¼ mile buffer around the rivers are treated under guidelines set for a VQO of Retention. See the Scenic Quality section of Table 13 Design Elements in Chapter 2 for further information.

Valued Scenic Viewpoints

Although the vegetative treatments described under alternatives 2 and 3 meet scenic quality standards specified in the Forest Plan, it is prudent to also consider whether the treatments would be readily seen from valued viewpoints around the Breitenbush community, Forest Road 46, or from vistas accessible by trails. Valued and visually sensitive viewpoints were identified using knowledge of the project landscape, input from the local community, and visualization assessment using ArcGIS and GoogleEarth.

The valued and visually sensitive viewpoints within the planning area and surrounding vicinity were identified as points along the South Breitenbush, South Breitenbush Gorge, Crag, McCoy 6 Boulder Ridge Route, and Mansfield trails, roadside views along Highway 46, views from the Breitenbush community and the Fox Creek group campground, and vistas from Mt. Jefferson, Minto Mountain, Triangulation Peak, Gold Butte, and Hall Ridge.

Commercial thinning treatments in alternatives 2 and 3 are proposed in Scenic-Retention Foreground areas along Highway 46, parts of South Breitenbush Gorge and Crag trails, and the South Breitenbush trailhead. The prescribed treatments and residual trees per acre planned are designed such that the management activities would not be visually evident to the casual forest visitor. Form, line, color, and texture would remain consistent with that of the characteristic landscape. Views from Forest Service system trails and the Fox Creek group campground near proposed commercial thinning would be further protected by a 50 ft. no-harvest buffer (see Scenic Quality section of the Design Elements Table 13 for more detail). The speed at which visitors would be viewing the landscape from Highway 46 (35-45 mph) would further reduce the perceptibility of proposed treatments. Thinning that is noticeable would likely have a beneficial effect of opening views into the forest for visitors and through-drivers and providing a richer mosaic of tree and vegetation diversity.

Figure 40 Fox Creek Group Site. Current conditions left, Photoshop simulation of thinning right.

Views from the Breitenbush community would be protected by vegetation within and immediately surrounding the property in addition to the undulated topography of the area. A site visit showed that middleground vegetation located on the Breitenbush property would provide a thick screen in front of any management activities that are proposed in the project. None of the background landscapes that are visible from the site (i.e. Devils Ridge) would be affected by proposed project activities. Fuels treatments taking place adjacent to the Breitenbush community and summer homes would be conducted in a way to preserve existing site aesthetics and minimize adverse impacts to scenery (for further details, see the

Scenic Quality section of Table 13: Design Elements).

Figure 39 Breitenbush View of Devils Ridge from Footbridge, left. View from Breitenbush Middle Pool, right.

Meadow restoration is proposed along segments of the Mansfield trail in alternative 2 and the McCoy 6 Boulder Ridge Route (used by snowmobiles and OHVs) in alternatives 2 and 3. Although treatments would be enhancing existing natural features and would be repeating form, line, color, and texture of the characteristic landscape, the intentions may not be evident to forest visitors. Restored meadows would provide trail users with variation in scenery and valuable views of alternative landscapes from dense forest. Temporary educational signage would be placed along the more visually sensitive Mansfield trail during and immediately after project implementation. This signage would further connect the public to management activities on Forest Service land and provide an educational opportunity.

Understory habitat enhancement in unit 560 would encompass a segment of the Triangulation trail and the McCoy 3-Outerson Route. This treatment would thin smaller trees (less than 7" in diameter) to allow ground vegetation to thrive. Views from the trail segment and snowmobile/OHV route would not be altered from the original landscape character, and would provide a visual benefit of adding variation in Project activities would not have visual impacts to wilderness character because no treatments are proposed in designated wilderness. Impacts to scenery viewed from the Mt. Jefferson wilderness would be minimal. Views of the proposed treatments would not be visible from the majority of the wilderness due to dense vegetation and undulating topography. The vistas atop Mt. Jefferson and Minto Mountain would be too far from the project area for forest visitors to easily discern any of the treatment areas from the surrounding landscape. Views from Triangulation Peak may have some alterations to the texture of the landscape, but changes would be difficult to recognize from naturally occurring variation and variation resulting from past timber harvests. Proposed treatments would also be unlikely to be noticed by casual forest visitors atop Hall Ridge. Any treatments visible would conform to the landscape's existing character and would be challenging to detect.

Figure 40 View from Gold Butte Lookout 9-27-16

Proposed activities would have a minimal effect on views from Gold Butte. Any changes in scenery would borrow from existing variation in the landscape and would likely go unnoticed by the casual forest visitor. The following Photoshop simulation of proposed activities in alternative 2 show that, although detectable, thinning and sugar pine restoration treatments would be difficult to identify from the surrounding variation in the landscape. Treatments proposed in alternative 3 would have a similar, minimal effect on views from Gold Butte.

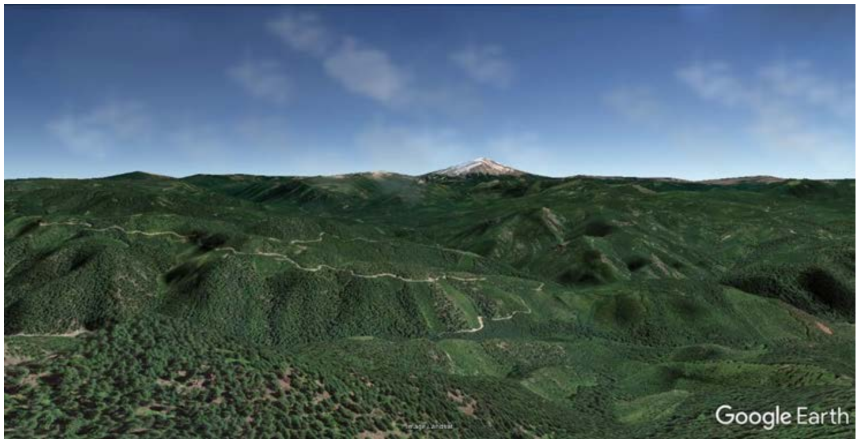


Figure 41 GoogleEarth view from Gold Butte facing SE towards project area

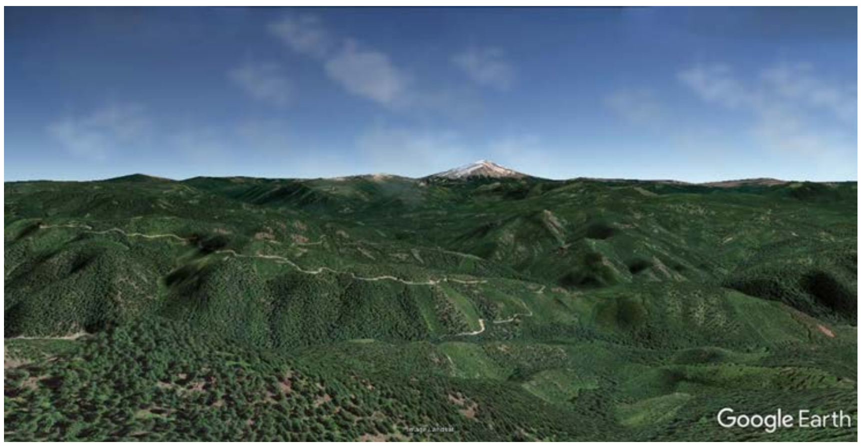


Figure 42 Photoshop simulation of proposed treatments in Alternative 2 from Gold Butte

Scenery Enhancement

In addition to the visual benefits of varying the landscape through thinning along Highway 46, alternatives 2 and 3 would include visual enhancement treatments in units 28, 30, and 69. Gaps ½ acre in size are proposed in alternative 2 along the powerline corridor in units 28 and 30, which is visible from Highway 46. These gaps would soften the existing straight line along the corridor and help to create a more natural appearing landscape. The proposed treatment in unit 30 would remain the same for alternative 3, but the gap in unit 28 would be limited to a band of younger timber along the powerline corridor. Although this smaller gap would still aid in softening the edge, it would have a less impactful positive effect for visuals.

Figure 44 Conditions of Powerline Corridor

Figure 43 Photoshop simulation of 1/2 acre gaps and thinning in units 28 and 30 in Alternative 2

An accentuated view of Mt. Jefferson from the summit pull-out would result from the 1/3 acre gap proposed below Highway 46 in unit 69 in alternatives 2 and 3. This treatment would enhance the scenic value of this section of the West Cascades National Scenic Byway and would provide an additional scenic vista in the project area.

Figure 45: Unit 69 visual enhancement treatment

Cumulative Effects

Alternative 2 and 3

Past and present natural and human caused disturbances or modifications (including fire, disease, timber harvest, fire suppression, prescribed fire treatments, power line corridors, private resort development, and road development) are visible within and adjacent to the project area. Since 1997, approximately 20 acres of the project area has been harvested. This acreage amounts to less than 0.1% of the project area, and vegetation has regrown in the majority of these areas, therefore, no long-term adverse incremental cumulative effects to scenic quality are anticipated.

3.11 Recreation

3.11.1 Summary of Effects Analysis

Alternative 1 would have no direct, indirect or cumulative effects on recreation. Alternative 2 and 3 would have temporary adverse effects due to trail closures, increased noise and dust and log truck traffic during harvest activity. Benefits of timber harvest activity would include improved access to dispersed recreation areas due to road maintenance, improved scenery from secondary forest roads and an enlarged and improved trailhead parking area at the South Breitenbush Trail.

3.11.2 Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects to recreation is the Hwy 46 project planning area which includes the project activity units and those portions of the Breitenbush watershed.

3.11.3 Affected Environment

The project area is popular for both developed and dispersed recreation activities including: camping, hiking, hunting, fishing, bicycling, boating, picnicking, target shooting, berry picking, viewing scenery, and driving for pleasure. Portions of the West Cascades National Scenic Byway and Cascading Rivers Scenic Bikeway are within the project area. The forested slopes along the Breitenbush River form an important scenic backdrop for the byway and river corridor.

Visitor use in the project area is largely driven by river-dependent recreation activities. Private non-motorized boating opportunities (i.e., kayaks, and rafts) are popular year round. Several developed recreation sites provide river access and/or day use facilities like picnic tables, restrooms and garbage service. Seasonal fishing (from the bank and/or boat) is popular with local residents and visitors. Several campgrounds along Forest Road 46 provide access opportunities to explore the area, enjoy a picnic or go for a short hike on a developed trail. There are four special use permits for utilities within the project area as well as 71 recreation residences (summer homes).

Forest Road 46 is part of the West Cascades National Scenic Byway as well as the Cascading Rivers Scenic Bikeway. Forest Road 46 is a popular route for scenic driving and road cycling. It is not uncommon to find the roads busy with individual or group road cyclists during the summer months. Those same cyclists also share the road with those choosing to enjoy the scenery from the comfort of their car.

Overnight camping occurs in many places and in many forms in the project area including at unmanaged dispersed campsites and at developed campgrounds or resort style private accommodations.

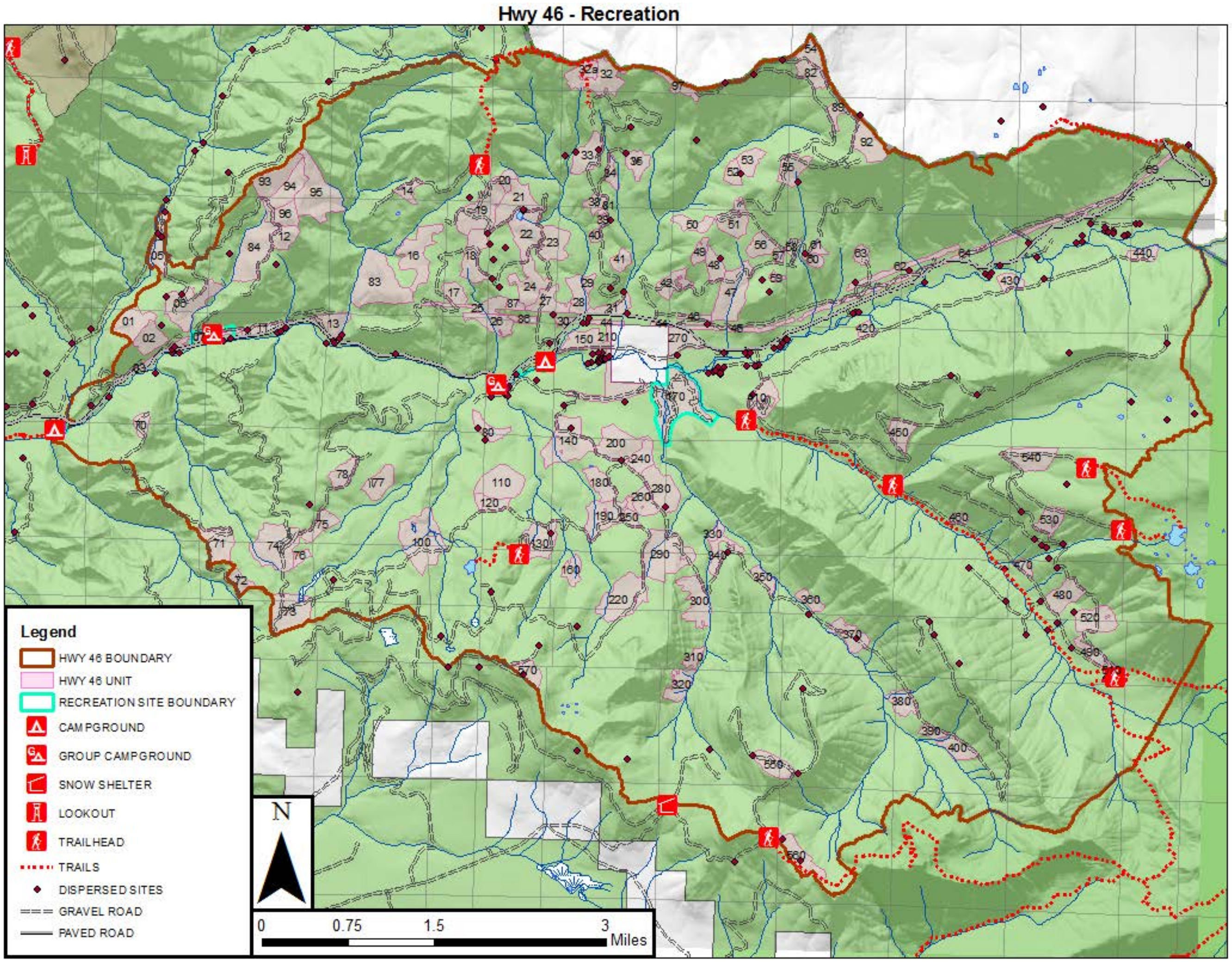


Figure 46 Recreation Uses in Hwy 46 Project area

Recreation Opportunity Spectrum (ROS)

The Forest Service uses a land classification system to inventory and describe a range of recreation opportunities called the Recreational Opportunity Spectrum (ROS) from the Willamette Forest Plan FEIS, page III-93. This system seeks to identify recreation settings of varying characteristics that range from remote undeveloped areas to easily accessed highly developed sites. Settings are described in the following five ROS Classes: Primitive, Semi-primitive Non-motorized, Semi-primitive Motorized, Roaded Natural, and Roaded Modified. Primitive falls on the most unmodified natural environment end of the spectrum and Roaded Modified falls on the most substantially modified end of the spectrum. Table 54 displays the ROS classes and treatment acres for each alternative within the project area. Table 55 displays ROS allocations and desired conditions.

Table 54 Management Areas and ROS Allocations

Management Allocation (MA)	ROS Allocation	Acres in Alternative 2 Treatment Units	Acres in Alternative 3 Treatment Units
Matrix (MA 14A) – Max Modification	Roaded Modified	1210.5	823.9
Adaptive Management Reserve (MA 17) – Scenic Partial Retention Middleground 11C	Roaded Natural	298.8	197.7
Adaptive Management Reserve (MA 17) – Scenic Retention Foreground 11F	Roaded Natural	240.5	152.8
100-acre Late Successional Reserve (MA 16B) - Dispersed Recreation – Semiprimitive Motorized (MA 10C)	Semi-Primitive Motorized	5.2	3.0

Table 55 Hwy 46 Project Area ROS Allocation Summary and Desired Conditions

ROS Class	Desired Condition for setting	Desired Condition for Activities
Roaded Modified	Opportunity to get away from others, but with easy access Environment will appear substantially modified Access and travel is conventional motorized vehicle Shape and blend vegetation alterations, foreground should be natural appearing	Access for people with disabilities is a moderate challenge Rustic facilities provide some comfort and site protection Moderate site modification can occur
Roaded Natural	Opportunity to affiliate with others but with some chance for privacy	Access for people with disabilities is difficult

ROS Class	Desired Condition for setting	Desired Condition for Activities
	Some obvious control of users Mostly natural appearing setting Vegetation modification done to maintain desired visual characteristics	No on site facilities except occasional signing site modification by users
Semi-Primitive Motorized	Moderate probability of experiencing solitude, closeness to nature, tranquility. High degree of self-reliance, challenge and risk in using motorized equipment. Predominantly naturally appearing environment.	Access for people with disabilities is difficult. Rustic and rudimentary facilities primarily for site protection using native material.

Recreational Driving/Road Access

Driving for pleasure (sightseeing) is a popular activity within the project area, primarily during the summer months when roads are open and free of snow. There is one National Scenic Byway in the project area; the West Cascades National Scenic Byway. Visitors enjoying this route will sometimes stop along their drive to picnic at one of several developed sites, visit interpretive sites, or choose their own special place to relax before continuing on their journey. In addition to scenic driving on byways, visitors also drive other Forest Service roads for pleasure; this use fluctuates from very light on most dead end roads to moderate use on secondary and connector roads, with increased use during the hunting season. Forest Road 46 is also designated as the Cascading Rivers Scenic Bikeway, used by cyclists as a challenging cycling route between the towns of Estacada and Detroit. Cyclists have access to share the full lane of travel with motorized vehicles while travelling this route.

Developed Recreation Sites

Breitenbush, Cleator Bend Group Camp, and Fox Creek Group Site are the three developed campgrounds within the project area. Breitenbush Campground is extremely popular and provides 30 campsites. Cleator Bend Group Camp is a small, reserveable group site that has accommodations for up to 45 people. Both Breitenbush Campground and Cleator Bend Group Camp are near the private resort community of Breitenbush Hot Springs. Fox Creek Group Site is a reserveable group campground on Forest Road 46 and provides a more primitive experience with an open gathering area, restroom and garbage facilities, and accommodations for groups of approximately 75 people.

Dispersed Use

Dispersed use incorporates a multitude of recreational activities within the general forest, but outside of developed recreation sites. Activities include, but are not limited to: scenic driving, hiking, bird watching, hunting, fishing, boating, water-play, mountain biking, horseback riding, and camping. There are over 160 known dispersed campsites within the project area. These sites are usually associated with favorite hunting areas or are areas with some interesting natural features such as fresh water streams, lakes, rock formations or an appealing forest environment. There are over 40 high use campsites along Breitenbush

Road that provide access to the Breitenbush River and have an appealing forest environment with associated camping areas. The remaining sites are moderately used and are primarily in the more upland areas of the watershed and tend to be used by hunters during hunting season.

There are 11 rock pits within the project area. Rock pits are used primarily for recreational target shooting and occasionally dispersed camping.

Trails

In the project area the entire South Breitenbush Gorge National Recreation Trail (South Breitenbush Gorge NRT) is 6.2 miles in length with a lower trail head near the Breitenbush Hot Springs Resort and an upper trail head near the Mt. Jefferson Wilderness boundary. The South Breitenbush Gorge NRT provides one other access point about midway its length allowing for a variety of route and transportation options.

There are nine other trailheads within the project area:

- Mansfield – Trail #3355
- Rapidan – Trail #3360
- Crown Lake – Trail #3361
- Roaring Creek – Trail #3362
- Short Mountain – Trail #3363
- Crag Trail – Trail #3364
- Leone Lake – Trail #3367
- Triangulation – Trail #3373
- South Breitenbush – Trail #3375

Although many of these trails are lower use trails, they all receive enough use to be maintained on a regular basis. All of these additional trailheads have had expansion of their parking areas, due to public use, outside of the established area onto sensitive natural ground. These expansion areas are experiencing vegetation loss, erosion and soil compaction.

Special Interest Areas

Short Lake is located within the project area approximately 8.7 air miles north and east from Detroit, Oregon. Short Lake is located in T9S R7E Section 18 at approximately 3080 feet above sea level. The 1.7 acre lake is surrounded by mature forests, but evidence of forest management practices are visible in the surrounding area. The lake is a popular destination for dispersed recreation camping, as well as fishing, birding, boating and wildlife viewing.

Winter Recreation

During the winter season, portions of the project area become a popular snowmobile recreation area with staging at the intersection of FSR 46 and the FSR 2231. During years with snow, FSR 46 is not plowed beyond that intersection, allowing snowmobile users to access the upper Breitenbush road systems, the McCoy Motorized Recreation Area, and the Olallie Scenic Recreation Area. The Breitenbush Hot Springs Resort plows a small portion of FSR 2231 and the entire length of FSR 890, to provide user access to their resort.

Off Highway Vehicles

Off Highway Vehicle (OHV) use on the forest road system in the project area is quite common. Many forest users load and offload near the Breitenbush Road and explore the adjacent forest roads. Additionally, the McCoy Motorized Recreation Area is located within the southern portion of the project area. The McCoy Motorized Recreation Area uses the existing forest road system to provide scenic opportunities for OHV riders.

3.11.4 Environmental Consequences

Direct and Indirect Effects

Alternative 1 - No Action

Recreation use of the National Forest in the project area would remain unchanged with the No-Action alternative. The recreating public would continue to use the project area for recreational purposes, and would continue current use of developed and dispersed campsites, day use areas, interpretive sites, boat launches, trails, and roads. Therefore, Alternative 1 would have no direct or indirect effect on recreation within the project area.

Alternatives 2 and 3

Recreational Driving/Road Access

Short term effects of proposed timber harvesting, log truck hauling, and fuels treatments would include the following during timber harvest: localized road closures, and disruption to hunting, hiking, camping, and driving in some areas. The logging activity, hauling, and fuels treatments would likely cause noise and dust or smoke disturbances in some instances. No permanent roads would be constructed and 1.99 miles of roads would be permanently closed as a result of the Hwy 46 project. Alternative 2 would construct 5.2 miles of temporary road and Alternative 3 would construct 3.0 miles. Road maintenance on secondary roads in the project area would improve ride quality and comfort for visitors seeking recreation opportunities in the area. Alternative 2 would maintain approximately 133 miles of road and Alternative 3 would maintain approximately 99 miles.

Post-sale activities along FSR 4600-040 would include the decommissioning of approximately 0.4 miles of FSR 040 will be decommissioned and rehabilitated to improve natural hydrologic function around Short Lake and reduce road maintenance. FSR 4600-059 would be realigned to provide access around the decommissioned portion of FSR 040.

Developed Recreation Sites

Hazardous Fuels Treatments would occur around the recreation residences and the Breitenbush Hot Springs Resort in the project area. These treatments would have short term direct effects such as increased noise during treatment periods. Slash piles would be noticeable immediately after treatments have occurred but would be burned, masticated and spread or removed. Stumps and other indicators of harvest activity would become less noticeable after vegetation recovery takes place (3-6 years). Overall, positive benefits would result from hazardous fuels treatments because of scenery improvements (increased depth of view into the forest) and for fire safety (reduced fuel loads). Proposed fuels treatments in units 170, 210 and 270 would improve public safety in the Breitenbush and Devil's Creek summer home tracts, as well as the Breitenbush Hot Springs Resort, by reducing wildfire risk. A recreation specialist would be involved during the layout phase to ensure screening vegetation and other recreation assets are protected. While these fuel treatments are not adjacent to the developed campgrounds, there may be short term direct effects in the vicinity of the campgrounds. Design elements stipulate that no fuels treatments would take place when the nearby campgrounds are in fee status to ensure public access to these areas is not affected.

In Alternative 2 and 3, thinning treatments are to be pursued in Units 7 and 11, which is located in and adjacent to Fox Creek Group Campground. Additional harvest activities in Units 30, 80, and 150, will occur near Cleator Bend Group Campground and Breitenbush Campground. Harvest activities would occur outside of the camping season when the campgrounds are closed, but there may be times when harvest activities need to be accomplished during the primary camping season. These activities would have short term direct effects such as increased noise and truck traffic during treatment periods, and potential campground closures. Pre-sale tree and sale area boundary marking would be placed on the side of trees facing away from the road to reduce visibility. Logging slash, skid trails and exposed stumps would be noticeable in the short term after harvest activity has concluded but would become less noticeable over time (3-6 years) as vegetative recovery takes place. Design elements would require removal, mastication or burning of logging slash, low cutting or angle cutting away from the developed portions of site and removal of timber sale boundary markers. A recreation specialist would be integrated into the layout phase prior to project implementation. Longer-term, beneficial, effects to the campground would include improvements to the site to improve visitor experience.

Dispersed Use

Existing vehicle access and improved access from road maintenance would occur on approximately 133 miles in Alternative 2 and 99 miles in Alternative 3. This would improve access to much of the project area, improving safety and driving comfort for road users who are seeking dispersed camping opportunities. Indirect effects of these improvements may include increased dispersed camping use and other activities in areas previously not used due to poor road conditions.

Several rock pits within the project area are to be utilized for road maintenance and temporary road construction material during harvest operations. Two rock pits, Mansfield Pit and Lower Skunk Creek Pit will require development of a pit plan if deemed necessary for pit expansion, while seven rock pits will be used for material extraction and/or as waste areas. Use of the rock pits would cause short term effects of: localized road closures, and disruption to hunting, camping, target shooting, and driving in some areas. The activity in the rock pits would likely cause noise and dust disturbances in some instances. Indirect effects of these improvements may include increased trash, dispersed camping use and an increase in target shooting because of improved access and visibility to the rock pits.

Trails

The South Breitenbush Gorge National Recreation Trail (SBGNRT) is nearly parallel and southwest to FSR 4685 for its entire length. Units 410, 460, 470, 480, 490, and 510 are immediately adjacent on the northeast side of FSR 4685. Unit 510 encompasses the trail head parking area for the SBGNRT, Crag Trail and South Breitenbush Trail. The SBGNRT and the trail head parking area in Unit 510 would be temporarily closed while logging activity is underway to ensure public safety. Due to the proximity of the trail to FSR 4685 and the adjacent units (410, 460, 470, 480, and 490), noise from harvest activities would potentially disrupt visitors along the trail. Pre-sale tree and sale area boundary marking would be placed on the side of trees facing away from the road to reduce visibility. Logging slash, skid trails and exposed stumps would be noticeable in the short term after harvest activity has concluded but would become less noticeable over time (3-6 years) as vegetative recovery takes place. Design elements would require removal, mastication or burning of logging slash, low cutting or angle cutting away from the road and removal of timber sale boundary markers. A recreation trails specialist would be integrated into the layout phase prior to project implementation.

Longer term beneficial effects to the trail as a result of project implementation would include an expanded and improved parking area at the trailhead and improved road access and signage. The trail head in Unit 510, is also the trail head to two other trails leading into the Mt. Jefferson Wilderness.

In Alternatives 2 and 3, the logging activity, hauling, and fuels treatments would likely cause noise and dust or smoke disturbances to other trails or trail heads in the project area due to seasonal timing of harvest activities.

Special Interest Areas

Management actions within the Short Lake Lakeside Area (LA) will focus on protection of the area's resources and restore hydrologic processes, while fostering public use and enjoyment. Due to the current road alignment, the natural hydrology in the area has been disrupted. Post-sale road realignment would have a direct, beneficial effect on the natural resources within the Short Lake LA (See Short Lake SIA Document).

Winter Recreation

In response to the public safety concerns of log truck traffic near the Breitenbush community all haul routes south of FSR 46 and west of FSR 4685, in Alternatives 2 and 3, have been redesigned to haul as much as physically possible over FSR 2231. This routing element within the project area will have a direct effect on winter recreation within the McCoy Motorized Recreation Area if harvest activities require plowing of roads. Short term effects of proposed timber harvesting and log truck hauling would include the following during timber harvest: localized road closures and disruption to snowmobile access and groomed trails. The logging activity and hauling would likely cause noise disturbances in some instances.

Harvest activities within the project area north of FSR 46 will have a direct effect on winter recreation primarily along FSR 46 if harvest activities require plowing of roads. Short term effects of proposed timber harvesting and log truck hauling would include the following during timber harvest: localized road closures and disruption to snowmobile access. The logging activity and hauling would likely cause noise disturbances in some instances.

Off Highway Vehicles

Off Highway Vehicle (OHV use is a recreational activity commonly pursued in the southern portion of the project area within the McCoy Motorized Recreation Area. OHV use is expected to be affected. In response to the public safety concerns of log truck traffic near the Breitenbush community all haul routes south of FSR 46 and west of FSR 4685, in Alternatives 2 and 3, have been redesigned to haul as much as physically possible over FSR 2231. This routing element within the project area will have a direct effect on OHV recreation within the McCoy Motorized Recreation Area. Short term effects of proposed timber harvesting, log truck hauling, and fuels treatments would include the following during timber harvest: localized road closures and disruption to OHV access. The logging activity, hauling, and fuels treatments would likely cause noise, dust, and smoke disturbances in some instances.

Harvest activities within the project area north of FSR 46 will have a direct effect on OHV recreation. Short term effects of proposed timber harvesting, log truck hauling, and fuels treatments would include the following during timber harvest: localized road closures and disruption to OHV access. The logging activity, hauling, and fuels treatments would likely cause noise, dust, and smoke disturbances in some instances.

Cumulative Effects

Alternative 1

No direct or indirect effects to recreation would occur under Alternative 1 because no timber harvest is proposed under this alternative; therefore, no cumulative effects would occur.

Alternatives 2 and 3

Past and present natural and human caused disturbances or modifications including timber harvest and road construction are evident throughout the project area. Two timber sales have been recently completed in and near the project area. These projects were French Thin and Breit Thin. The activities described in Hwy 46 would add incremental improvements to the road conditions in the project area through maintenance activities, which may cumulatively increase dispersed recreation.

3.12 Eligible Wild and Scenic Rivers

3.12.1 Summary of Effects Analysis

Alternatives 1 would have no direct or indirect effects on eligible Wild and Scenic Rivers in the project area. Alternatives 2 and 3 would have direct adverse effect to the scenic quality of the river corridors in areas where timber harvest activity occurs. The impact of these adverse effects will reduce with time as brush and moss grows, making stumps less easily visible. The actions proposed in Alternatives 2 and 3 will not jeopardize the eligibility of either the Breitenbush River or South Fork Breitenbush River for inclusion in the national Wild and Scenic River System. There will be no cumulative effects associated with any of the three alternatives.

3.12.2 Scale of Analysis

The geographic scale used to assess direct, indirect, and cumulative effects to Wild and Scenic Rivers is the Hwy 46 project planning area as well as the portions of the Breitenbush River and the South Fork Breitenbush River which extend either upstream or downstream from the project area. The South Fork Breitenbush River located above the project area is included in the Mount Jefferson Wilderness. The portion of the Breitenbush River below the project area is included entirely within the Willamette National Forest.

3.12.3 Affected Environment

The project area includes portions of the Breitenbush River and the South Fork Breitenbush River which have been determined to be eligible for inclusion into the national Wild and Scenic River System. Until suitability is determined, the area within ¼ mile on either side of the Breitenbush River is to be managed to meet Wild and Scenic River (Recreation) Standards and Guidelines as outlined in Management Area 6c in the Willamette National Forest Land and Resource Management Plan (1990). Also until suitability is determined, the area within the project area that is ¼ mile on either side of the South Fork Breitenbush River is to be managed to meet Wild and Scenic River (Scenic) Standards and Guidelines as outlined in Management Area 6b in the Forest Plan. The location of these rivers is shown in the figure below.

Eligibility status of Wild and Scenic Rivers is determined by identification of the river's free flowing status and it's "Outstandingly Remarkable Values" (ORVs) as defined by the Wild and Scenic River Act. For the Breitenbush River, the most significant ORV is its variety and quality of recreational activities. The river is used for camping, fishing, commercial resort activities, kayaking, hiking, recreational driving and general enjoyment of the forest environment. Additional identified ORVs of the Breitenbush River include the quality of the ecological setting, wildlife variety, historic values, and very high water quality. The area includes stands of old growth forest, habitat areas for sensitive and threatened species, and is, or contributes to, the water supply for several communities in the North Santiam River corridor. (LRMP, WNF, 1990 and Breitenbush River Resource Assessment, 1993)

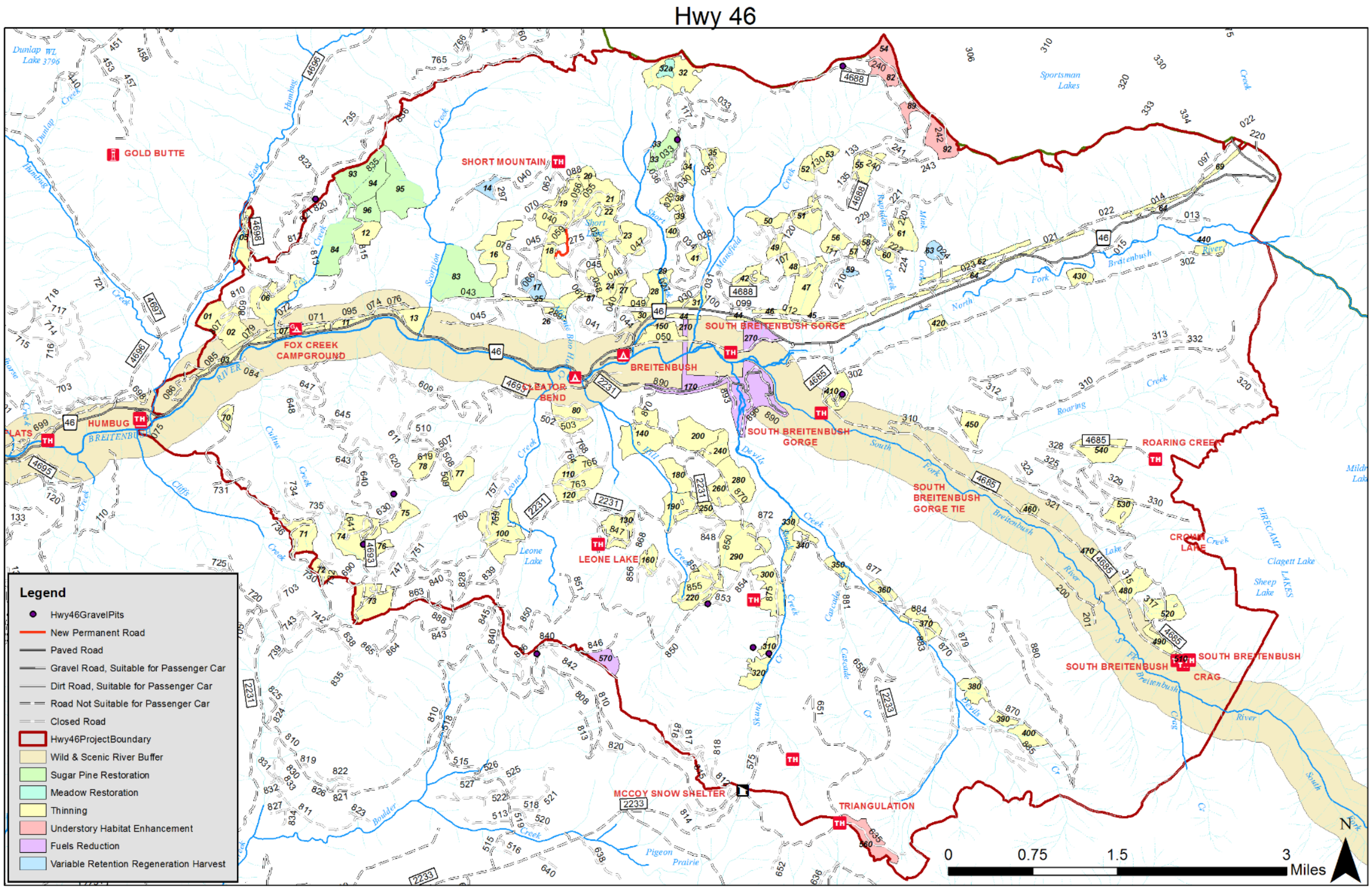


Figure Eligible Wild and Scenic River

For the lower segment of the South Fork Breitenbush River within the project area, the most significant ORV is its scenic quality. Its clear waters include the cascades and waterfalls as the river runs through the South Breitenbush Gorge emerging in old growth forest. Other ORVs include recreational use especially for hiking along the South Breitenbush National Recreational Trail, the rivers geology and hydrology, and high water quality. (LRMP, WNF, 1990 & South Breitenbush River Resource Assessment, 1993)

3.12.4 Environmental Consequences

Direct and Indirect Effects

Alternative 1 - No Action

Alternative 1 would result in no change to the condition of ORVs or eligibility status of the Breitenbush River or the South Fork Breitenbush River. There are no direct or indirect effects to Wild and Scenic River resources.

Alternatives 2 and 3

Alternatives 2 and 3 include proposed timber harvest activities within the area ¼ mile from either side of the Breitenbush River and the South Fork Breitenbush River. Proposed activities are compliant with all standards and guidelines included in the Willamette National Forest Land and Resource Management Plan (1990) for both Scenic and Recreational Wild and Scenic River segments (Management Areas 6b and 6c), with the exception of one standard and guide: “Stumps should be flush cut” (MA-6c-12 & MA-6b-11). Flush cutting of stumps is being proposed within 100’ of forest system roads and not in other areas of harvest units within the ¼ mile corridor on either side of the rivers. A 300’ no cut buffer along the river channels will result in no stumps within this area. Due to the high cost of flush cutting stumps when timber is harvested, both alternatives 2 and 3 do not include this mitigation measure to maintain or enhance the quality of the scenery within the corridor as is included as a management goal in the Willamette National Forest Land and Resource Management Plan. Not following this direction will result in direct adverse effects to the scenic quality of the river corridors for as long as stumps are visible in areas where timber harvest activity occurs. The duration of time that stumps will be visible will likely vary from a few years to twenty or more according to site specific conditions. Over time, the growth of brush and moss will make stumps less easily visible. This effect is more significant for the South Fork Breitenbush River due to its most important ORV being scenic quality. The effect is less significant for the main stem of the Breitenbush River which has its most important ORV defined as recreational access.

Separate from the adverse effect to scenic quality and associated ORVs, the actions proposed in Alternatives 2 and 3 will not jeopardize the eligibility of either the Breitenbush River or South Fork Breitenbush River for inclusion in the national Wild and Scenic River System. Protecting the eligibility of the rivers is the overall guiding direction in management of these rivers.

Cumulative Effects

Alternative 2 and 3

All land adjacent to the entire length of both the Breitenbush River and the South Fork Breitenbush River is either included in the national forest system and managed by the Willamette National Forest or included in the private property of the Breitenbush Hot Springs resort and conference center.

Based on personal communication with a representative of the Breitenbush Hot Springs on October 27, 2016, they have no current or future plans for any actions that would impact the ORVs or free flowing qualities of the Breitenbush River where it flows through their property.

Other than those proposed in this project in Alternatives 2 and 3, there are no activities proposed by the Willamette National Forest in other past or future projects in or beyond the project area that will have effects on the rivers’ ORVs or other qualities of each river and their eligibility for inclusion in the national Wild and Scenic River system.

3.13 Wilderness

3.13.1 Summary of Effects Analysis

Alternative 1 would have no direct, indirect or cumulative effects on Wilderness. Alternative 2 and 3 would have temporary adverse effects to wilderness character due to increased noise during harvest activity. There are no direct or indirect benefits to Wilderness from any of the proposed alternatives.

3.13.2 Scale of Analysis

The geographic scale used to assess direct, indirect and cumulative effects to Wilderness is the Hwy 46 planning area and the entire Mount Jefferson Wilderness, Bull of the Woods Wilderness and Opal Creek Wilderness, which are located adjacent to, or near the project area.

3.13.3 Affected Environment

For the purposes of determining impacts to Wilderness this section will consider impacts to wilderness character that originate from activities occurring outside Wilderness, but within the project area.

The Wilderness Act and Forest Service Policy clearly direct the Agency to manage Wilderness areas for the "…preservation of their wilderness character…". Wilderness character has four defining qualities:

- <u>Untrammeled</u>; Wilderness is essentially wild, unconstrained, unhindered and free from modern human control or manipulation. It is untrammeled.
- <u>Natural</u>; Wilderness ecological systems are substantially free from the effect of modern civilization. They are natural.
- <u>Undeveloped</u>; Wilderness is essentially without permanent structures, enhancements, or modern human occupation. To retain its primeval character, a wilderness ideally is managed without the use of motorized equipment or mechanical transport. It is undeveloped.
- <u>Outstanding opportunities for solitude or a primitive and unconfined type of recreation</u>; Many visitors welcome wilderness, not only for the self-reliant, challenging, non-motorized, non-mechanized recreational experiences it provides, but as a haven for self-discovery and rejuvenation, a refuge from civilization. Remoteness from sights and sounds of human activity outside the Wilderness is an indicator for success in protecting this quality (Keeping it Wild 2; USFS, 2015).

3.13.4 Environmental Consequences

Direct and Indirect Effects

Alternative 1 - No Action

Wilderness use and effects would remain unchanged with the No-Action alternative. Therefore, Alternative 1 would have no direct or indirect effect on Wilderness within the project area.

Alternative 2

Effects to Wilderness are shown below as related to the four qualities of Wilderness character:

Untrammeled

There will be no impacts to the untrammeled quality of the Wilderness for this project because there are no proposed activities within the Wilderness.

Natural

There will be no impacts to the natural quality of the Wilderness for this project because there are no proposed activities of a large enough scope or scale occurring in areas outside of wilderness that would result in changes to the natural quality inside wilderness.

Undeveloped

There will be no impacts to the undeveloped quality of the Wilderness for this project because there are no proposed activities within the Wilderness.

Opportunities for solitude or a primitive and unconfined type of recreation

The greatest potential for impacts to wilderness character will be to this quality of character. To analyze potential impacts topography was taken into consideration to determine those areas within Wilderness that are likely to experience impacts due to noise from harvest activities. See figures 54 and 55 for units within the viewshed of two points that are likely to experience moderate to high levels of use during the summer season. This viewshed model serves as a predictor of the likelihood that sound generated by activities will cause impacts within the receptor area due to topographical alignment or masking. Determination of which units show a likelihood of impacting the Wilderness are based on the method of harvest.

A threshold level of 40 dB (typical sound level in a quiet library; also the threshold in Wilderness soundscape preservation management plans by the National Park Service) was used in this analysis as the level of noise at which Wilderness character will likely be affected by the sounds of operations. The three methods of harvest have different potentials for impact based on the distance sound is expected to travel from the harvest units. Table 56 shows the estimated distance of impacts from noise depending on harvest method. Carry distances for sound uses the general rule of a 6 dB drop for each doubling of distance (http://www.sengpielaudio.com/calculator-distance.htm). Ground-based activities utilize equipment such as chainsaws, skidders, and log trucks. The estimate for representative noise level of these types of equipment is 65 dB at 150 feet. Skyline harvest activities utilize the same equipment as above, with the addition of the yarder with its whistle, the loudest of the equipment for this system at approximately 140 dB at source. The carry distance for noise from the yarder whistle was corrected for the absorption of noise from the atmosphere. This correction was only relevant to the yarder whistle calculation due to its high frequency (~1200Hz). This correction accounts for a .2 dB reduction in noise for every 100 feet of distance from source (http://www.sengpielaudio.com/calculator-air.htm). Helicopter harvest method displays the greatest distances of associated impacts with a representative noise level of 88 dB at 488 feet, and a resultant distance of impact of approximately 24 miles.

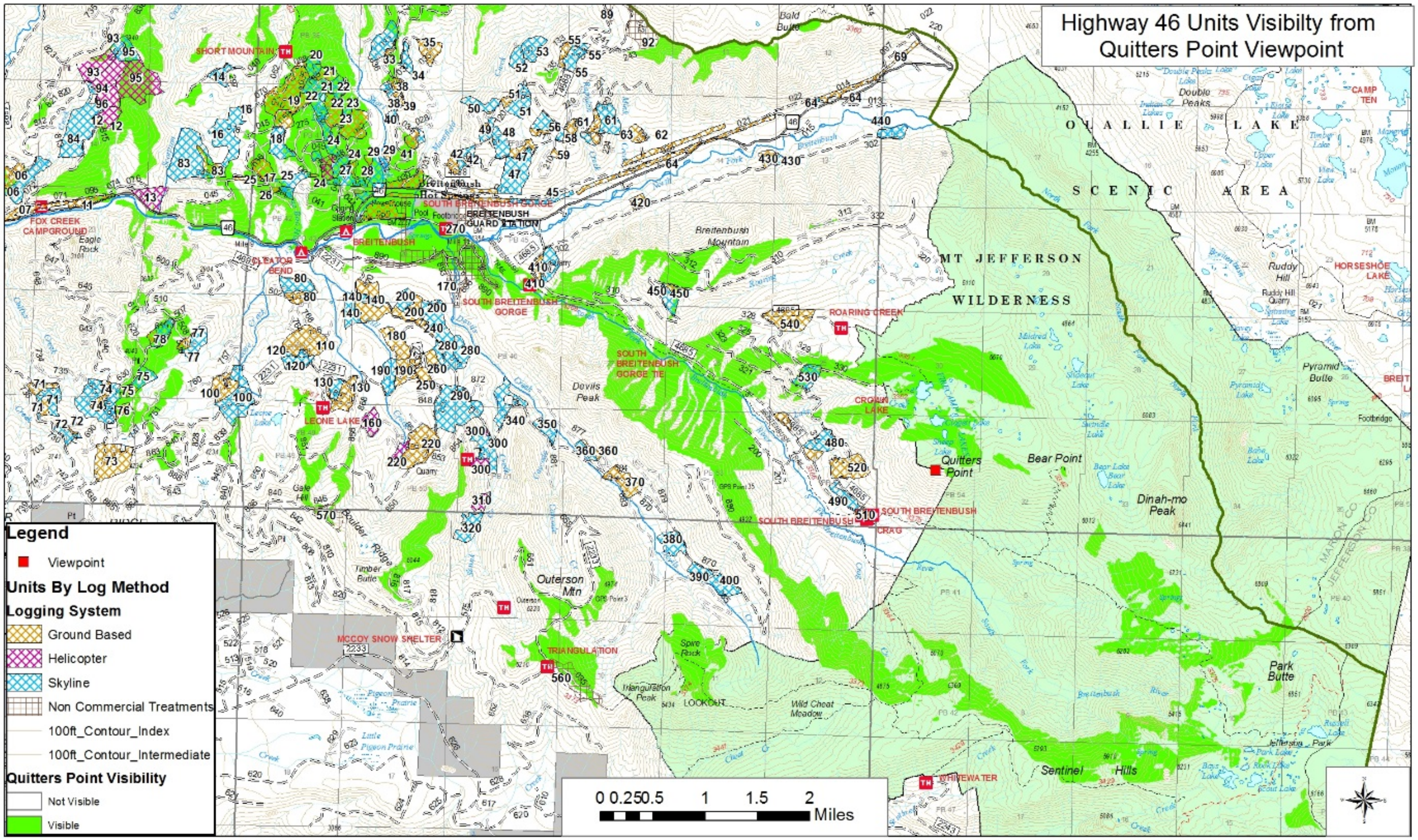


Figure 47 Viewshed from Firecamp Lakes vicinity

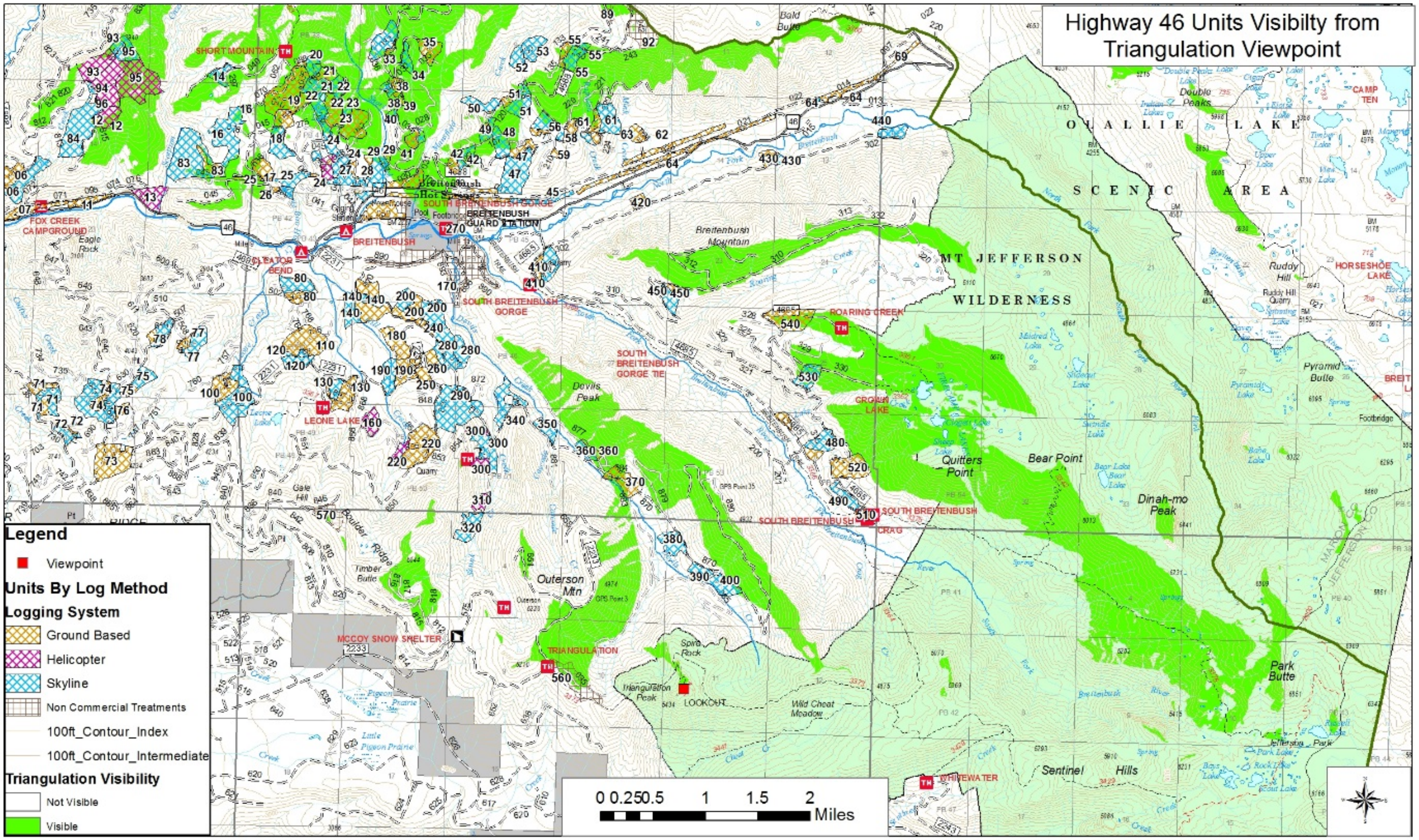


Figure 48 Viewshed from Triangulation Peak vicinity

None of these calculations capture noise absorption due to vegetative cover or terrain masking. Sound absorption from vegetation can account for approximately 100 dB reduction per mile in continuous vegetation (The effects of vegetation on road traffic noise; Peng; et al). It is extremely difficult to model vegetation screening across a landscape with such a diversity of vegetative structure and composition. Terrain masking can also have substantial effect on carry distance of noise. A reduction of 20 dB occurs after a sound source drops 30 feet behind a barrier (ridgeline) from a receptor as shown in table 56 below (https://www.fhwa.dot.gov/environment/noise/noise_barriers/design_construction/keepdown.cfm). This principle can be applied for terrain masking/damping and the resulting reduction in dB levels observed. At distances of greater than 30 feet below a ridgeline further sound damping will occur but 20dB was used in this analysis.

Noise impacts from the helicopter units have the greatest potential to reach deep into the Wilderness. Because of this, viewshed models were run for each helicopter unit, or cluster of units. These models were run from the highest points of the units (or clusters of units), with an addition of 300 feet of elevation to compensate for the length of long-line required to extract the timber. A long-line 150 feet in length is generally used for this type of operation to allow enough clearance from tree tops when hooking the logs, logs must then be lifted above tree tops to be transported to the landings. This requires the helicopter to be 250 to 300 feet higher than the highest elevation within a particular unit to extract the timber.

Table 56 Noise in dB of Different Logging Systems at Indicated Distances

Ground based(dB)	**D(ft.)**	**D(mi)**
65	150	0.0
60(40w/masking)	267	0.1
50	844	0.2
40	2667	0.5
Skyline(dB)		
140	1	0.0
70(50w/masking)	1622	0.3
60(40w/masking)	2885	0.5
50	4392	0.8
40	6222	1.2
Helicopter(dB)		
88	488	0.1

70(50w/masking)	3876	0.7
60(40w/masking)	12258	2.3
50	41600	7.9
40	124800	23.6

Impacts to wilderness character and wilderness users from noise related to the proposed activities are summarized in three general categories. Impacts from ground-based harvest activities and non-commercial activities, impacts from skyline harvest activities, and impacts from helicopter harvest activities. All of these impacts will occur during operations and will not persist beyond harvest activities. These impacts are generally of short duration, however, if harvest activities for units that may impact wilderness occur through multiple years, these impacts become longer term with greater impact. Most recreation within the potentially impacted area occurs from approximately June 15th through October 15th. Most operations for the proposed action will likely occur during this time period.

Impacts from ground-based and non-commercial activities occurring in five units will likely penetrate approximately a quarter mile within the Mount Jefferson Wilderness. It is likely this distance will be less due to damping from vegetative screening. This effected area will likely result in low numbers of visitor experience impact because the affected areas do not experience large volumes of visitors. Non-commercial unit 560 includes proposed design elements to mitigate impacts to Wilderness character shown in the design elements table in Chapter 2.

Impacts from skyline activities occurring in seven units will have a larger impact to visitor experience penetrating up to approximately three quarters of one mile into the Mount Jefferson Wilderness. It is likely this distance will be less due to damping from vegetative screening. The areas potentially impacted by these activities do receive a moderate amount of visitation during peak season.

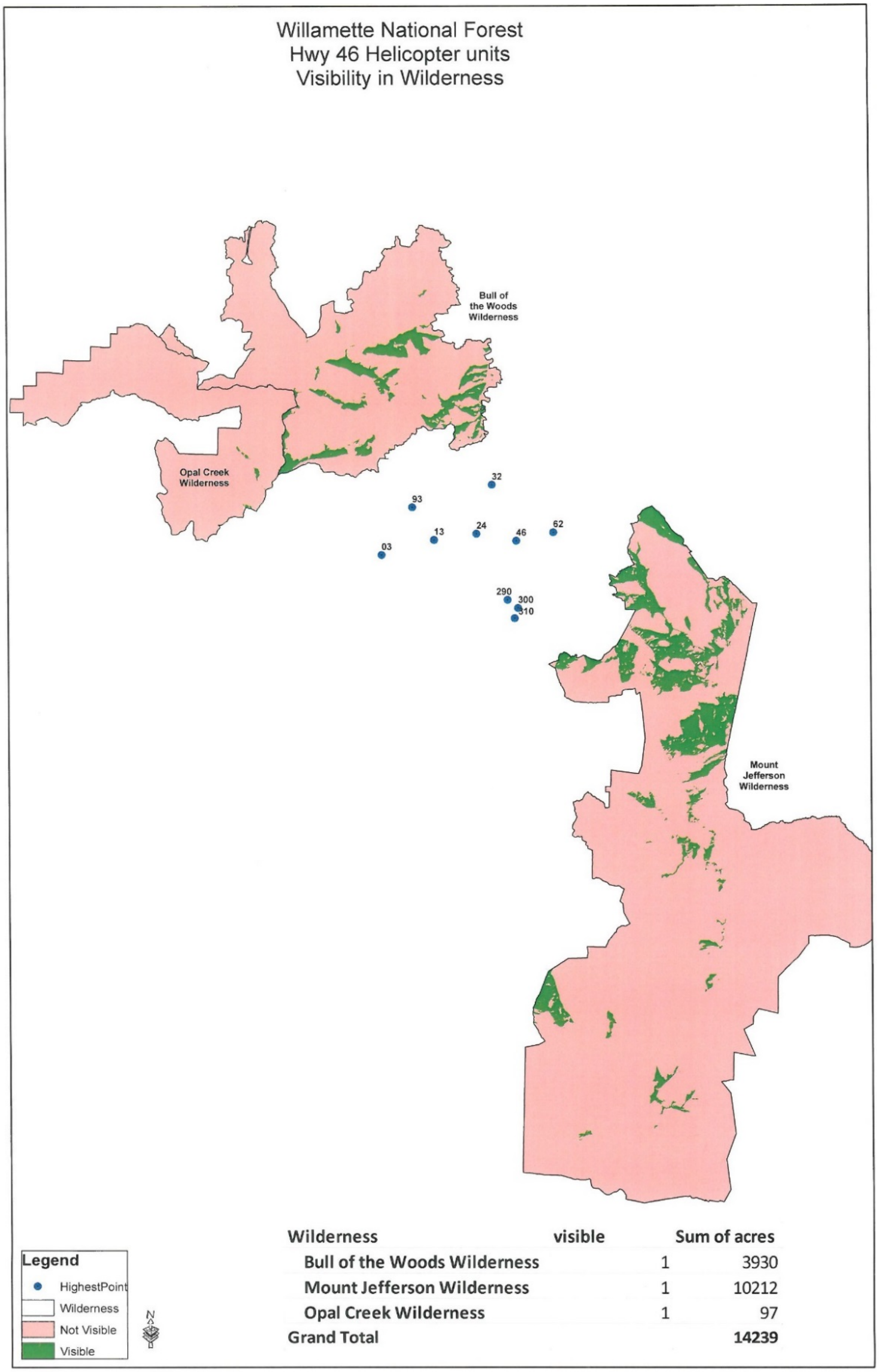
Impacts from skyline activities occurring in seven units will have a larger impact to visitor experience penetrating up to approximately three quarters of one mile into the wilderness. It is likely this distance will be less due to damping from vegetative screening. The areas potentially impacted by these activities do receive a moderate amount of visitation during peak season.

Impacts from helicopter activities will have the greatest potential to degrade Wilderness character and visitors' experience of solitude across a larger portion of the landscape. Figure 51 indicates the viewshed analysis for areas that will be within range of expected noise impacts of helicopter units. The model indicates that impacts from noise can be expected in the Bull of the Woods Wilderness, Mt Jefferson Wilderness and the Opal Creek Wilderness. Potentially affected acres are indicated in table 57 below.

Table 57 Acres potentially affected by helicopter noise

Wilderness Name	Potentially Affected Acres	Percentage of Total Wilderness Acres
Bull of the Woods	3930	11
Mount Jefferson	10212	9
Opal Creek	97	.5

Figure 49 Area (in green) with expected impacts from helicopter operations



Wilderness	visible	Sum of acres
Bull of the Woods Wilderness	1	3930
Mount Jefferson Wilderness	1	10212
Opal Creek Wilderness	1	97
Grand Total		**14239**

Collectively it is possible that all impacts due to noise will impact approximately .5% (97 ac.) of the wilderness landscape in Opal Creek Wilderness, 9% (10212 ac.) in Mount Jefferson Wilderness, and 11% (3930 ac.) in the Bull of the Woods Wilderness. While as much as 11% of the wilderness landscape will have diminished quality of opportunities for solitude during operations, the majority will be unaffected by operations offering unaffected opportunities for solitude. This estimate for affected acreage is likely an overestimation due to the fact that damping due to vegetative cover is not taken into account in the carry-distance calculations of noise caused by operations due to the variability in the composition and structure of vegetation across the project area. These impacts to Wilderness character will be intermittent in nature, both temporally and spatially. Impacts from noise created by operations will occur intermittently until all harvest activities are complete. Summer-time operations will likely have impacts on visitor experience in areas of the Wildernesses that experience moderate to heavy use. Wilderness character will be impacted any time that an operation projects noise at a level higher than 40 dB into the wilderness. This impact to Wilderness character is independent of whether there are visitors present to hear the noise.

Alternative 3

Effects to Wilderness are shown below as related to the four qualities of Wilderness character:

Untrammeled

There will be no impacts to the untrammeled quality of the Wilderness for this project because there are no proposed activities within the Wilderness.

Natural

There will be no impacts to the natural quality of the Wilderness for this project because there are no proposed activities of a large enough scope or scale occurring in areas outside of wilderness that would result in changes to the natural quality inside wilderness.

Undeveloped

There will be no impacts to the undeveloped quality of the Wilderness for this project because there are no proposed activities within the Wilderness.

Opportunities for solitude or a primitive and unconfined type of recreation

Effects from activities proposed in alternative 3 are essentially the same as alternative 2. The difference being that helicopter units (13, 24, and 95) north of highway 46 will be dropped; dropping these units reduces the number of effected acres in the Mount Jefferson Wilderness by 42 acres to 10170 acres. Design elements for non-commercial unit 560 are shown below to mitigate impacts to Wilderness character shown in the design elements in Chapter 2 (table 13).

Cumulative Effects

Alternative 1

There are no known activities within the project area that would contribute to cumulative effects for actions occur under Alternative 1 because no timber harvest is proposed under this alternative; therefore, no cumulative effects would occur.

Alternatives 2 and 3

A Wilderness planning effort has begun to address visitor use impacts within the Cascade Crest Wilderness areas including Mount Jefferson Wilderness area. Visitor use management actions under consideration will occur completely within the wilderness. The planning effort will attempt to improve Wilderness character. There are no foreseeable synergistic effects to wilderness character from the proposed action and the potential visitor use management actions. Therefore, no foreseeable cumulative effects will occur.

3.14 Inventoried Roadless Areas (IRA)

3.14.1 Summary of Effects Analysis

Alternative 1 would have no direct, indirect or cumulative effects on Inventoried Roadless Areas. Alternatives 2 and 3 would treat approximately 19 acres of the 6036 acre Mt. Jefferson, North Inventoried Roadless Area. Alternatives 2 and 3 would thin approximately 14 acres of a 45 year old plantation in the IRA, reducing the stand to 70-90 tpa and harvesting approximately 186 mbf.

3.14.2 Affected Environment

Mt. Jefferson, North Inventoried Roadless Area (IRA) is 6036 acres, 2320 acres (38%) are within the Hwy 46 project boundary. The IRA is 7% of the Hwy 46 project area.

Mt. Jefferson, North IRA borders the west side of Mt, Jefferson Wilderness and is accessed by many roads and trails. The area is composed of a series of irregular areas adjacent to the northwest boundary of the wilderness.

Alternatives 2 and 3 propose treatments on 19 acres in the IRA. The stand is a 45 year old plantation that was previously clear-cut with a ground based system and planted with Douglas-fir. The unit is 43 acres, 19 acres fall in the IRA, as shown in figure 53. The stand is dense, with 220 tpa with a diameter greater than 7 inches dbh, as shown in figure 52. The average tree diameter is 12.9 inches dbh, average height is 86 feet.

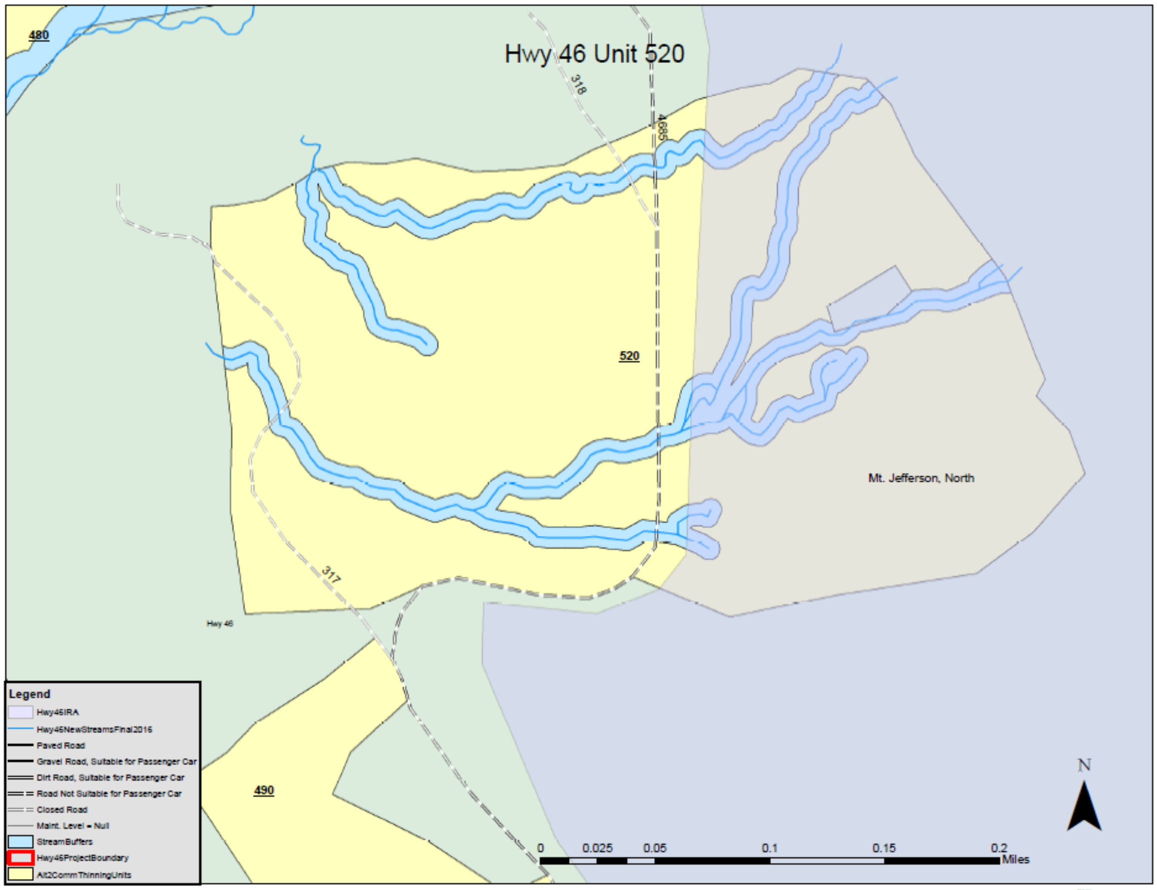


Figure 51 Map of Unit 520

Figure 50 Unit 520 Current Conditions

3.14.3 Environmental Consequences

Direct and Indirect Effects

Alternative 1 - No Action

No direct or indirect effects to IRA would occur under alternative 1 because no timber harvest would occur.

Alternatives 2 and 3

In both action alternatives 14 acres would be thinned to 70- 90 tpa, and 5 acres would be left in no cut stream buffers and skips. Harvest would remove approximately 186 mbf from the IRA (less than 0.5% of total project volume). Following harvest the slash would be treated by underburning.

All treatments in the IRA would maintain and meet the 9 roadless area characteristics in CFR 294.11.

- (1) High quality or undisturbed soils, water and air: Previously disturbed areas would be used during the ground based yarding. Streams are protected with 30 or 60 foot buffers to protect soils and water.
- (2) Sources of public drinking water: All streams are buffered to protect water quality.
- (3) Diversity of plant and animal communities: Currently the stand has very little plant diversity. The stand was planted with Douglas-fir following regeneration harvest and is dense with approximately 220 tpa. The proposed thinning would open the canopy to allow new plants to grow in the understory, increasing the diversity of plant species in the stand. The remainder of the IRA will be untouched, leaving all plant and animal communities as they are.
- (4) Habitat for threatened, endangered, proposed, candidate and sensitive species and for those species that depend on large, undisturbed areas of land: Commercial thinning in the IRA portion of unit 520 will improve threatened, endangered, proposed, or sensitive species habitat by increasing structural and species diversity as well as increase growth, which also will restore the characteristics of ecosystem composition and structure.
- (5) Primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation: The proposed thinning would not change the class of dispersed recreation in the area. Dispersed recreation could be temporarily displaced during operations, as well as affected by noise from logging operations, however these effects would be short term.
- (6) Reference landscapes: The reference landscape would not be altered.
- (7) Natural appearing landscapes with high scenic quality: Thinning the stand to 70 to 90 tpa would open the stand allowing for deeper views into the forest. The landscape would remain natural appearing in the treatment area. The remainder of the IRA would not be affected.
- (8) Traditional cultural properties and sacred sites: None present in the proposed treatment. The remainder of the IRA will not be treated, and any existing cultural property and cultural sites will be not be disturbed by this project.
- (9) Other locally identified unique characteristics: None present in the proposed treatment. The remainder of the IRA will not be treated, and any unique characteristics in the IRA will be not be disturbed by this project.

Best Management Practices and Design Elements would be in place to protect: soil, water, and air; plant and animal communities and habitat for TES species; classes of recreation and landscapes; cultural properties and unique areas.

Approximately 0.3% of the Mt. Jefferson, North Inventoried Roadless Area would be treated by thinning, the remainder of the IRA would not be affected.

Cumulative Effects

Alternative 1

No direct or indirect effects to IRA would occur under alternative 1; therefore, no cumulative effects would occur.

Alternatives 2 and 3

There are no known activities within, or adjacent to the IRA that would contribute to cumulative effects for actions occurring under Alternatives 2 or 3. Therefore, no foreseeable cumulative effects will occur.

3.15 Noise

3.15.1 Summary of Analysis

Alternative 1 would have no direct, indirect or cumulative effects from noise. Alternatives 2 and 3 would have temporary adverse effects due to increased noise during harvest activity.

3.15.2 Affected Environment

Noise is often described as unwanted sound. In an urban setting, street and traffic noise is often considered background noise by local residents. However, in a more rural setting, where street and traffic noise occurs less frequently, one might notice the sound of a car approaching as an unexpected foreground noise. Noises in a rural setting, where less ambient noise is present, are often amplified and more impactful to an occupant of the area. The landscape where the Hwy 46 project is planned occurs in a rural area such as this with less ambient noise. As such, man made noises are often more noticed by visitors. Noise was brought forward during the scoping period as a public concern.

National Forest System Road 46 is a heavily traveled highway. Because of this, visitors recreating along and near Road 46 expect to encounter more noise from traffic, including cars, motorcycles, and trucks. These visitors are more accustomed to and expect frequent noise in the environment and are therefore less impacted by these noises. Noise levels are reduced, however, by increasing distance, air density, wind, and obstructions (vegetative cover, and natural landscape features such as hills, ridges, and valleys [terrain masking]). As visitors move farther away from the heavily traveled Road 46, the noise from the highway is reduced by the increasing distance, air density, wind, vegetative cover, and terrain masking. Once away from the noise impact of Road 46, human caused noises can be more impactful on visitor experiences.

As described in the Draft Environmental Impact Report for Proposed Jackson Demonstration State Forest Management Plan (CA State Board of Forestry, 2004), “Ambient (background) sources of natural noise range from short-term soft sounds, as in the sound of the wind in the trees (30-50db), to short-term loud cracks and rumbles, as in the sound of falling rocks (60-80 dB). Ambient noise can also be loud and constant, as in the deafening sound of a large waterfall (100db).”

Noise from Motorcycles: National Forest System Road 46 is a heavily traveled forest road and is extremely popular for motorcycle touring. The loud, whiny motor noise associated with motorcycles often carry through the natural setting in areas of low ambient noise.

Noise from Timber Harvesting: results from activities such as chainsaws, back-up beepers on ground based logging equipment, cable yarders and their associated whistle (talkie tooter), diesel motors, log trucks, and helicopters. Rock pit expansion may also require blasting.

Noise from Helicopters: 11.6% of the acreage in the Hwy 46 project would use helicopter as a harvest method in alternative 2 and 3% of the acreage would use helicopter as a harvest method in alternative 3. Using helicopters for logging operations reduces the amount of road building and ground disturbance, but can be expensive and noisy. Helicopter sounds can carry many miles, especially when they fly above ridges which otherwise act as natural sound barriers.

3.15.4 Noise Impact Analysis

Ambient noise in the Breitenbush Drainage is generally natural and not a problem to people. The chief noise-making activities in the Breitenbush Watershed currently results from forest visitors in the area – motorcycles, cars, recreational shooting (although there is a shooting closure within ½ mile of the Breitenbush Road), etc. If the Hwy 46 project is implemented, added noise from timber harvest must also be considered. There are various types of harvest methods, and each comes with its' associated noise levels:

Table 58 Noise Produced by Various Logging Equipment

Harvest Method	Noise level – Equivalent Continuous Noise Level (Leq)* – dB
Tractor Logging w/backup alarm or log truck	65 at 150 feet
Chain Saw	65 at 150 feet
Talkie Tooter whistle from Cable Yarding	140 dB at source
Helicopter	88 dB at 488 feet

Some comparable sound levels of common sound sources are as follows:

- Auto (60 mph) at 100 feet – 65 dB
- Vacuum cleaner at 10 feet – 70 dB
- Electric lawn mower at 3 feet – 85 dB
- Food blender at 3 feet – 90 dB

When measuring sound from a point source, the doubling rule is used to determine how quickly the sound drops off, or attenuates, with distance from the sound. The doubling rule states that when the distance is doubled from a point source, the sound level decreases by six decibels. The carrying distance for noise from the cable yarding whistle is reduced due to the absorption of noise from the atmosphere. This correction is only relevant to the yarder whistle calculation due to its high frequency (~1200 Hz). This correction accounts for a .2 dB reduction in noise for every 100 feet of distance from source (http://www.sengpielaudio.com/calculator-air.htm).

It is worth mentioning that none of these calculations capture noise absorption due to vegetative cover or terrain masking. Sound absorption from vegetation can account for approximately 100 dB reduction per mile in continuous vegetation (The effects of vegetation on road traffic noise; Peng; et al). Terrain masking can also have substantial effect on carry distance of noise. A reduction of 20 dB occurs after a sound source drops 30 ft. behind a barrier (ridgeline) from a receptor as shown in Table 59 below (https://www.fhwa.dot.gov/environment/noise/noise_barriers/design_construction/keepdown.cfm). This principle can be applied for terrain masking/damping and the resulting reduction in dB levels observed. At distances of greater than 30 feet below a ridgeline further sound dampening will occur. The following table indicates this rule as it relates to noise point sources found in timber harvest:

Table 59 Noise Attenuation at Increasing Distances

Ground based(dB)	D(ft.)	D(mi)
65	150	0.0
60(40W/terrain masking)	267	0.1
50	844	0.2
40	2667	0.5
Skyline(dB)		
140	1	0.0
70(50w/terrain masking)	1622	0.3
60(40W/terrain masking)	2885	0.5
50	4392	0.8
40	6222	1.2
Helicopter(dB)		
88	488	0.1
70(50w/screening)	3876	0.7
60(40w/screening)	12258	2.3
50	41600	7.9
40	124800	23.6

According to noise research, a sound of 50 dB is equivalent to the sound of light traffic (http://www.noisehelp.com/noise-level-chart.html) or the sound experienced in a normal library (http://www.karmayog.org/noisepollution/upload/293/Decible_Levels_Common.pdf). It is not expected that sound at or below this level within the natural environment present in the Hwy 46 planning area along with the natural background noise of the sounds of wind, water, and Highway 46 road noises will impact the recreation user in the area.

In order to evaluate the sound impacts from possible timber harvest activities in the Hwy 46 planning area, activities will be evaluated using 50 dB to measure impacts, assuming sounds below this level will not impact recreating users in the mid to upper Breitenbush drainage outside of wilderness.

Table 59 above shows the expected sound level relating to ground based, skyline, or helicopter yarding varying distances. These measurements are calculated assuming there are no barriers between the point source of the sound and the person experiencing the sound (sound receptor) at various distances. On the ground there is usually vegetation between the point source and sound receptor (vegetative cover), or even terrain breaks (terrain masking). The presence of any of these will further reduce how the sound carries.

From Table 59 above:

- Ground based yarding beyond 0.2 miles will produce sounds at or below 50 dB.
- Skyline yarding beyond 0.8 miles will produce sounds at or below 50 dB.
- A helicopter beyond 7.9 miles will produce sounds at or below 50 dB.

The above distances will be less if there is vegetative cover or terrain masking between the point source and the sound receptor. For example, if a helicopter is operating on the other side of a ridge from the sound receptor, the sound is muffled as it is experienced by the sound receptor. A reduction of 20 dB occurs after a sound source drops 30 feet behind a barrier (ridgeline) from a receptor as shown in Table 59 above (https://www.fhwa.dot.gov/environment/noise/noise_barriers/design_construction/keepdown.cfm).

Therefore, the following limits will be used when assessing sound impacts from timber harvest operations assuming that sounds below 50 dB will not impact the visiting public in the area:

- Ground based yarding – activities greater than 0.2 miles from receptor.
- Skyline yarding – activities greater than 0.8 miles from the receptor unless terrain masking results in further muffling. If the skyline is operating in units that are behind terrain breaks, it will be assumed that activities beyond 0.3 miles distant will produce sounds below 50 dB [because a reduction of 20 dB occurs after a sound source drops 30 feet below a ridgeline – see 70 dB in table 59 above].
- Helicopter yarding – activities greater than 7.9 miles from the receptor unless terrain masking results in further muffling. If the helicopter is operating in units that are behind terrain breaks and can fly away from the receptor, it will be assumed that activities beyond 0.7 miles distant will produce sounds below 50 dB [because a reduction of 20 dB occurs after a sound source drops 30 feet below a ridgeline – see 70 dB in table 59 above].
-

The Breitenbush Hot Springs Resort is centrally located in the project area and depends heavily on a natural environment. It is also located adjacent to Cleator Bend and Breitenbush Campgrounds which also depend on a natural forest environment. Because of the central location and extreme importance of a natural setting and soundscape to the Breitenbush Hot Springs Resort, sound impacts will be assessed from a point on this private land near the hot springs themselves.

The following map displays the units proposed for treatment in the Hwy 46 project, by harvest method, and whether they are visible from the Breitenbush Hot Springs Resort, assuming that those not visible are behind a terrain break, softening the sound produced from timber harvest (terrain masking):

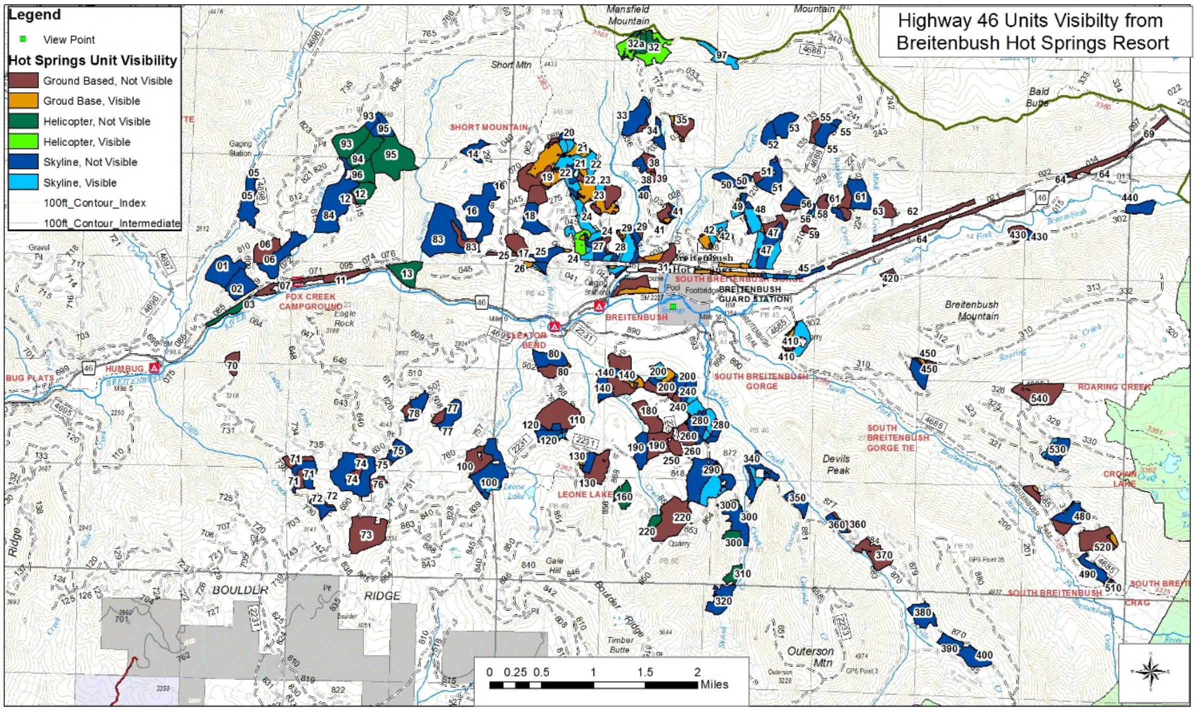


Figure 52 Hwy 46 Units Visibility from Breitenbush Resort and Conference Center

The following table lists the proposed harvest units likely to produce noise above the 50 dB limit being set as a goal to minimize auditory impacts to visitors and residents in the area near the Breitenbush Hot Springs Resort. This information was gathered by applying the 50 dB distance limits developed above to the units by harvest method and whether, or not, a terrain break (terrain masking) existed. Design Elements will reduce these impacts.

Table 60 Units with Potential Noise Impacts

Unit	Alt. 2	Alt. 3	Logging System (Acres)			Comment
			Hel	Sky	Grnd	
24	X		8			Hel - no terrain break and within 7.9 mi.
27	X			18		Part has no terrain break and within 0.8 mi.
28	X			13		Part has no terrain break and within 0.8 mi.
30	X	X		7		Part has no terrain break and within 0.8 mi.
32	X		57			Hel no terrain break and within 7.9 mi.
32a	X		8			Hel no terrain break and within 7.9 mi.
42	X	X		12		No terrain break and within 0.8 mi.
200	X	X		28		No terrain break and within 0.8 mi.
240	X	X		22		No terrain break and within 0.8 mi.

Log Truck Traffic: In addition to noise from timber harvest in units, log trucks also create noise, dust, and add to congestion on roads. Highway 46 is part of a National Scenic Byway, a State Scenic Bikeway, and also has a between 400 to 800 vehicles per day with some peak days estimated to be greater than 900 vehicles per day. Timing of log haul should be scheduled to minimize impacts on Highway 46. Units located in the southern part of the planning area that are accessed by FDR 2231 will be hauled southeast over Boulder Ridge and down to Highway 22 just west of Idanha. This will reduce noise and congestion near the Breitenbush Hot Springs Resort as well as along the mid and lower stretches of Highway 46.

Cumulative Effects

Alternative 1

No direct or indirect effects from noise would occur under alternative 1; therefore, no cumulative effects would occur.

Alternative 2 and 3

Noise created by logging activities proposed in alternatives 2 and 3 would have cumulative effects to the existing sounds, natural and man-made, currently existing in the planning area. These effects would be cumulative during the time additional noise is being made during logging operations. As soon as logging operations cease, the cumulative effect of noise would end, making the cumulative effects of noise from logging ephemeral.

3.16 Economics

3.16.1 Summary of Effects Analysis

Alternatives 2 and 3 would have a positive benefit/cost ratio which would generate sufficient stumpage funds to pay for restoration activities, both required and optional. Alternative 2 would have a benefit/cost ratio of 1.34. Alternative 3 has a benefit/cost ration of 1.29. In a matter of fiscal return on investment, Alternative 2 would cover all costs plus return approximately $7.3 million to the treasury while Alternative 3 would cover all costs plus return approximately $3.9 million to the treasury.

Alternative 1 would not contribute to local economy, forest sector jobs, or the National Forest Fund (NFF) which in turn contributes directly to local governments. Alternatives 2 and 3 would have beneficial direct effects to the local economy, forest sector jobs, and the NFF.

3.16.2 Scale of Analysis

The scale used to evaluate Economics associated with the Hwy 46 project is Linn and Marion Counties, Oregon. The project lies within Marion County, but is immediately adjacent to Linn County where several of the potential purchasing sawmills are located. Funds generated would contribute towards Marion County Title II payments. There would also be a positive economic benefit to Linn County. If part of the sale area was also sold as a stewardship sale, this sale could also benefit local economies through direct payments to purchasers under stewardship authority.

3.16.3 Affected Environment

The project area is located on both sides of Highway 46 in the upper and middle Breitenbush watershed, approximately 5 miles east of State Highway 22 and the City of Detroit, OR.

State Highway 22: This route is the primary link between the upper Willamette valley and central Oregon. It also serves as a gateway to the Cascade Mountains and the recreation areas of the North Santiam River area. As such, traffic volumes are high. According to information obtained from the Oregon Department of Transportation (ODOT) in March 2014, traffic volumes monitored at different locations on Highway. 22 within the Canyon in 2012 range from 3,000 to 9,000 daily trips with projected

2032 volumes increasing the trips to between 3,600 and 10,400. However, summer weekends demonstrate significant peaks well above these figures.

National Forest System Road 46: This route is one of the most heavily traveled forest roads on the Willamette National Forest. It is a two lane paved road similar to a typical county rural highway. This road is a popular link in the nationally recognized West Cascades Scenic Byway. It links Highway 22 at Detroit on the Willamette National Forest (NF) to Clackamas Highway 224 near Estacada on the Mt. Hood NF. This road also provides access to the internationally known Breitenbush Hot Springs Retreat and Conference Center, numerous campgrounds, and picnic areas. In 2014, this road was also designated under the Oregon Scenic Bikeway Program as the Cascading Rivers Scenic Bikeway travelling between Estacada and Detroit. It also provides access to land areas where timber management is a significant management objective. As a result there is a substantial mix of commercial and recreational traffic. Included in the mix are bicyclists and pedestrians of all ages. This route is also a popular motorcycle touring route in the summer. Summer seasonal traffic volumes are estimated to be in the range of 400 to 800 vehicles per day. Peak holiday (Memorial Day, July 4 and Labor Day) traffic volumes are estimated to be greater than 900 vehicles per day. The road snows closed in the winter and is only plowed as far as the Breitenbush Hot Springs Retreat and Conference Center.

The Hwy 46 project is located in the Breitenbush Watershed which is a 5th field watershed in the North Santiam Watershed. The North Santiam is located in both Linn and Marion Counties about one hour east of Salem, OR. The Canyon area consists of 670 square miles and includes the small cities of Lyons, Mehama, Mill City, Gates, Detroit and Idanha.

The communities of the Santiam River Canyon have been severely impacted by the reduction of timber harvest following the listing of the spotted owl as a threatened species in 1990. Oregon Employment Department data from 1999 shows that logging, mills, and wood products (manufacturing) supported 63.5% of all employment in the region. The industry continues to experience declines – in 2012, data shows a decline in manufacturing to 41% of employment in the region. Although timber harvest levels have dropped, timber harvest is still a very important component in the economy of the Santiam River Canyon. According to an Oregon Forest Resource Institute (OFRI) report from 2012, pg. 41, approximately 10.8 jobs are created with each incremental increase in million board feet made available for harvest.

Oregon Employment Department statistics from 2012 show that the North Santiam Canyon Employment by Industry is as follows:

Table 61 North Santiam Canyon Employment

North Santiam Canyon Employment by Industry, 2012	Percent of Total
Manufacturing (Primarily wood products)	41%
Total All Government	17%
Leisure & Hospitality	14%
Trade, Transportation & Utilities	10%
Construction	5%
Professional & Business Services	5%
Natural Resources & Mining	4%
Other Services	2%
Education & Health Services	1%
Information & Financial Activities	1%

Although leisure and hospitality only comprised 14% of the total employment in the North Santiam Canyon in 2012, this category is growing and represents an important economic sector now and into the future. Local economic drivers in the leisure and hospitality industry include:

- The outstandingly remarkable and accessible natural environment provided by the large amount of public land including Forest Service, State, BLM, County, and City lands which is a large draw to the recreating public.
- The nearby City of Detroit is a tourist/recreation center. It hosts annual tourist events and also serves as a base for recreators to access public lands. Although the 2010 census showed that Detroit had a population of 202 year-round residents, the number grows greatly in the summer months as recreation on Detroit Lake and the surrounding forest draws many summer time residents and campers to the area. This trend is expected to continue into the future, making recreation and tourism an important part of the economy in and around Detroit.
- A 2008 Oregon Marine Board Triennium Survey indicates that Detroit Lake continues to be the highest used lake in the state of Oregon with almost 72,000 boat use days and over 81,000 activity days (Triennial Survey Results [2008]. Oregon State Marine Board. www.oregon.gov).
- The increasing outfitter/guide industry including rafting, fishing, boating, horseback riding, hiking, and many other growing recreation opportunities.
- Increasing travel for pleasure including driving, motorcycling, biking, hiking, etc.
- The Breitenbush Hot Springs Retreat and Conference Center (BBHS), which lies in the heart of the Hwy 46 project, is an internationally known resort. BBHS brings a large number of visitors to the North Santiam and Breitenbush Canyons. Monthly total visitation (Guests – overnight stay + day use) averages from a low of 2250 guests in February to a high of 4250 guests in August.

3.16.4 Environmental Consequences

Direct and Indirect Effects

The direct economic effects of the alternatives are displayed in Table 62. A standard criterion for deciding whether a government program can be justified on economic principles is net future value (NFV) – the discounted monetized value of expected net benefits (OMB A-94). Another standard criterion for economic efficiency is the benefit/cost ratio (B/C ratio) which is the product of the present value of benefits divided by the present value of costs.

Alternative 1

The No-Action alternative would not harvest any timber, and therefore, would not support direct, indirect, and induced employment. It would not result in increased income to the regional or local economy (including the counties). Current levels of employment in the wood products sector would not change under this alternative. If the Hwy 46 project were not replaced by another project, the No-Action alternative could contribute to a continued decline in forestry and milling related jobs.

Alternative 2 and 3

All action Alternatives are economically viable, considering current selling values, timber volume per acre, yarding systems required, the proposed temporary road construction and system road maintenance needed, and the identified post-timber harvest projects identified in this analysis. The economic analysis utilized to make this determination is available in the Hwy 46 project analysis file at the Detroit Ranger District office. Based on the expected return to the Federal government plus the value of restoration activities potentially funded by stumpage, Alternatives 2 and 3 would provide a positive benefit/cost ratio.

Though the combined economic benefit from implementation of any of the action alternatives is expected to be positive, each of the action alternatives from the Hwy 46 project would have a localized beneficial effect for the socio-economic environment of western and central Oregon with a greater impact to Marion and Linn Counties. Both action Alternatives would also have a benefit in the form of revenues going towards the National Forest Fund (NFF). Portions of revenue generated by the sale of timber from the action Alternatives would be available to the county for roads and schools.

Alternatives 2 and 3 would both increase logging activity in the area. Alternative 2 would yard 2,785 acres and alternative 3 would yard 2,006 acres. Increased logging activity would increase traffic, noise, and congestion in an already busy and heavily used area for recreation and leisure in the nearby Forest Service campgrounds, trails, summer homes, dispersed recreation sites, as well as the privately owned Breitenbush Hot Springs Resort and Conference Center. If this project were implemented, careful planning and specific design elements should be developed to minimize the impact to the leisure and hospitality industry which currently represents 14% of the employment in the North Santiam Canyon.

Table 62 Estimated Economic Alternatives

	Alternative 1	Alternative 2	Alternative 3
Timber volume produced (MMBF)	0	~40	~24
Discounted Cost [2]	$500,000	$28,442,238	$17,066,623
Discounted Revenues	$0	$21,178,725	$14,159,898
Net Future Value (NFV)	---	$7,263,513	$2,906,725
Benefit/Cost Ratio	---	1.34	1.29

(1) All values are for comparative purposes only. Actual values would be dependent on market values during time of sale and cost of associated activities at that time.

(2) Costs include approximate planning cost for the Hwy 46 project.

Employment: In general, the primary effect on timber harvest-related employment would occur from commercial timber harvest associated with the action alternatives from an estimated selling year of 2018 through a final harvest year of around 2021. Both action alternatives would provide some opportunity for timber harvest-related employment. Assuming 10.8 jobs are created with each increase in million board feet made available for harvest, alternative 2 would create approximately 170 more jobs in the timber industry than alternative 3.

Cumulative Effects

Alternative 1

Because this is the no action alternative, there would be no impact on the environment from the incremental impact of an action when added to the impacts of other past, present, or reasonably foreseeable future actions (40 CFR §1508.7). Current levels of employment in the wood products sector would not be affected. If the Hwy 46 project were not replaced by another project, the No-Action alternative could contribute to a continued decline in forestry and milling related jobs.

Alternative 2 and 3

No past, present or reasonably foreseeable projects overlap in time or space with the Hwy 46 project, contributing to the local economy. Therefore there are no cumulative effects.

3.17 Climate Change

The proposed action (Alternative 2) would treat approximately 4,060 acres in the project area. Harvest treatments proposed include commercial thinning, dominant tree release, gap creation, quality early seral creation, sugar pine restoration, meadow restoration and skips. Fuels treatments include mechanical treatments and post-harvest underburn. Non-commercial treatments include understory habitat enhancement and hazardous fuels reduction.

Climate change is a global phenomenon because major greenhouse gasses (GHG) mix well throughout the planet's lower atmosphere (IPCC 2013). Considering emissions of GHG in 2010 was estimated at 49 ± 4.5 gigatonnes globally (IPCC 2014) and 6.9 gigatonnes nationally (US EPA, 2015), a project of this magnitude makes an infinitesimal contribution to overall emissions. Therefore, at the global and national scales, the proposed action's direct and indirect contribution to greenhouse gasses and climate change would be negligible. In addition, because the direct and indirect effects would be negligible, the proposed action's contribution to cumulative effects on greenhouse gasses and climate change would also be negligible.

The Intergovernmental Panel on Climate Change has summarized the contributions to climate change of global human activity sectors in its Fifth Assessment Report (IPCC 2014). In 2010, anthropogenic (human-caused) contributors to greenhouse gas emissions came from several sectors:

- Industry, transportation, and building – 41%
- Energy production – 35%
- Agriculture – 12%
- Forestry and other land uses – 12%

There is agreement that the forestry sector contribution has declined over the last decade (IPCC, 2014, Smith et al, 2014, FAOSTAT, 2013) The main activity in this sector associated with GHG emissions is deforestation, which is defined as removal of all trees, most notably the conversion of forest and grassland into agricultural land or developed landscapes (IPCC 2000).

The Hwy 46 Project does not fall within any of these main contributors of greenhouse gas emissions. Forested land would not be converted into a developed or agricultural condition. In fact, forest stands are being retained and thinned to maintain a vigorous condition that supports trees, and sequesters carbon long-term. US forests sequestered 757.1 megatonnes of carbon dioxide after accounting for emissions from fires and soils in 2010 (US EPA, 2015). However there is growing concern over the impacts of climate change on US forests and their current status as a carbon sink. There is strong evidence of a relationship between increasing temperatures and large tree mortality events in forests of the western United States. There is widespread recognition that climate change is increasing the size and frequency of droughts, fires, and insect/disease outbreaks, which will have major effect on these forests' role in the carbon cycle (Joyce et al. 2014).

The project is in line with the suggested practice of reducing forest disturbance effects found in the National Climate Assessment for public and private forests (Joyce et al. 2014). Here specifically, the project proposes to improve stand conditions, diversity, density and structure with thinning, gaps, and dominant tree release. Thinning the overstocked stands would make more growing space and resources available to the remaining trees, resulting in decreased tree stress and development towards larger diameter stands. The release of carbon associated with this project is justified given the overall change in condition increases forest resistance to release of much greater quantities of carbon from wildfire, drought, insects/disease, or a combination of these disturbance types (Millar et al. 2007). This project is also consistent with options presented by the IPCC for minimizing the impacts of climate change on forest carbon, and represents a potential synergy between adaptation measures and mitigation. Actions aimed at enhancing forest resilience to climate change by reducing the potential for large-scale, catastrophic disturbances such as wildfire also prevents release of GHG and enhances carbon stocks (Smith et al. 2014). The proposed action is consistent with these recommendations because it would improve stand conditions, diversity, density and structure, allowing the forest to adapt, persist and function better over time and into the future.

Timber management projects can influence carbon dioxide sequestration in three main ways: (1) by increasing new forests (afforestation), (2) by avoiding their damage or destruction (avoided deforestation), and (3) by manipulating existing forest cover (managed forests). Land-use changes, specifically deforestation and regrowth, are by far the biggest factors on a global scale in forests' role as sources or sinks of carbon dioxide, respectively (IPCC, Intergovernmental Panel on Climate Change, 2000). Projects that create forests or improve forest conditions and capacity to grow trees are positive factors in carbon sequestration. The proposed action (Alternative 2) falls into this category.

Specifically Required Disclosures:

See Appendix C for a description as to how the action alternatives comply with applicable State and Federal Laws, regulations and policies.

3.18 Unavoidable Adverse Impacts

Implementation of any of the alternatives, including the No-Action alternative, would inevitably result in some adverse environmental effects. The severity of the effects would be minimized by adhering to the direction in the management prescriptions and Standards and Guidelines in Chapter IV of the Willamette Forest Plan, as amended the Northwest Forest Plan, and additional design elements proposed in Chapter 2 of this document. These potential adverse environmental effects are discussed at length under each resource section.

3.19 Irreversible and Irretrievable Commitments of Resources

“Irreversible" commitment of resources refers to a loss of future options with nonrenewable resources. An "Irretrievable" commitment of resources refers to loss of opportunity due to a particular choice of resource uses.

The soil and water protection measures identified in the Forest Plan Standards and Guidelines, design elements in Chapter 2, and Best Management Practices are designed to avoid or minimize the potential for irreversible losses from the proposed management actions.

Concerning threatened and endangered plant, wildlife, and fish species, a determination has been made that the proposed actions would not result in irreversible or irretrievable commitment of resources that foreclose formulation or implementation of reasonable or prudent alternatives.

With all action Alternatives (2 and 3): Tree removal would result in an irretrievable loss of the value of removed trees for wildlife habitat, soil productivity, and other values. Little irreversible loss of soil should occur due to extensive design elements associated with timber harvest and prescribed fire (tractor harvest only on slopes less than 30%, skyline yarding with partial or full suspension to meet Forest Plan Standards and Guidelines, etc.).

3.20 Short-Term Effects versus Long-Term Productivity

NEPA requires consideration of “the relationship between short-term uses of man’s environment and the maintenance and enhancement of long-term productivity” (40 CFR §1502.16). This includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requires of present and future generations of Americans (42 CFR § 101(a)).

The Forest Plan establishes a sustained yield of resource outputs while maintaining productivity of resources. The specific direction and mitigation measures included in the Forest Plan and Northwest Forest Plan ensure the long-term productivity of resources will not be impaired by the application of short-term management practices. Additionally, project Design elements, Mitigation and Enhancement, and Monitoring (Section 2.5, 2.6, 2.7) were developed to reduce the environmental effects of the proposed activities and ensure project activities are implemented to comply with standards and guidelines, goals, objectives, conservation strategies and Best Management Practices.

Chapter 4 – List of Preparers

Bradford Peterson – Wilderness Manager
USDA Forest Service, Willamette National Forest, Detroit Ranger District
Contribution: Wilderness Analysis
Education / Experience: B.S. Environmental Science: Humboldt State University. 16 years of experience with the USFS (Willamette) as a Wilderness Ranger, Wilderness Manager.

Cara Kelly – Archeologist
USDA Forest Service, Willamette National Forest, Detroit and McKenzie River Ranger Districts
Contribution: Heritage Resources Analysis
Education / Experience: B.S. Anthropology: University of Oregon, MAIS, Anthropology, B.S. Geography: Oregon State University. 27 years of experience with the USFS (Willamette) as an archeologist in Cultural Resource Management.

Chris Donaldson – Fuels Specialist
USDA Forest Service, Willamette National Forest, Detroit and Sweet Home Ranger Districts
Contribution: Fuels and Air Quality Analysis
Education / Experience: B.S. Anthropology: B.S. History: Southern Oregon University. 15 years of experience with the USFS (Willamette, Rogue River-Siskiyou) in Fire Management, currently Assistant Fire Management Officer.

Danny Matthews – Transportation Planner
USDA Forest Service, Willamette National Forest, Detroit and Sweet Home Ranger Districts
Contribution: Transportation Analysis
Education / Experience: B.S. 7 years of experience with private sector engineering firms. 6 years of experience with the USDA (NRCS (Wyoming) and USFS (Willamette)) as an engineering technician and transportation planner.

Darrin A. Neff – Fish Biologist
USDA Forest Service, Willamette National Forest, Detroit Ranger District
Contribution: Fish Analysis
Education / Experience: B.S. Environmental Science: Oregon State University, Graduate coursework in Fisheries, Oregon State University. 4 years of experience as a Fish Biologist with Oregon Department of Fish and Wildlife, 9 years as a Fish Biologist with USDI BLM, and 6 years as a Fish Biologist with the USFS.

Daryl Whitmore – Wildlife Biologist
USDA Forest Service, Willamette National Forest, Detroit Ranger District
Contribution: Wildlife Analysis
Education / Experience: B.S. Wildlife: Oregon State University, 30 years of experience as a Wildlife Biologist with the USFS (Willamette).

Doug Shank – Forest Geologist
USDA Forest Service, Willamette National Forest,
Contribution: Soils Analysis
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Emily Lauderdale – Natural Resource Specialist
USDA Forest Service, Willamette National Forest
Contribution: Scenic Quality Analysis
Education / Experience: B.A. German; Environmental Policy & Culture, Northwestern University, Master of Landscape Architecture (MLA), University of Michigan. One year experience with the USFS (Willamette) in natural resources.

Grady McMahan – District Ranger
USDA Forest Service, Willamette National Forest, Detroit Ranger District
Contribution: Noise Analysis
Education/Experience: B.S. Forest Management: Utah State University. 38 years of experience with the USFS (Utah, Alaska, Colorado & Oregon) in presale forestry/logging systems, recreation specialist/planning, and administration.

Jamie Sheahan Alonso – Hydrologist
USDA Forest Service, Willamette National Forest, Detroit Ranger District
Contribution: Hydrology Analysis
Education / Experience: B.S. Applied Ecology and Environmental Science, Michigan Technological University, M.S. Resource Management: Central Washington University. 2 years of experience with the USFS and 5 years prior experience with watershed management.

Jennifer Lippert – Forest Botanist
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Contribution: Botanical Analysis
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Josh Weathers – Recreation Specialist
USDA Forest Service, Willamette National Forest, Detroit Ranger District
Contribution: Developed and Dispersed Recreation Analysis
Education / Experience: A.A.S. Forest Management: Chemeketa Community College, B.A.S. Natural Resources: Oregon State University. 14 years of combined experience with the BLM (Salem District) and USFS (Willamette) as a recreation site manager and natural resources specialist (specializing in recreation management).

Lyn Medley – *NEPA Planner*
USDA Forest Service, Willamette National Forest, Detroit Ranger District
Contribution: Project Lead, Writer/Editor, NEPA Compliance
Education / Experience: B.S. Forestry, Michigan State University. 32 years of experience with USFS (Routt, Davy Crockett, Willamette) and USDI BIA (Warm Springs) in forestry and planning.

Mark Leis – District Silviculturist
USDA Forest Service, Willamette National Forest, Detroit Ranger District
Contribution: Vegetation Analysis and Silvicultural Prescription
Education / Experience: B.S. Forestry: Michigan State University. Region 6 Certified Silviculturist. 29 years of experience with USFS (Boise, Willamette) in silviculture and timber.

Robert Mickey – *Logging Systems Specialist and Pre-sale Lead*
USDA Forest Service, Willamette National Forest
Contribution: Logging Systems, Economic Analysis for logging activities

Education / Experience: B.S. Forest Resource Management / Forest Operations, University of Montana, Missoula. 5 years of experience with the USFS (Willamette N.F.) as a logging systems specialist and timber sale forester.

Suzanne Cable – *Recreation, Lands and Minerals Staff Officer*
USDA Forest Service, Willamette National Forest, Detroit and Sweet Home Ranger Districts
Contribution: Wild and Scenic Rivers Analysis
Education / Experience: B.A. Environmental Studies, Brown University, M.S. Resource Conservation, University of Montana. Over twenty years of experience with the USFS on eight national forests in five regions working in positions from Wilderness Ranger to Recreation, Lands and Minerals Staff

Additional Support and consultation was provided by the following individuals, Federal, State, tribal, and local agencies during the development of this environmental impact statement:

Forest Service Employees	
Robert Gentry, Natural Resource Officer	Dean Mills, GIS
Ramon Alonso, Roads Engineer	Christina Ellis, GIS
Lizandra Nieves-Rivera, Soils Scientist	
Chris Wagner, Botanist	
Joe Doerr, Forest Wildlife Biologist	

Chapter 5 – List of Agencies, Governments, Organizations, and Individuals Given Notice of Availability

The agencies, governments, organizations, and individuals listed below were notified of the availability of the Draft Environmental Impact Statement (DEIS). A complete list of recipients, including names and contact information, is available in the Hwy 46 project file at the Detroit Ranger District.

Agencies and Governments

Bonneville Power Administration
City of Detroit
City of Idanha
Confederated Tribes of Grand Ronde
Confederated Tribes of Siletz Indians
Confederated Tribes of Warm Springs
Klamath Tribes
Linn County
Marion County
Office of Congressman Peter DeFazio
Office of Senator Jeff Merkley
Office of Senator Ron Wyden
Oregon Department of Environmental Quality
Oregon Department of Fish and Wildlife
Oregon Department of Forestry
United States Environmental Protection Agency
United States Fish and Wildlife Service

Organizations

American Forest Resource Council
Benton Forest Coalition
Breitenbush Resort and Conference Center
Cascadia Wildlands Project
Chemeketans
Frank Lumber Company
Freres Lumber Company
Friends of the Breitenbush Cascades
Forest Service Employees for Environmental Ethics
Grow Santiam
North Santiam Watershed Council
Oregon Hunters Association
Oregon Wild
Pacific Crest Trail Association
Portland General Electric
Rocky Mountain Elk Foundation
WildEarth Guardians

Individuals

Over 300 people, including interested parties, stakeholders, landowners, and individuals that provided comments during project scoping have been notified of the Notice of Availability and the DEIS 45-day comment period. A complete list of recipients, including names and contact information, is available in the Hwy 46 project file at the Detroit Ranger District.

Appendix A – Proposed Treatment Descriptions for the Action Alternatives

Proposed treatments for the Hwy 46 project area are thinning, gaps, skips, Dominant Tree Release (DTR), quality early seral habitat creation, sugar pine restoration (including shelterwood with reserves), meadow restoration, understory habitat enhancements, riparian treatments, hazardous fuels treatments.

Activities Common to Thinning

Thinning would maintain/increase the health and vigor of the remaining trees not harvested. Skips and gaps ranging between 1-3 acres (see Gaps, and DTR description below) would be placed in many of the stands to promote vertical and horizontal diversity (see Appendix B for a unit by unit prescription).

Conifer trees would be removed through commercial thinning. Sugar pine would not be removed from the stand; however they may be cut for operational purposes. Generally, remnant large woody debris on the forest floor would be maintained or increased throughout the stand. Snags would be maintained on site if not a hazard to logging operations. Units in LSR will not have trees 20 inches dbh and greater harvested, unless they occur in gaps. Units not in LSR will not have trees 30 inches dbh and larger harvested. Either could have these trees cut for operational purposes, but not removed from the stand.

Project generated fuels may be removed with treatments such as piling and burning, underburning, firewood collection, whole tree harvesting or chipping. However, not every acre harvested would have fuels treatments prescribed. Areas which are projected to be below the standards and guidelines (FW-212 and 252) presented by the Forest Plan would likely have minimal fuels treatments prescribed. All post-harvest fuels treatments would reduce fuel loads within the stand.

Activities Common to Gaps and Quality Early Seral Habitat

Retention trees would be left (see description below for specifics) in openings to function as legacy trees that would benefit a variety of resources. Live retained trees would be released to encourage large tree development, future snag creation, diversity in future stand structure, and development of future large down woody debris.

Retention trees may be spaced both sparsely throughout the opening and also in clumps, increasing the diversity across the landscape. Emphasis would be placed on retaining multiple desired retention tree species where feasible. Live trees with ‘elements of wood decay’ may be selected as retention trees, which could include trees with features like dead tops, broken tops and heart rot. This would increase the diversity of the prescriptions across the landscape.

Live retention trees may or may not be used as snag (wildlife) enhancement projects; however, retention trees meeting criteria for wildlife trees (i.e. having *Phellinus pini* conks or other elements of wood decay) would serve as a wildlife tree and offset the need for further enhancement. Snags would be maintained on site, if not a hazard to logging operations.

Harvest Treatment Descriptions

Thinning: The silvicultural prescriptions are designed to reduce tree density and inter-tree competition which will result in:

- Maintenance or improvement of stand health and vigor.

- Acceleration of large diameter tree development due to enhanced growth.
- Increase structural and species diversity by allowing advanced regeneration to release into the mid and overstory.
- Increased shrub and herbaceous growth developing more understory complexity.
- Provide timber products to the local economy.

Most of the commercial thinning will be implemented using a Designation by Description (DxD) prescription. With this method, trees are designated as cut trees if they are within a given spacing of trees larger in diameter. For example, in a 15 foot DxD prescription, all smaller trees within 15 feet of the largest trees will be cut, leaving the largest trees spaced between 15 to 30 feet apart. This is essentially a "thin from below", favoring the largest and most vigorous trees in the stand. Desired residual trees per acre as well as average diameter are used to calculate the spacing. Maximum diameter cut limits and species retention can be identified to protect relic old trees or minor species components.

A variety of thinning intensities are prescribed in this project. Heavier thinnings of 40-60 residual tpa are prescribed for stands with larger trees, as these trees need more space to grow than smaller ones. Most of the plantations are of similar age and structure and are prescribed thinnings to 70-90 tpa. A few of the youngest plantations will receive a thinning ranging from 80-110 residual tpa to allow the trees room to grow without lowering the canopy cover below 40% in riparian reserves.

Thinning to 40-100 tpa is prescribed to provide a wide range of canopy covers within the stands while still maximizing areas of stand and individual tree growth. This treatment is prescribed for some of the older stands that already have some species and structural diversity and will be applied with individual tree marking to ensure diversity retention and to allow for clumpiness desired for these stands. Unit 150 is prescribed a 60-100 thin due to its smaller average diameter and varied structure.

No Harvest Skips: No treatment areas, called skips, are proposed within the stands to promote complexity by providing variable density within and among stands. Skips can be areas left untreated due to 1) resource considerations such as protection buffers adjacent to streams and special habitat areas, 2) logistical considerations such as logging feasibility, 3) areas not in need of thinning or 4) leaving untreated areas embedded within a stand to promote complexity. This combination of treatment and no treatment will result in skips within the stands to promote variable density both at the stand scale and across the landscape.

Dominant Tree Release (DTR): Dominant tree release gaps (DTR) are proposed as a tool to promote complexity by providing variable density within stands, allowing for maximum tree growth, increased crown depth and expansion, enhanced species growth into the mid and overstory, as well as allowing for understory development. One or more dominant trees are left and all other trees within a radius of these tree(s) are removed, creating either a ¼ acre gap or a ½ acre gap around the tree(s). If desirable advanced regeneration is present in the opening, than it is released by the treatment and grows into the overstory at a faster rate. If no advanced regeneration is present, than the appropriate species is planted. Generally for this project, ¼ acre DTRs are created on northerly slopes where climax species such as western hemlock and western redcedar are present (planted if not present); while ½ acre gaps are created on southerly slopes and planted with seral species such as sugar pine, western white pine, or incense cedar. Climax species may be planted in the shady (southern) portions of these gaps as well. Stand selection for DTR placement is based on a variety of factors including plant association, stand structure, and land allocation.

Wildlife Gaps: Gaps one to three acres in size are proposed to be located in twelve units (Units 6, 16, 18, 21, 22, 23, 28, 32, 35, 47, 180, and 200). These gaps will contribute to the quality early seral habitat as described in Quality Early Seral Habitat below as well as adding species and structural complexity at both the stand and landscape level. Gaps would not be a conventional clear-cut treatment. The objective would be to leave some green trees in either scattered pockets and/or scattered throughout the opening post-harvest. Seven to eight trees per acre of residual trees will be left in each gap. Gaps will be broadcast burned where practical and all will be planted with seral conifers. These retention trees would be released to grow to encourage large tree development, future snag development, diversity in future stand structure, and development of future large down woody debris. In 30 to 60 years the stand structure would be more complex with at least a two cohort stand making up the overstory.

Visual Enhancement Gaps: To enhance scenic views, three gaps have been proposed in this project. Units 27 and 30 would each have a ½ acre "scallop" along the powerline corridor with residual overstory to soften the view of the straight line of the corridor. Unit 69 would have a 1/3 acre gap below road 46 to increase the view of Mt. Jefferson from the summit pull-out.

Meadow Restoration: The proposed treatment is to cut and remove most of the conifers within the boundaries of the historic meadow, leaving 7-8 tpa of larger live trees and retaining any relic conifers from before the fire. The reduction in water uptake by the trees currently there should help to restore moisture to portions of the meadow as well as reduce shade, allowing meadow plants to re-establish.

Sugar Pine Restoration: Proposed treatments aim to both protect and reinvigorate existing sugar pine as well as re-establishing it in areas suitable to its prolonged existence. Prescriptions will include shelterwood with reserve cuts, broadcast burning, planting of rust resistant stock, and pre-commercial regeneration release.

In the shelterwood with reserve cuts stands would be thinned to 10-20 or 20-30tpa, leaving the largest trees. Reserve trees would be spread across treatment area. Sugar pine or legacy trees would not be harvested.

Quality Early Seral Habitat: The proposed regeneration harvesting will meet all Green Tree Retention guidelines outlined within the Northwest Forest Plan providing a minimum of 15% of each unit uncut in a combination of clumps and scattered trees (USDA, 1994). An average of 7-8 tpa of live larger trees will be left for snag recruitment. All units will be broadcast burned, planted at 150-200 tpa of seral species, and seeded with native grass species for big game forage. Some snags may also be created from the residual trees.

Post-Harvest Tree Planting

Reforestation would be expected to occur within five years of harvest, and occur from both tree planting and natural regeneration. Post-harvest densities would be sufficiently low to allow shade-intolerant species such as Douglas-fir to regenerate in addition to increasing diversity with the ingrowth of species such as western white pine and western red cedar. Slash and other debris would be utilized as shade and as a deterrent to browse by ungulates. Planting in identified root rot pockets would be species that are less susceptible to root rot like western red cedar, sugar pine, and white pine. No additional effects would be realized by completion of this project because planting has been accounted for in the Forest and Stand Structure analysis.

Quality early seral habitat units as well as gaps and some DTRs will be planted with the appropriate species. Spacing in units/gaps where early seral habitat is the objective will be planted at a wider spacing to keep the unit in the brush/forb stage as long as possible while still meeting the Willamette Forest Plan guidelines requiring a minimum of 150 trees per acre stocking after five years. DTRs will be planted if adequate advanced regeneration is not present after harvest.

Non-commercial Treatments

Understory Habitat Enhancement: These treatments include enhancement of understory vegetation and meadow enhancement. Units 54, 82, 89, 92, and 560 will thin conifers less than 7 inches dbh to reduce shading of ground vegetation. No commercial harvest of conifers is proposed for these units. The northwest portion of unit 73 is a dry meadow being encroached by Douglas-fir. Enhancement would involve falling and leaving the encroaching trees leaving approximately 190-220 tpa.

Riparian Treatments: Units 6, 100, 190, 430, and 520 would have conifers thinned to the stream bank for some the portions of streams. In addition, small gaps (less than ¼ acre in size) would be created within these treatment areas in locations where it would be the most beneficial to hardwood release. Total acres of these gaps would not exceed 4 acres. All portions within the no-harvest buffers will be felled and left. Thinning intensities will match the prescription for the rest of the unit.

Hazardous Fuels Treatments: This prescription would reduce fuels in the Wildland-Urban Interface through non-commercial methods. The primary objectives are to reduce ladder fuels and surface fuel loads (horizontal and vertical continuity). Stands with this treatment are generally older (>120yrs old) and would focus on cutting trees and shrubs no greater than 10 inches at dbh. Changes to the fuel and stand structure would reduce potential wildfire behavior in the Breitenbush Wildland-Urban Interface. Treatments include: cutting/thinning, hand piling and burning, chipping, mastication, or firewood.

Post-Harvest Fuels Treatments Description

Slash from logging would be reduced with a variety of methods.

- Underburning: this would include both broadcast burning and jackpot burning. Variable retention regeneration and sugar pine restoration units would be treated with underburning as well as some of the wildlife gaps. Units with sugar pine in them would be protected from damage by pulling back slash and debris from the bole and by burning only in the fall.
- Grapple piling: a machine grapple is commonly used in ground based units to concentrate slash in piles away from standing trees. These piles are burned in the fall.
- Hand pile: this labor intensive treatment will generally be reserved for fuels treatment units adjacent to private property and other visually sensitive areas.
- Chipping: another slash disposal method used in visually sensitive areas and around structures.

The implementation of fuels treatment may vary in method from what is the proposed in the alternatives to meet standards and guidelines (i.e. grapple piling instead of underburning). However, the implemented fuels treatments would remain within the range of effects analyzed in the Environmental Impact Statement.

Hand Treatments and Mechanical Treatment: Hand treatments require manually hand piling created slash that is ≥1 inch in diameter and ≥3 feet in length. Mechanical treatments use machines to pile or chip/mulch fuels. Slash piles may occur within the unit or at landing(s). Piles would generally be placed in locations to minimize the damage of residual standing snags or live trees; however some piles could be located to cause tree mortality to create snags for wildlife habitat. Piles would then be burned at a later date after the slash has sufficiently dried and conditions would not allow fire to spread to surrounding area.

Hand, grapple, and landing piles are covered with approved plastic following construction. This creates a drier pocket of fuel in the middle of the pile and enables them to be burned in the late fall or early winter when there is very low risk of the piles spreading into other fuels.

Post-Harvest Underburn: Post-harvest underburns are intended to reduce fuels created by harvest activities and help promote structural and biological diversity in stands. Underburning would comply with Forest Plan standards and guidelines in regards to consumption of fuels and maintaining down-woody material, duff cover, and snags. Spring-like burning conditions would reduce the risk of burning large woody material because of high moisture content and provide conditions for lower fire intensity meeting fuels treatment standards and guidelines. An objective for the post-harvest underburning would be to minimize overstory tree mortality; however, some mortality up to 10% would be acceptable. Mortality trees that occur adjacent to roads may be removed for safety reasons.

Roads Treatments

Road Maintenance: For all action alternatives, existing forest roads needed for harvest activity would be maintained to allow safe access to harvest areas and to reduce adverse impacts to resources. Road maintenance associated with haul routes would result in decreased maintenance cost, improved safety, and reduced potential for resource damage related to degraded roads that would be needed for current and future resource management. Road maintenance activities may include felling danger trees, clearing and grubbing, replacing drainage structures, asphalt pavement patching, repairing holes in the roadbed, reconstructing ditches, application of dust abatement material, and placement of aggregate surfacing.

Temporary Road Construction and Decommissioning*:* Temporary roads would be created in both action alternatives. These roads would be placed in areas to minimize impacts to resources and would be decommissioned after use. Previously disturbed sites would be utilized where possible. The initial effects of the construction would be compacted soils; however those effects would be offset by decommissioning. The effects of decommissioning would be the same as subsoiling, and is generally beneficial to the residual stand because of reduced compaction and root growth, so increased growth is possible along skid trails and landings that have treatment.

Road Realignments*:* For all action alternatives, road realignments are needed to facilitate haul and for resource protection. In these circumstances, new portions of roads will be constructed by clearing of vegetation, installing ditches and drainage features, grading and compacting base material and surface material. The unused portion of the road will have drainage features removed and the footprint subsoiled and seeded. Forest Service construction standards will always be followed.

Short Lake Reroute: Post-sale activities along FSR 4600-040 would include the decommissioning of approximately 0.4 miles of FSR 040 will be decommissioned and rehabilitated to improve natural hydrologic function around Short Lake and reduce road maintenance. FSR 4600-059 would be realigned to provide access around the decommissioned portion of FSR 040.

Appendix B – Detailed List of Project Activities by Unit for the Proposed Action

Definitions for the following table:
Harvest Prescriptions: Skips: Riparian and Non-Riparian Skips; Thin: Riparian and Non-Riparian Thinning; DTR: Dominant Tree Release; SPSW: Sugar Pine Shelterwood Harvest; NCT: Non-commercial treatment
Logging Systems: H – Helicopter, Sk – Skyline, G – Ground Includes harvested acres, not skips
Post-Harvest Fuel Treatments: MT – Mechanical Treatment, HP – Hand Pile, UB – Underburn actual numbers would be dependent on feasibility and funding at harvest

Alternative 3 has same unit prescriptions. Units for Alternative 3 are: 1, 2, 3, 5, 6, 7, 11, 19, 20, 23, 25, 26, 30, 33, 34, 35, 38, 42, 44, 45, 46, 47, 48, 49, 51, 52, 53, 57, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 69, 70, 71, 72, 73, 74, 75, 76, 80, 82, 89, 92, 100, 110, 120, 130, 140, 140a, 160, 170, 180, 190, 200, 210, 220, 240, 250, 260, 270, 280, 290, 300, 310, 320, 340, 350, 350, 370, 400, 410, 420, 430, 440,450, 460, 470, 480, 490, 510, 520, 530, 540, 560, 570.

Unit	Acres	Harvest Prescription Acres								Logging System Acres			Post-Harvest Fuel Treatment Acres			Est. Vol. (MBF)
		Skips	Thin	EarlySeral	Meadow Restoration	DTR	Gaps	SPSW	NCT	H	Sk	G	MT	HP	UB	
1	43	19	24								24				24	115
2	33	0	30					3			33				33	117
3	13	0	13							13				3		36
5	39	19	20								18	2	10			95
6	66	5	56				3	2			36	25	25		36	463
7	19	3	16									16	12			207
11	17	1	16									16	10			49
12	24	3	19					2		18		3			19	533
13	31	11	20							20				4		612
14	15	2		13							13				13	679
16	64	18	42.25			.75	3				42	4			25	1371
17	20	4		16								16			16	519
18	46	15	28.25			.75	2				19	12			20	473
19	71	54	17									17			17	68
20	13	1	11			1					12					102
21	59	4	50.5			1.5	3				34	21	15		20	1386

Unit	Acres	Harvest Prescription Acres								Logging System Acres			Post-Harvest Fuel Treatment Acres			Est. Vol. (MBF)
		Skips	Thin	EarlySeral	Meadow Restoration	DTR	Gaps	SPSW	NCT	H	Sk	G	MT	HP	UB	
22	56	15	37			1	3				27	14			39	1913
23	41	24	14				3				4	13	17			448
24	47	16	29.5			1.5				8	23				9	524
25	23	4	19								13	6	4	2		25
26	10	5	4.75			.25					5		4			78
27	31	10	19.5			1	.5				17	4			21	289
28	31	14	14				3				13	4	4	2		364
29	8	4	0						4			4				0
30	8	0	7.5				.5				7	1	8			30
31	22	7	15									15	15			199
32	63	7	51.5			1.5	3			56					56	1045
32a[1]	11	3			8					8						315
33	39	3	32					4			33	3			33	560
34	13	2	11								11					75
35	24	9	9				6					15			15	248
38	15	5	9.5			.5					3	7	7			99
39	5	0	3					2			2	3	5			94
40	6	0	1					5			6				6	129
41	16	2	13			1					4	10	8			214
42	27	4	22			1					11	12	14			396
44	12	4	8									8	8			47
45	26	8	18								14	4	16			528
46	7	0	7									7	7			68
47	71	15	47.5			1.5	7				46	10			56	964
48	23	3	18.5			1.5					20		1			105
49	13	0	12			1					12	1	3			76
50	21	0	21								20	1	3			187
51	38	3	33.5			1.5					28	7	5		20	143
52	17	2	14.25			.75					15					193
53	24	9	14			1					15					74
54	25	0	0						25					10		0

[1] Unit 32a is meadow restoration. Encroaching conifers will be removed on 8 acres.

Unit	Acres	Harvest Prescription Acres								Logging System Acres			Post-Harvest Fuel Treatment Acres			Est. Vol. (MBF)
		Skips	Thin	EarlySeral	Meadow Restoration	DTR	Gaps	SPSW	NCT	H	Sk	G	MT	HP	UB	
55	34	6	28								21	7	10			398
56	24	12	11			1					12		7			86
57	4	0	4								4		1			14
58	10	0	9.5			.5					2	8	8			301
59	5	1	0	4								4			4	71
60	11	0	10.5			.5					6	5	5			147
61	43	3	38.5			1.5					29	11	8			474
62	29	9	20									20	20			171
63	14	2		12								12			12	200
64	68	20	48									48	48			557
69	10	5	4.7				.3					5	5			243
70	15	0	14			1						15	15			107
71	44	1	42			1					25	18	18	6		251
72	17	0	15.5			1.5					14	3	4			117
73	63	12	49.5			1.5					51				51	480
74	83	21	61			1					57	5			62	430
75	26	13	13								11	2	8	2		161
76	8	5	3									3	3			22
77	31	1	28.5			1.5					23	7	6	2		310
78	25	0	23			2					20	5	5	2		249
80	43	0	42.5			.5					27	16	15			281
81	2	0	2									2		1		27
82	25	0							25					5	5	0
83	107	14	27			1		33	32		43	18			83	963
84	83	24	47					12			59				59	782
87	1	0	1									1	1			4
89	17	0	0						17					5		0
92	43	0	0						43					15		0
93	47	5	37					5		37	5				42	199
94	40	5	29					6		30	5				35	708
95	90	21	53					16		62	7				30	772
96	25	1	20					4		24					24	463
97	20	0	20								20					413

Unit	Acres	Harvest Prescription Acres								Logging System Acres			Post-Harvest Fuel Treatment Acres			Est. Vol. (MBF)
		Skips	Thin	EarlySeral	Meadow Restoration	DTR	Gaps	SPSW	NCT	H	Sk	G	MT	HP	UB	
100	90	21	68.5			.5					47	22	34			625
110	60	13	46.5			.5					2	45	47			222
120	21	4	17								17		3			76
130	45	13	32								7	25	30			182
140	63	20	39.5			3.5					33	10	43			796
140a	19	4	15									15	15			216
150	33	4	26			3						29	29			486
160	19	2	15.75			1.25				17			16			341
170	160	27	0						133					133		0
180	31	2	23				6					29	29			414
190	51	20	30			1					11	20	30			591
200	55	6	45.25			.75	3				28	21	25			1060
210	4	0	0						4					4		0
220	75	31	42.75			1.25						44			44	941
240	28	0	26.5			1.5					22	6	6			414
250	11	2	8.5			.5						9	9			175
260	27	3	23			1					9	15	15			287
270	35	3	0						32					32		0
280	52	5	45.25			1.75					47		20			1114
290	90	48	40			2					37	5	5		25	555
300	51	21	28.5			1.5				5	25		25			392
310	12	1	10.5			.5				11						13
320	28	10	16.5			1.5					18					194
340	31	5	25			1					26				14	599
350	16	8	7.5			.5					8					72
360	16	3	12.5			.5					8	5	5			156
370	32	8	23			1						24	24			357
380	27	8	18			1					19					314
390	13	4	8.5			.5					9					79
400	26	10	15.25			.75					16					139
410	34	4	28.5			1.5					20	10	10			530
420	11	1	9.25			.75						10			10	125
430	17	2	14			1					3	12			14	218

Unit	Acres	Harvest Prescription Acres								Logging System Acres			Post-Harvest Fuel Treatment Acres			Est. Vol. (MBF)
		Skips	Thin	EarlySeral	Meadow Restoration	DTR	Gaps	SPSW	NCT	H	Sk	G	MT	HP	UB	
440	17	10	6.75			.25					7					45
450	27	4	22			1					18	5	8	2	23	130
460	8	1	6.75			.25					4	3				117
470	9	4	4.75			.25						5	5			63
480	37	4	30.5			2.5					25	8			33	665
490	18	2	15.25			.75					16				16	317
510	8	1	6.75			.25						7	7			124
520	43	12	29.5			1.5						31			31	414
530	26	3	21			2					23				23	433
540	48	5	41.5			1.5						43	43			350
560	45	0	0						45				45			0
570	24	0	0						24							0
Total	4,046	877	2517.45	45	8	72.75	47.8	94	384	317	1532	936	916	230	1113	39,997

Appendix C – Compliance with Laws, Regulations and Executive Orders

The National Environmental Policy Act (NEPA), 1969 – NEPA establishes the format and content requirements of environmental analysis and documentation. Preparation of the Hwy 46 DEIS was prepared in full compliance with these requirements.

The National Forest Management Act (NFMA), 1976 –All proposed timber harvest units are planned to occur on suitable land. If regeneration harvest is implemented the sites would be capable of restocking within 5 years of harvest by either natural or artificial means. Proposed commercial thinning would increase the rate of growth of remaining trees. Some locations would favor species or age classes most valuable to wildlife. The resultant reduced stress on residual trees would make treated stands less susceptible to pest-caused damage. Design elements have been identified to protect site productivity, soils, and water quality.

The burning of activity fuels would reduce long-lasting hazards from wildfire and reduce the risk of pest outbreaks over the project area as a whole. Air quality would be maintained at a level that would meet applicable Federal, State, and local standards. All proposed activities would provide sufficient habitat to maintain viable populations of fish and wildlife. Critical habitat for threatened or endangered species would be protected through avoidance. The action alternatives would accelerate development of forest habitats that are currently deficient within the analysis area to enhance the diversity of plant and animal communities in the long-term. See discussions under the applicable resource sections above, for further support that proposed activities that would comply with the seven requirements associated with vegetative manipulation (36 CFR 219.27(b)), riparian areas (36 CFR 219.27(e)), and soil and water (36 CFR 219.27(f)).

Forest Plan Consistency – Actions analyzed in the Hwy 46 DEIS are consistent with a broad range of Forest Plan Standards and Guidelines that have been discussed and disclosed throughout the document. The timber stand treatments associated with the project are consistent with the goals and management direction analyzed in the Willamette National Forest Land and Resource Management Plan FEIS and Record of Decision. Road improvements are designed to be consistent with the 1994 Northwest Forest Plan amendments to the Forest Plan and the Aquatic Conservation Strategy objectives.

Northwest Forest Plan Aquatic Conservation Strategy - The Aquatic Conservation Strategy (ACS) is an integral part of the Northwest Forest Plan and was developed to maintain and restore the ecological health of watersheds and aquatic ecosystems on public lands through implementation of four components: 1) riparian reserves 2) key watersheds 3) watershed analysis 4) watershed restoration. Based on the analysis presented in this DEIS and Appendix E, the ACS Objectives would be met in each alternative.

The Preservation of Antiquities Act, June 1906 and the National Historic Preservation Act, as amended, October 1966 – Section 106 of the National Historic Preservation Act (NHPA) of 1966 (amended in 1976, 1980, and 1992) is the foremost legislation governing the treatment of historic properties (a.k.a. heritage or cultural resources) during project planning and implementation. Other legal framework considered the effects of its actions on heritage resources is listed below:

36 CFR800 (Protection of Historic Properties),

36 CFR 63 (Determination of Eligibility to the National Register of Historic Places), and

36 CFR 296 (Protection of Archaeological Resources), and

Executive Order 13007 – Sacred Sites

The 1995 Programmatic Agreement (PA) among the USDA Forest Service PNW, the Advisory Council on Historic Preservation, and the Oregon State Historic Preservation Officer (SHPO) Regarding Cultural Resource Management in the State of Oregon by the USDA Forest Service, (amended in 2004), provides a process by which the Forest Heritage Specialist may certify that the Forest has complied with Section 106 of NHPA for the project.

In accordance with this PA, an appropriate inventory was conducted during the summers of 2013, 2014 and 2015. All known cultural sites in the Area of Potential Effect (project area) were protected by avoidance, resulting in a determination of “No Historic Properties Affected” on December 28, 2016. Documentation was provided by SHPO and copies have been retained in the Forest and District Heritage files.

Clean Air Act Amendments, 1977 – The alternatives are designed to meet the National Ambient Air Quality Standards through avoidance of practices that degrade air quality below health and visibility standards. This project is consistent with by the 1990 Clean Air Act and the 1977 Clean Air Act and its amendments (See Chapter 3.2 and 3.12).

The Clean Water Act, 1987 – This act establishes a non-degradation policy for all federally proposed projects. Compliance with the Clean Water Act would be accomplished through planning, application and monitoring of Best Management Practices (BMPs). Based on the analysis presented in this FEIS, TMDL requirements for the Breitenbush River Basin would be met in each alternative (See Chapter 3.4).

The Endangered Species Act (ESA), December 1973 – The ESA establishes a policy that all federal agencies would seek to conserve endangered and threatened species of fish, wildlife and plants. Biological Evaluations for plants and wildlife have been prepared, which describes possible effects and impacts of the proposed action on sensitive, and other species of concern that may be present in the project area. A Biological Assessment (BA) was prepared for the northern spotted owl, and for spring Chinook salmon.

Endangered Species Act (ESA) informal consultation with the U.S. Fish and Wildlife Service (USFWS) for Upper Willamette River spring Chinook salmon is in the process of being completed. A final Biological Assessment will be submitted to USFWS in June 2017. A letter of concurrence was received from April 14, 2010 concurring with the determinations in the Biological Assessment (below

Endangered Species Act (ESA) formal consultation with the USFWS for the Northern Spotted Owl will completed in 2017 and evaluated by the USFWS.

Upper Willamette River spring Chinook salmon are listed as threatened on the Endangered Species list. This species occurs in the Breitenbush River. This analysis found that the Hwy 46 Project “may affect, not likely to adversely affect” Upper Willamette spring Chinook salmon. In order for the Forest Service to obtain authorization we must conduct consultation with the fish agencies under Section 7 of the ESA.

Magnuson-Stevens Fishery Conservation and Management Act, 1976 (MSA) – The Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires the identification of habitat “essential” to conserve and enhance the federal fishery resources that are fished commercially. The Pacific Fishery Management Council (PFMC) designated Essential Fish Habitat (EFH) for Chinook, coho, and Puget Sound pink salmon in their Amendment 14 to the Pacific Coast Salmon Plan, issued September 27, 2000. The interim final rule implementing the EFH provision of the MSA (62 FR 66531) requires federal agencies to consult with the National Marine Fisheries Service for any action that may adversely affect EFH.

Essential fish habitat under the Magnuson-Stevens Fishery Conservation and Management Act is designated in all areas except above impassible dams (Big Cliff and Detroit Dams), and natural migration barriers. The Magnuson-Stevens Fishery Conservation and Management Act reauthorization in 1996 established a new requirement for essential fish habitat that requires Federal agencies to consult with the National Marine Fisheries Service on activities that may adversely affect essential fish habitat. Essential fish habitat for the Pacific coast salmon fishery means those waters and substrate necessary for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to a healthy ecosystem. The species designated in the Breitenbush River is spring Chinook salmon.

Technically the Breitenbush River upstream Big Cliff and Detroit Dams is not considered EFH but since reauthorization of the act the USACE has constructed an adult fish collection facility and is actively transporting Chinook salmon above the dam. Therefore, we treat the Breitenbush upstream of Detroit Dam as EFH. This project would not adversely affect EFH because of the no cut buffers we established along EFH fish bearing streams, project design elements, and the implementation of Best Management Practices (BMPs).

Federal Mine Safety and Health Act of 1977, Public Law 91-173, as amended by Public Law 95-164. Development of Rock Quarries would conform to the requirements of the act, which sets forth mandatory safety and health standards for each surface metal or nonmetal mine. The purpose for the standards is to protect life by preventing accidents and promoting health and safety.

Inventoried Roadless Areas and Wilderness – All treatments in the IRA would maintain and meet the 9 roadless area characteristics in CFR 294.11 Best Management Practices and Design Elements would be in place to protect: soil, water, and air; plant and animal communities and habitat for TES species; classes of recreation and landscapes; cultural properties and unique areas.

Alternative 2 and 3 would have temporary adverse effects due to increased noise during harvest activity. There are no direct benefits to Wilderness from any of the proposed alternatives.

Prime Farmland, Rangeland, and Forestland – No prime farmland, rangeland, or forestland occurs within the project area.

Survey and Manage Species – The action alternatives comply with the Northwest Forest Plan as amended by the 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines. Pre-disturbance surveys were conducted and site management applied consistent with the January 2001 species list.

Management Indicator Species (Aquatic) – The Willamette Forest Plan recognized anadromous and resident salmonids as economically important species and designated them as management indicator species for riparian habitat and water quality. The most common salmonid sport fish that occurs on the Detroit Ranger District is coastal cutthroat trout. The Hwy 46 project would maintain and improve habitat conditions for aquatic Management Indicator Species in the project area. Therefore, the Hwy 46 project would not contribute to a negative trend in viability of this species.

Management Indicator Species (Terrestrial) – The Willamette Forest Plan recognized elk and deer as economically important species that are commonly hunted, and designated them as management indicator species for winter range. Designated management indicator species for old growth and mature conifers are pileated woodpecker, marten, and northern spotted owl. The bald eagle was selected as a management indicator species for old growth conifers near large bodies of water, and the peregrine falcon was selected as a management indicator species for cliff nesting habitat. The Hwy 46 project would maintain habitat conditions for elk, deer, pileated woodpeckers, marten, bald eagles and peregrine falcons in the project area. The Hwy 46 project would not contribute to a negative trend in viability for any of the terrestrial wildlife management indicator species.

Executive Orders 11988 and 11990: Floodplains and Wetlands – Executive Order 11988 requires government agencies to take actions that reduce the risk of loss due to floods, to minimize the impact of floods on human health and welfare, and to restore and preserve the natural and beneficial values served by floodplains. Proposed harvest treatments would not occur within 100-year floodplains. Executive Order 11990 requires government agencies to take actions that minimize the destruction, loss, or degradation of wetlands. Streamside riparian areas, seeps, springs, and other wet habitats exist in the project area. These areas would be either avoided, or managed according to the amended Willamette Forest Plan Standards and Guidelines. Riparian Reserves would also be protected with design elements. As a result, proposed treatments would be consistent with Executive Orders 11988 and 11990.

Executive Order 12898: Environmental Justice – Executive Order 12898 requires that federal agencies adopt strategies to address environmental justice concerns within the context of agency operations. With implementation of either action alternatives, there would be no disproportionately high and adverse human health or environmental effects on minority or low-income populations. Nearby communities would mainly be affected by economic impacts connected with contractors implementing harvest, road reconstruction, tree thinning, planting, and other fuels treatment activities. Racial and cultural minority groups could also be prevalent in the work forces that implement activities. Contracts contain clauses that address worker safety.

Executive Order 12962: Recreational Fishing – The June 7, 1995, Executive Order requires government agencies to strengthen efforts to improve fisheries conservation and provide for more and better recreational fishing opportunities, and to develop a new policy to promote compatibility between the protection of endangered species and recreational fisheries, and to develop a comprehensive Recreational Fishery Resources Conservation Plan. Proposed activities in the project area would promote the restoration of riparian function in stands in corridor and headwater aquatic reserves and to develop additional large wood to stream reaches that currently lack adequate amounts. This would improve fish habitat and would provide better future fishing opportunities for the public.

Executive Order 13186: Migratory Birds – Migratory birds are protected under the Migratory Bird Treaty Act of 1918 (16 U. S.C. 703-704). The U.S. Fish and Wildlife Service is the lead federal agency for managing and conserving migratory birds in the United States. However, under Executive Order (EO) 13186, all federal agencies are charged with the conservation and protection of migratory birds. A Memorandum of Understanding (MOU 2008) between the Forest Service and U.S. Fish and Wildlife Service requires, during NEPA planning, that the FS, to the extent practical, evaluate and balance long-term benefits of projects to migratory birds against any short- or long-term adverse effects. It also requires the FS to consider approaches, to the extent practical, for identifying and minimizing take of migratory birds that is incidental to otherwise lawful activities. Region 6 has compiled some information to assist biologists in disclosing effects to avian species during NEPA planning (Forest Service and Bureau of Land Management 2013). Effects to FS sensitive birds, federally ESA listed birds, birds that are Management Indicator Species and migratory bird species that have been identified by USFWS as Species of Conservation Concern in the Northern Pacific Forest (USFWS 2008) and that have habitat in the proposed treatment units are addressed in Chapter 3.

Seasonal restrictions are recommended in the Hwy 46 design elements (Table 13) on specific units to protect owls. This would minimize disturbances to nesting migratory birds and reduce the likelihood of harm to individual birds. Design elements to retain existing snags where possible, and to retain live trees, create snags, and fall trees for dead wood sources would provide structural features migratory birds would use.

Executive Order 13443: Facilitation of Hunting Heritage and Wildlife Conservation – August 17, 2007, Executive Order requires Federal agencies "to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat." The proposed creation and enhancement of early seral habitat in both action alternatives in the project area would improve forage for game species and provide better hunting opportunities for the public.

Other Jurisdictions – There are a number of other agencies responsible for management of resources within the project area. The Oregon Department of Fish and Wildlife is responsible for management of fish and wildlife populations, whereas the Forest Service manages the habitat for these animals. The Oregon Department of Fish and Wildlife has been contacted regarding this analysis and Nancy Taylor, a biologist with the agency, has participated in early collaboration and has attended public field trips.

Proposed harvest treatments within riparian areas have been designed to comply with "Sufficiency Analysis for Stream Temperature – Evaluation of the adequacy of the Northwest Forest Plan Riparian Reserves to achieve and maintain stream temperature water quality standards" (USDA Forest Service and USDI BLM, 2004). This document was prepared in collaboration with Oregon Department of Environmental Quality and United States Environmental Protection Agency to provide documentation of Northwest Forest Plan compliance with the Clean Water Act with regard to state water quality standards for stream temperatures. As such, it redeems several of the Forest Service responsibilities identified in a "Memorandum of Understanding between USDA Forest Service and Oregon Department of Environmental Quality To Meet State and Federal Water Quality Rules and Regulations" (USDA Forest Service and Oregon DEQ, May 2002). The Sufficiency Analysis provides current scientific guidance for management of riparian vegetation to provide effective stream shade, including appropriate methods of managing young stands for riparian objectives other than shade, such as production of large wood for future recruitment.

Oregon Department of Environmental Quality and the Oregon Department of Forestry are responsible for regulating all prescribed burning operations. The USDA Forest Service Region 6 has a Memorandum of Understanding with Oregon Department of Environmental Quality, Oregon Department of Forestry, and the USDI Bureau of Land Management regarding limits on emissions, as well as reporting procedures. All burning would comply with the State of Oregon's Smoke Management Implementation Plan and, for greater specificity, see the memorandum of understanding mentioned above.

The project area includes portions of the Breitenbush River and the South Fork Breitenbush River which have been determined to be eligible for inclusion into the national Wild and Scenic River System. Until suitability is determined, the area within ¼ mile on either side of the Breitenbush River is to be managed to meet Wild and Scenic River (Recreation) Standards and Guidelines as outlined in Management Area 6c in the Willamette National Forest Land and Resource Management Plan (1990). The actions proposed in Alternatives 2 and 3 will not jeopardize the eligibility of either the Breitenbush River or South Fork Breitenbush River for inclusion in the national Wild and Scenic River System.

Energy Requirements and Conservation Potential – Some form of energy would be necessary for projects requiring use of mechanized equipment. Commercial thinning and some partial cutting units would involve both heavy and small machines for yarding logs during the implementation period. Projects such as road reconstruction and maintenance could require heavy machinery for a small amount of time. Both possibilities would result in minor energy consumption. Alternatives that harvest trees could create supplies of firewood as a by-product, which would contribute to a supply of energy for the local community for home heating.

Appendix D – Past, Present and Reasonably Foreseeable Future Actions Relevant to the Cumulative Effects Analysis

The Council on Environmental Quality issued an interpretive memorandum on June 24, 2005 regarding analysis of past actions, which states, "agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions."

The cumulative effects analysis in this document is also consistent with Forest Service National Environmental Policy Act (NEPA) Regulations (36 CFR 220.4(f)) (July 24, 2008), which state, in part:

> CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Once the agency has identified those present effects of past actions that warrant consideration, the agency assesses the extent that the effects of the proposal for agency action or its alternatives will add to, modify, or mitigate those effects. The final analysis documents an agency assessment of the cumulative effects of the actions considered (including past, present, and reasonable foreseeable future actions) on the affected environment. With respect to past actions, during the scoping process and subsequent preparation of the analysis, the agency must determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making. (40 CFR 1508.7)

The table below provides a summary of past, present, and reasonably foreseeable future actions that overlap in time and space with the Hwy 46 project and could contribute cumulative effects to the resources in the project area.

Action	Agency	Description	Resources Affected
Past Actions			
Hazardous Fuels Reduction	Breitenbush Hot Springs Resort and Conference Center	Mastication of hazardous fuels Completed 2014 Approximately 51 acres	Vegetation, Soil, Water, Wildlife, Fisheries, Roads and Access Management, Invasive Plants

Action	Agency	Description	Resources Affected
Past Actions			
Hazardous Fuels Reduction	USFS	Reduction of hazardous fuels in the summer home tracts Completed 2006 - 2012 Approximately 50 acres	Vegetation, Soil, Water, Wildlife, Fisheries, Roads and Access Management, Invasive Plants
Present Actions (ongoing)			
Powerline	PGE and Bonneville	Powerline runs through the project area	Vegetation, Soil, Water, Wildlife, Fisheries, Roads, Invasive Plants, Scenery, Recreation
Reasonably Foreseeable)			
North Fork Breitenbush Restoration	USFS	Large wood enhancement along approximately 5 miles of the North Fork Breitenbush River, Respect-the-River treatments to dispersed campsites, road storage and decommissioning. Planned implementation 2019-2022.	Vegetation, Soil, Water, Wildlife, Fisheries, Roads, Invasive Plants, Scenery, Recreation
Legacy Roads Storm Damage Risk Reduction	USFS	Drainage improvements on Devils Creek Road and additional roads in the Breitenbush Watershed to reduce road sediment delivery to streams. Locations and miles to be determined Summer 2017.	Soil, Water, Fisheries, Roads

Appendix E - An Evaluation of Activities Authorized by the Hwy 46 Project DEIS for Consistency with the Aquatic Conservation Strategy

Introduction

The Aquatic Conservation Strategy was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands. A goal of this strategy is to maintain a "natural" disturbance regime. In addition, management activities must comply with nine objectives that are included in the strategy and any associated standards and guidelines. A variety of tactics to accomplish these goals and objectives are incorporated into four primary components. These components are:

- Riparian Reserves
- Key Watersheds
- Watershed Analysis
- Watershed Restoration

These four components, along with Late Successional Reserves, are designed to operate together to maintain and restore the productivity and resiliency of riparian and aquatic ecosystems (Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl - USFS, BLM 1994, (ROD), pages B9-B12).

The Four Components

1. Riparian Reserves

The Northwest Forest Plan defined Riparian Reserves as “portions of watersheds where riparian-dependent resources receive primary emphasis and where special standards and guidelines apply” (ROD page B12). Riparian Reserves include those portions of a watershed directly coupled to streams, ponds, lakes, and wetlands - that is, the portions of a watershed required for maintaining hydrologic, geomorphic, and ecologic processes that directly affect standing and flowing water (ROD pgs. B-12 and B-13).

The Riparian Reserve network in the Breitenbush watershed totals over 27,925 acres which is 40% of the entire land base (Breitenbush Watershed Analysis update, 2014). The Watershed Analysis made no final recommendations to adjust riparian reserve widths for the streams in the watershed, retaining the initial reserve widths (of two site potential tree heights for fish bearing streams and one site potential tree height for all other streams) from the ROD for all streams.

During the analysis for the Hwy 46 Project, no reductions of Riparian Reserve widths along any streams were proposed. However, silvicultural treatments were proposed within Riparian Reserves for several units in order to improve structural diversity and vegetative diversity. Timber harvest is prohibited within Riparian Reserves but there are 3 exceptions provided in the ROD. One of which is Standard and Guideline TM-1(c).

Standards and Guidelines (S&Gs)

TM-1(c). Apply silvicultural practices for Riparian Reserves to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives.
Standard and Guideline TM-1(c) in the Northwest Forest Plan (1994) provides direction on when silvicultural activities can take place in Riparian Reserves. Our task is to review all the Riparian Reserves in the project area and at the landscape level to determine if treatment is warranted. Based on our field investigations and a landscape level analysis of hardwoods in the Breitenbush watershed we developed recommendations for each riparian reserve. The Riparian Reserves where we propose treatment (thinning, gaps in the secondary shade zone, and gaps near the stream channel) are previously managed stands (i.e. plantations) that are densely stocked and had little or no hardwoods in the reserve.

There are no cut buffers of varying width (30 feet to 340 feet) prescribed for every stream in the project area. Thinning Riparian Reserves means that there will be a short-term, localized effect on the supply of coarse woody material and ACS objective 8 states that we maintain and restore amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability. The plantations where we propose thinning are dense and there is a need to control stocking in order to maintain a healthy stand of trees. Densities in proposed unit Riparian Reserves range from 75 to 397 TPA, averaging 200 TPA. In contrast, recent forest research in the Coast Range and Western Cascades indicates that existing old growth stands developed with natural stand densities of 40 to 60 conifers per acre (Tappeiner et al 1997; Poage & Tappeiner 2002). Having a no-cut buffer adjacent to every stream would maintain a high level of trees per acre compared to what has been found in these studies. In the thinned Riparian Reserves there would still be 40-60 tpa similar to what was found in the studies, with the exception of Unit 32a which would be thinned to 5-10 tpa to achieve meadow restoration objectives. Natural stand densities for units with Riparian reserves range from 86 to 293 tpa, averaging 165 tpa. The majority of the natural stands that are proposed for treatment are fire-regenerated stands and in similar condition to dense plantations. The previously managed stands proposed for treatment in the Hwy 46 Project Area were harvested and replanted using direction that pre-dates the Willamette Land and Resource Management Plan (1990) and prior to the Northwest Forest Plan (1994). As a result, the majority of these forest stands were set on a management-induced trajectory that has led to artificially dense, conifer-dominated stands, with tree densities above the range of natural variability expected in this area. When we conducted field investigations we based the no cut buffer on stream size, stream class, gradient, channel complexity, and how functional the existing coarse woody material was in the stream channel. We expect that the amount of woody material left in the no cut buffer and the remainder of the Riparian Reserve would be sufficient to sustain physical complexity and stability. All but 3 units along fish bearing streams have wider no cut buffers (i.e. from 100 feet to 1 site potential tree height (172 feet) or 2 site potential tree heights(344 feet) so thinning in these riparian reserves would have limited effects on fish and caddisflies. The 3 units along fish bearing streams have a fall and leave silvicultural prescription to accelerate riparian diversity.

The Breitenbush Watershed Analysis (1996) described past conditions, current conditions, and trends in riparian vegetation in the watershed. Fires, road construction, and timber harvest on some land types, and flooding can accelerate debris flow occurrence. Conditions of riparian stands will depend on previous timing of fires and pulses of debris flows. It is reasonable to speculate that the extensive fires of the Late-1800s would have created open riparian stands in many of the Breitenbush drainages. Further, the fires combined with great flood of 1861 would have triggered debris flows in many first to third order streams during that period, with some affecting larger streams. By 1900, many small riparian areas would have shown mixed conifer / red alder stands with conifer about to go into a period of rapid height growth. For larger streams recovering from the impacts of 1800s fires and the 1861 flood, some red alder, cottonwood, or willow may have persisted near the active channel shelf, but conifers would have established and by the early 1900s have overtopped the deciduous trees to dominate floodplains. By the time of the 45 year flood even in 1945, most of the stands would have lost remnants of red alder and little evidence of these events would remain. With fire suppression few large fires have occurred since the early 1900s. It is estimated that 160 fires have been suppressed in the watershed since the arrival of the Civilian Conservation Corps (CCC) in the 1930s with the majority being caused by lightning.

The Breitenbush Watershed Analysis (1996) also discussed trends in riparian vegetation. Given the Riparian Reserve network established by the Northwest Forest Plan (1994), the riparian areas within the watershed will increase dominance in the conifer communities. Unlogged areas will continue recovery from the 1964 flood (the flood of record in the Breitenbush Watershed). Alder stands initiated during the 1945 and 1964 floods will persist until the middle of the next century when they will decline under emerging conifers. Older floodplains reset during the 1861 flood will be old growth by that time. A major flood would reset succession along floodplains and would affect the least confined valleys the most. In the absence of large fires, however, the disturbance would be evident for a century.

We conducted a “hardwood analysis” for the all the Riparian Reserves in the Breitenbush River watershed. For this analysis we used satellite imagery (WorldView 2) collected on July 19, 2013 and Google Earth imagery. The analysis found that 4.6% of the Riparian Reserves in the Hwy 46 project area had a deciduous and deciduous/shrub component. Deciduous leaves have a higher nutritional quality than coniferous needles. Near stream treatments (comprising 20 acres in total) along certain streams we expect will result in hardwoods that will colonize the sites and if not we would plant hardwoods (e.g. red alder, vine maple, and big leaf maple) to improve the quality of allochthonous sources of energy for the aquatic community. These near stream treatments would not be commercial and are therefore not “timber harvest.” All trees felled for these near stream treatments would be left on site.

At a watershed level, coarse woody debris levels will be maintained. There are 13,502 acres of Riparian Reserve in the project area. Alternative 2 and 3 would thin approximately 6.0% and 4.5%, respectively, of the Riparian Reserve acres in the project area. The action alternatives would create 20 acres of streamside treatments which is approximately 0.0001% of riparian reserve acres in the project area. The trees that are cut to create the near stream treatments would be left on site to provide structure and down woody material.

The recommendations made for silvicultural treatments were based on the need to control stocking and achieve the desired vegetation and structural characteristics needed in those plantations in order to improve stand vigor and the nutritional quality of organic matter used by the stream community. Also, we have been suppressing wildfires since the early 1900s, eliminating an important environmental disturbance from the landscape. We believe that this lack of wildfire is one of the contributing factors for the low percentage of hardwoods in the Breitenbush watershed and due to this we are outside the range of natural variability.

2. Key Watersheds

The Northwest Forest Plan created an overlay of Key Watersheds that are intended to provide refugia for at-risk stocks of anadromous salmonids and resident fish species. Refugia are a cornerstone of the conservation strategy for these species, consisting of watersheds that provide high quality habitat or are expected to provide habitat. Two different levels of protection, or tiers, are identified, as well as non-Key watersheds (ROD page B19). In key watersheds, completion of a watershed analysis is required prior to most management activities. While not officially designated a key watershed under the NWFP, the Breitenbush is managed as a Key Watershed through an agreement with the City of Salem, due its source as municipal drinking water supply and re-introduction of ESA-listed andoramous fish through the truck and haul program. One of the important components of Key Watershed is that there must be no net gain in roads. If new roads need to be built, then an equivalent mileage must be decommissioned. This project will result in a net decrease in road mileage of 1.99 miles.

Standards and Guidelines

> **No new roads would be built in roadless areas in Key Watersheds.**
>
> The Hwy 46 project is consistent with this S&G. No new roads are proposed to be constructed in roadless areas.
>
> **Timber harvest cannot occur in Key Watersheds prior to completing a watershed analysis.**
>
> A watershed analysis was completed for the Breitenbush watershed in 1996 and was updated in 2014.

Preliminary data collection at the nearby H.J. Andrews Experimental Forest in 2013 support the fundamental idea that historically, light regimes in these headwater ecosystems were highly variable with areas of low light where canopies cover the stream and areas of high light associated with canopy gaps. The McKenzie River Ranger District worked with Oregon State University researchers to collect observational information on gaps on a tributary to McCrae Creek. This creek is comparable in size to the streams on the Detroit Ranger District where we are proposing streamside treatments, but it has not only mid-seral Douglas fir forest but also sections of old growth riparian forest. This stream also has a self-sustaining population of resident wild coastal cutthroat trout. Results from this and other streams in the region showed that there are more gaps in the old growth reach and greater light availability to the stream channel compared to the plantation. In our assessments of juvenile trout growth through the summer, we observed greater growth rates in young-of-year cutthroat in the old growth reach as compared to the plantation reach. The two reaches are in close proximity in the same stream with comparable young-of-year and large adult populations, suggesting that these differences in growth are likely due to the differences in stream conditions between the two reaches.

As required by the S&Gs these activities must be analyzed to ensure that significant risk to the watershed values does not exist. The Breitenbush River Watershed Analysis (1996) identified the following values for the watershed:

- Forest Road 46 is a National Scenic Byway and National Scenic Bikeway.
- Recreation. The Breitenbush watershed provides a wide variety of recreational opportunities from backpacking in the Mt. Jefferson Wilderness to fishing, hunting, and camping.
- Scenic and Aesthetic. The Breitenbush River is a Candidate River under the Wild and Scenic Rivers Act. The “outstandingly remarkable values” identified for the Breitenbush are scenery, recreation, fish, and cultural.
- Spiritual. The public has expressed to the Forest Service that they find certain places in the Breitenbush watershed as spiritual. For example, Breitenbush hot springs and the Jefferson Park area of the Mt Jefferson Wilderness.
- Employment. The Breitenbush watershed provides a variety of forest products from timber to floral design products. A number of recreation sites are managed under contract with the Forest Service by concessionaire. The salmon that are produced in the Breitenbush are part of a larger stock of fish that provide jobs in the commercial and sport fishing industries.

- The North Santiam River system provides the drinking water for the city of Salem and communities located in the Santiam canyon. The Breitenbush River is a major tributary to the Santiam River.
- Ecological Values. The Breitenbush watershed provides a variety of habitats and a diversity of wildlife species.

Given the small scope and area relative to the rest of the Breitenbush watershed, the streamside vegetation diversity project will have no effect on values such as the scenic byway, recreation of any sort, the scenic quality of the Breitenbush SIA or Wild and Scenic River values. The project may affect ecological values and water quality so this analysis will focus on those watershed values.

Water quality and especially stream temperature could be affected by the removal of shade trees. Oregon Department of Environmental Quality (DEQ) implements the Clean Water Act. Every two years, DEQ is required to assess water quality and report to EPA (Environmental Protection Agency) on the condition of Oregon's waters. DEQ prepares an Integrated Report that meets the requirements of the federal Clean Water Act (CWA) for Section 305(b) and Section 303(d). Following a temperature TMDL (Total Maximum Daily Load) or other cumulative effects analysis, waste load and load allocations will restrict all point sources and non-point sources to a cumulative increase of no greater than 0.3ºCelcius (0.5 Fahrenheit) above the applicable criteria after complete mixing in the water body, at the point of maximum impact.

We believe that water quality standards can be met and that stream temperatures will not rise by 0.3º C (0.5º F) due to the following:

- The individual streamside treatment areas (See hydrology report for individual unit treatment acres) are relatively small. Hardwoods would be planted in some of the areas, and within 6 to 10 years we expect that more hardwood trees would colonize the openings and provide effective shading.
- The streams are moderately to relatively steep (7%-29%) so the water would move quickly through the treatment areas. Relative to a flat stream (2% gradient) there would be less time for the sun to heat up the water as it passes through the treatment areas. In addition, shade will not be affected downstream of the treatment areas. In unit 430, the closest unit to listed fish habitat, the stream slope is 30% and has a north facing aspect.
- Because these streams are relatively steep they are considered “cascades” from a stream channel perspective. They have a variety of substrates such as sand, gravel, cobbles, small and large boulders. This creates complex channel conditions and allows for hyporheic exchange which helps to cool the stream.

Since we do not expect a jeopardy determination from the National Marine Fisheries Service and we do not expect to violate the 303(d) requirements of the Clean Water Act, this project would not pose a significant risk to the values identified in the Breitenbush Watershed Analysis (1994).

3. & 4. Watershed Analysis and Watershed Restoration

The Breitenbush Watershed Analysis was prepared for the Detroit Ranger District in 1996 and updated in 2014. The watershed was characterized in terms of past and current conditions, and a synthesis discussion was provided to guide development of management proposals to maintain and restore watershed conditions.

The Hwy 46 Project has incorporated information from the watershed analysis into the project design. Current vegetative landscape patterns reflect past management activities that did not consider what the landscape might look like under natural disturbance regimes. Many of the proposed projects seek to create vegetative patterns, late successional stand structures, and fuel loadings that would have been typical of this landscape under the natural disturbance regimes that historically occurred in the area.

Watershed restoration has been ongoing in the Breitenbush River since 1994. Most of this work has centered on dispersed recreation use and mitigation efforts have been focused there. Current planning efforts by USFS aquatics staff focus on large scale restoration efforts on the Breitenbush River, upstream of Cleator Bend campground and the N. Fk Breitenbush River. This planning effort will place LWD, rehabilitate dispersed campsite, decommission roads, replace culverts, and include planting of native trees and shrubs in the riparian zone. Numerous dispersed campsites adjacent to the Breitenbush have been closed or rehabilitated. Roads have been decommissioned and stored in the watershed and more roads are proposed for these treatments in the Hwy 46 project.

Aquatic Conservation Strategy Objectives

The previous discussions highlighted the consistency of the Hwy 46 Project with the four components of the Aquatic Conservation Strategy. This section will outline how the activities proposed in the alternatives conform to the nine objectives of the ACS. The information presented is summarized from Chapters 2 and 3 of the Environmental Impact Statement, where greater detail can be found if needed.

Objective #1 - 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.

Alternative 1 (No Action) – This alternative would maintain landscape complexity at the current condition. Several hundred acres of Riparian Reserves would remain in dense homogenous stand conditions until natural processes created openings and down wood. This could take several decades. Aquatic habitats would continue to experience a low volume of large (greater than 36" in diameter at 50' from the large end) in-stream wood. Until a fire or large flood disturbs the riparian habitat the Breitenbush River will continue to have a low percentage of hardwood vegetation in the Riparian Reserves.

Alternative 2 (Proposed Action) – The thinning treatments were developed so that they would, to the extent possible, emulate the effects of the natural fire regime that historically occurred in the vicinity as well as maintain existing habitat near streams and wetlands. Creating structural and species diversity within dense, homogenous Riparian Reserve stands were key drivers in the proposed treatments. The objective is to provide a balance between the maintenance of existing habitat for species, populations, and communities, with opportunities to develop landscape scale features with distribution, diversity and complexity of the historical landscapes. This includes aquatic and riparian elements of the landscape.

Specific treatments are included to enhance early seral habitat which has been declining in the watershed as a result of past fire suppression activities and land management choices. Though no regeneration harvest is proposed within the Riparian Reserves, these treatments would enhance the overall diversity and complexity across the landscape.

Within prescribed fire units, the introduction of low severity fire into patches of Riparian Reserves is anticipated. Fire would be allowed to back into the Reserves and burn in a mosaic pattern rather than requiring a fire line around the Reserves which would potentially result in erosion. Low severity fire is expected to increase the plant species and stand structural diversity on a small scale. At low burn severities, large wood would not be removed from the Reserves. In addition with local differences in soil moisture and relative humidity, the pattern of burning in the Riparian Reserves is expected to resemble a patchwork mosaic of unburned and lightly burned sites. In the unburned portions, the existing understory vegetation, including conifers, would be retained. In lightly burned areas, understory conifers would experience some mortality, but fire adapted species such as willow and other hardwood shrubs would re-sprout and, in some instances, be stimulated into increased growth in response to the disturbance. The net result would be increased plant species and stand structural diversity, with a closer resemblance to historic stand condition than non-thinned plantations.

Additionally, over 26,487 acres of Riparian Reserves throughout the Breitenbush 5th field would remain untreated.

Alternative 3 – The effects of Alternative 3 would be similar to Alternative 2 since the acres proposed for treatment within the Riparian Reserves are similar (372 acres). Treatments outside the Riparian Reserves affect fewer acres.

This objective would be maintained.

Objective #2 - Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

Alterative 1 (No Action) –Failing culverts and inadequately maintained roads would continue to affect the ability of some aquatic species to disperse. Culverts that are currently barriers to fish and other aquatic dependent species would not be replaced. Otherwise, implementation of this alternative would maintain existing spatial and temporal connectivity.

Alterative 2 (Proposed Action) – Road treatments include upgrade of stream crossings to accommodate 100 year flood events, so that these events can flow through the landscape unimpeded and without the risk of catastrophic fill failures. Riparian Reserves, as established by the Record of Decision for the Northwest Forest Plan and re-assessed in the Breitenbush Watershed Analysis have been incorporated into the design of all treatment units where streams occur. Treatments are proposed within riparian reserves, where they have the potential to enhance functions such as the development of future large wood, stand structural diversity, vegetative species richness and diversity, connectivity, and other late successional characteristics.

Alternative 3 – Implementation of this alterative incorporates many of the same elements as Alternative 2. Fewer culverts would be upgraded though most of these are on intermittent streams high up on the slopes where fewer aquatic species reside. Also fewer (372 acres) acres of riparian thinning would occur.

This objective would be maintained.

Objective #3 - Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

Alternative 1 (No Action) – Implementation of this alternative would maintain existing conditions. Roads and drainage features would continue to fail creating potential for damage to channel integrity. Large in-stream wood levels would remain low for several decades until natural processes occurred to create it. The ability of some streams to store gravels would be greatly reduced during this time which would continue to alter the channel morphology.

Alterative 2 (Proposed Action) – All proposed treatments were designed with channel stability in mind. All harvest activities restrict the use of ground disturbing equipment in and around streams, and provide for retention of all vegetation that is contributing to the stability of banks and channels. Where aerial yarding methods are prescribed, full suspension is required when yarding over streams and their buffers to prevent disturbance of stream banks and channels. Trees cut for skyline corridors would be retained on site as down woody material.

Trees cut for the near-stream treatments would all be maintained on site for down woody material. Tree stumps and their rootwads would maintain bank stability for a number of years. The duration is typically considered 5 years but we have noted stumps along streams providing stability for at least a decade. In addition, hardwoods would begin to colonize the treatment areas and their root systems would provide for bank stability. If natural colonization is not occurring as expected manual planting of the treatment sites would occur. We expect that hardwoods would be fully established in the treatment areas in six to ten years.

Roads are a known potential source of damage to stream habitat, where improper design or location, or inadequate maintenance results in failures or roadway erosion, channel confinement or fine sediment delivery to streams. The Hwy 46 Project addresses this concern by minimizing permanent road construction and upgrading numerous culverts. Approximately 117 miles of maintenance and reconstruction of portions of the existing road network that are in poor repair, replacement of undersized or old culverts, drainage improvement, and application of aggregate where necessary, will reduce chronic, low amplitude sources of fine sediment from the existing transportation system, and the potential of crossing fill failures. This will reduce the possibility of gravels and cobbles becoming embedded in fine materials in the stream channel bottoms. Approximately 5.2 miles of temporary roads will be constructed on stable locations, and all of these will be decommissioned following harvest activities. Additionally, approximately 1.99 miles of road would be decommissioned and 0.75 miles stored in a hydrologically stable condition.

Addition of in-stream large wood along 20 acres of stream (mostly fish-bearing) would occur. This would impact stream banks or beds by increasing a streams ability to store and sort gravels thus adding to the channel complexity.

<u>Alterative 3</u> – Implementation of this alternative would have similar effects as Alternative 2 with the exception of fewer road miles maintained and 2.2 fewer miles of temporary roads. This may result in impacts to the streams along roads not repaired.

This objective would be maintained.

<u>Objective #4</u> – Maintain and restore water quality necessary to support healthy riparian, aquatic and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

<u>Alterative 1 (No Action)</u> – Implementation of this alternative would maintain existing water quality conditions including current levels of shade for stream temperatures. As stands continue to develop towards more natural conditions, conditions would improve also. This could take several years to several decades in streams hit heavily by historic logging (clear-cutting to the stream edge) and stream “cleaning” (removal in in-stream wood).

<u>Alternative 2 (Proposed Action)</u> – The over-all objective of any treatment within the Riparian Reserves is to maintain compliance with the Regional TMDL Implementation Strategy so that stream temperatures are not detrimentally impacted. Over 26,487 acres of Riparian Reserves throughout the Breitenbush 5th field watershed would remain untreated. Where vegetative treatments are proposed within Riparian Reserves, effective stream shading is retained at levels sufficient to maintain water temperature. A

minimum of 50% canopy closure is preserved throughout the Riparian Reserve to maintain microclimates. No-harvest buffers were developed to preserve the primary shade zone. Five units are proposed for streamside treatment. All of the remaining units with perennial Class 3 and Class 2 streams have a minimum 60-foot no-harvest buffer.

Where in-stream wood or near-stream treatments are proposed, thermal loading is naturally low. The lengths of stream exposed to direct solar radiation are kept to a minimum to achieve resource objectives while providing shaded reaches to “re-cool” the stream immediately below the treatments. Additionally, the creation of in-stream wood improves gravel storage and pool formation which in turn increases hyporehic exchange and improving cold water influx to the channels.

Alternative 3 – Implementation of this alternative would have similar effects as Alternative 2. The acres Riparian Reserve treatments and the acres of stream side wood creation are the same. Design elements for stream-side shade is also the same though there are fewer acres (372 acres) proposed for thinning in Alternative 3.

This objective would be maintained.

Objective #5 – Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

Alterative 1 (No Action) – Under natural, unmanaged conditions, the sediment regime is regulated overland and via streamflow’s, (big events like debris flows and ongoing small inputs like bank erosion). Sediment storage and transport is influenced by stream channels, including obstructions such as large woody debris that slow the flow, allowing sediment to settle out. Approximately 22% of the Breitenbush 5th field watershed lies in designated wilderness, so much of the watershed would not have any change in sediment regime by No Action. This helps provide for landscape processes that are dominated by nature rather than humans. Implementation of this alternative would maintain existing anthropogenic sediment input at their current levels for potentially several years to several decades. Natural sediment regime processes would still continue, including debris flow and downstream delivery of sediment. However, Alternative 1 would not correct existing road erosion problems nor reduce the risk of future road or culvert failure.

Alternative 2 (Proposed Action) – Project design elements are intended to maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations, as discussed above under Objective 3. These design elements will also provide protection to water quality from the introduction of sediment into streams and resulting effects on stream turbidity.

Roads are a known potential source of damage to stream habitat, where improper design or location, or inadequate maintenance results in failures or roadway erosion. The Hwy 46 Project addresses this concern by minimizing permanent road construction and upgrading numerous culverts. Approximately 117 miles of maintenance and reconstruction of portions of the existing road network that are in poor repair, replacement of undersized or old culverts, drainage improvement, and application of aggregate where necessary, will reduce chronic, low amplitude sources of fine sediment from the existing transportation system, and the potential of crossing fill failures. This will reduce the possibility of gravels and cobbles becoming embedded in fine materials in the stream channel bottoms. During culvert replacement, some sediment may enter the stream system. However, the amount will be minimized by following BMPs and the impact will be relatively short lived. Approximately 5.2 miles of temporary roads will be constructed on stable locations, and all of these will be decommissioned following harvest activities. Additionally, approximately 1.99 miles of road would be decommissioned and 0.75 miles stored in a hydrologically stable condition.

All proposed treatments were designed with sediment transport potential in mind. All harvest activities follow Best Management Practices (BMP) guidelines and restrict the use of ground disturbing equipment in and around streams. This reduces the potential of water routing along skid roads or the creation of overland flow due to high compaction levels. Where aerial yarding methods are prescribed, full suspension is required when yarding over streams to prevent disturbance of stream banks and channels. Trees cut for skyline corridors would be retained on site as down woody material.

Alternative 3 – Implementation of this alternative would have similar effects as Alternative 2 with the exception of fewer road miles maintained or reconstructed. This may result in impacts to the streams along roads not repaired.

This objective would be slightly improved.

Objective #6 – 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.

Alterative 1 (No Action) – Approximately 22% of the Breitenbush 5th field watershed lies in designated wilderness. This helps provide for landscape processes that are dominated by nature rather than humans. Implementation of this alternative would maintain existing in-stream flows.

The area's sub-watersheds are moving into a vegetative condition which buffers the effect of snow accumulation from past clear-cutting harvest. With ARP values projected to remain well above the threshold of concern, No Action, would result in no changes to existing peak flows based on vegetation removal. However, lack of density reduction and fuel treatments of overstocked stands would retain an increased risk of high severity wildfire or disease outbreaks, that would have the potential to increase peak flows in the near-term following an event.

Alternative 2 (Proposed Action) –Implementation of a landscape design that is intended to restore vegetative structure, landscape patterns, and disturbance regimes to a more natural condition will result in a hydrology that more closely resemble those under which historic stream flow conditions developed. This alternative maintains current canopy cover at levels above the maximum mid-point Aggregate Recovery Percentage (ARP). Therefore, no altered flows are anticipated from implementation of this alterative.

It is anticipated that implementation of standards in the Willamette National Forest Plan would maintain stream flows sufficiently to create and sustain riparian, aquatic and wetland habitats, and to retain patterns of sediment, nutrient, and wood routing. In the short term, potential adverse effects on the timing, magnitude, duration, and spatial distribution of peak and high flows will be minimized by managing the planning subdrainages within the analysis area to Aggregate Recovery Percentage (ARP) levels.

Alternative 3 – Implementation of this alternative would have similar effects as Alternative 2, and no altered flows are anticipated.

This objective would be maintained.

Objective #7 – Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

Alterative 1 (No Action) – As mentioned in previous objective, approximately 22% of the Breitenbush 5th field watershed lies in designated wilderness which helps provide for natural landscape processes Implementation of this alternative would maintain existing floodplain inundations and water table elevations. Conifer encroachment would continue in the wet meadow in Unit 32a, reducing water availability for meadow vegetation and eventually losing the meadow habitat all together in the absence of other disturbance.

Alternative 2 (Proposed Action) – Implementation of a landscape design that is intended to restore vegetative structures, landscape patterns, and disturbance regimes to a more natural condition will result in watershed conditions that more closely resemble those under which historic stream flow conditions developed. Floodplains and wetland areas were excluded from consideration with the exception of Unit 32a for harvest activities and where treatment units occur adjacent to these features. Ground based equipment is restricted from buffers to minimize soil and groundwater impacts. Addition of in-stream wood has the potential to alter floodplains. However, research has shown that this type of alteration usually leads in increased channel complexity and improved aquatic habitat. Conifer encroachment would be addressed in the wet meadow in Unit 32a, increasing shallow water availability for meadow vegetation and increasing wet meadow diversity.

Alternative 3 – Implementation of this alternative would have similar effects as Alternative 2, and no altered flows are anticipated. Conifer encroachment would continue in the wet meadow in Unit 32a, reducing water availability for meadow vegetation and eventually losing the meadow habitat all together in the absence of other disturbance.

This ACSO would be maintained.

Objective #8 - Maintain and restore the species compositions and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distribution of coarse woody debris sufficient to sustain physical complexity and stability.

Alternative 1 (No Action) – This alternative would maintain landscape complexity at the current condition. Several hundred acres of Riparian Reserves would remain in dense homogenous stand conditions until natural processes created openings in which hardwoods and understory species could thrive. This could take several decades. Aquatic habitats would continue to experience low volumes of in-stream and terrestrial down wood.

Alternative 2 (Proposed Action) – Over 26,487 acres of Riparian Reserves throughout the Breitenbush 5th field would remain untreated and provide landscape-scale diversity. Some stands in Riparian Reserves are proposed for treatment to encourage development of large wood and late successional stand structure and increasing understory species diversity. Many of the plantations showed relatively high levels of large down wood that was left from the original harvest, with quite large diameters over 40”, such that it will last many more decades. At present, these stands are dense with a homogeneous overstory dominated by Douglas-fir. This forms a condition which shades out almost all light before it can reach the forest floor. Because of this, there are very little hardwoods or herbaceous vegetation on the forest floor. Thinning these stands outside of the streams primary shade zone will allow more sunlight to reach the forest floor and encourage greater vegetative diversity than currently exists. This activity will have the short term effect (years to a couple of decades) of reducing coarse woody material loading in the Riparian Reserve outside the no-harvest buffer. However given the unnaturally over-stocked conditions of these managed stands, in the long term (decades to a century) there will still be adequate woody material to maintained volumes within the natural range of variability.

Wetlands and floodplain areas that are critical to nutrient filtering are eliminated from treatment areas and use of ground disturbing equipment adjacent to them is restricted. Near-stream treatments and large wood input will help improve the nutritional quality of organic matter delivered to streams and allow for increased primary productivity.

Use of low severity fire is restricted to the edges of streamside buffers where the risk of adverse effects on ground cover and duff retention cannot impact water quality.

Alternative 3 - Implementation of this alternative would have similar effects as Alternative 2 with the exception there are fewer acres (372 acres) proposed for thinning in Alternative 3.

This objective would be slightly improved.

Objective #9 – Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

Alternative 1 (No Action) – This alternative would maintain current habitat conditions for both aquatic and riparian-dependent species. Many of the aquatic and riparian-dependent species need complex stand structures like that found in old-growth stands in order to thrive. However, several hundred acres of Riparian Reserves would remain in dense homogenous stand conditions until natural processes created openings in which hardwoods and understory species could thrive. This could take several decades. Meanwhile aquatic habitats would continue to experience low volumes of down wood and a lack of hardwood leaf litter. Deciduous trees provide leaf matter to streams that is of higher nutritional quality than conifer needles.

Alternative 2 (Proposed Action) – Over 26487 acres of Riparian Reserves throughout the Breitenbush 5th field watershed would remain untreated and provide landscape-scale diversity. In addition, this project complies with the Northwest Forest Plan and all of its applicable standards and guidelines. Objective 9 was expected to maintain and restore late-successional and old-growth forest ecosystems, and provide adequate viability levels for all late successional species including species listed in the FSEIS ROD Table C-3.

As discussed in the other Objectives above, many stands in Riparian Reserves are proposed for treatment to encourage development of large wood, late successional stand structure and understory plant diversity. This would help to create a rich variety of habitats for native species. Adequate amounts of down woody debris will be retained on site.

Thinning in the upland portion of the Riparian Reserves in Hwy 46 will help restore habitat for a variety of native plant species. Currently these areas are even aged Douglas-fir plantations and lack a diversity of understory vascular and lichen and bryophyte species. Thinning these areas could increase botanical species richness by creating more multi-aged and multi-canopy stands as well as increase species diversity.

Many of the sensitive and survey and manage plant species in the project area are found within or adjacent to Riparian Reserves. These sites will be buffered to protect the sites from disturbance and maintain the microclimate. See the Botany Report and/or Botanical Biological Evaluation for more information on these sites.

The Breitenbush River and its numerous tributaries provide excellent habitat for native fish. This is due to the cold, clean water. This habitat will be maintained by the implementation of no cut buffers along fish bearing streams. Additionally, upgrades to several culverts will provide better dispersal opportunities to aquatic invertebrates and salamanders. Roads that are decommissioned will restore stream channels so that there will be unobstructed passage at the former road crossing.

Alternative 3 - Implementation of this alternative would have similar effects as Alternative 2 with the exception that Alternative 3 proposes fewer acres (372 acres) of Riparian Reserve thinning and fewer miles of road maintenance/repairs.

This objective would be slightly improved.

Appendix F – DecAID Analysis

DecAID Project Analysis: Downed Logs and Snags

A collection of information, referred to as DecAID, has been developed by Region 6 to help projects identify the levels of snags and downed logs required to meet wildlife population needs (Forest Service 2012). At the landscape level, DecAID recommends providing dead wood at levels within the range of historic variability. The proposed treatments are entirely within the 5th field Breitenbush River watershed which was used to evaluate deadwood at the landscape level for this project.

DecAID evaluates deadwood levels by wildlife habitat type. The Breitenbush River watershed contains about 29,655 acres of Montane Mixed Conifer Forest and 31,949 acres of Westside Lowland Conifer-Hardwood Forest habitat (Acker 2015). Treatment units in the HWY 46 timber project are in these habitat types.

DecAID takes advantage of the spatially-comprehensive dataset of vegetation structure developed for Oregon and Washington by a team from the Pacific Northwest Research Station and Oregon State University using the statistical imputation method Gradient Nearest Neighbor (GNN) (LEMMA 2015). DecAID includes a process (“Distribution Analysis”) that allows use of GNN data to evaluate the current frequency distribution of different densities of snags and amounts of cover of down wood within geographic areas such as watersheds selected by users. By using inventory plot data from unharvested areas and information on historic disturbance regimes, the process also allows estimation of reference conditions for both snags and down wood (Forest Service 2012).

The median historic condition for the Breitenbush River watershed was estimated using levels of snags and downed logs found in strategic plots in unlogged stands of various ages and an estimate of the normal distribution of seral stages derived from the assumed fire return interval (Acker 2015). Median values are the mid-point where half of the time deadwood levels would be at or higher than that value and about half the time they would be at or lower than the value. Studies have indicated that fire frequency and severity varied considerably in the past due to substantial variability in weather conditions, and fire severity varied from century to century (Wimberley et al. 2000). Therefore, levels of dead wood have fluctuated considerably over time and plus or minus 50% of the estimated median value was used to approximate the historic range of variability.

<u>Downed Logs:</u> DecAID analysis (Acker 2015) found that downed logs in both total size class (> 5” diameter) and large size class (>20” diameter) for both Westside Lowland Conifer-Hardwood Forest and Montane Mixed Conifer Forest in the Breitenbush River watershed were similar to estimated historic median conditions. (Figures 1-4). That means that the abundance of downed logs currently is similar to what was historically present within the Breitenbush River watershed.

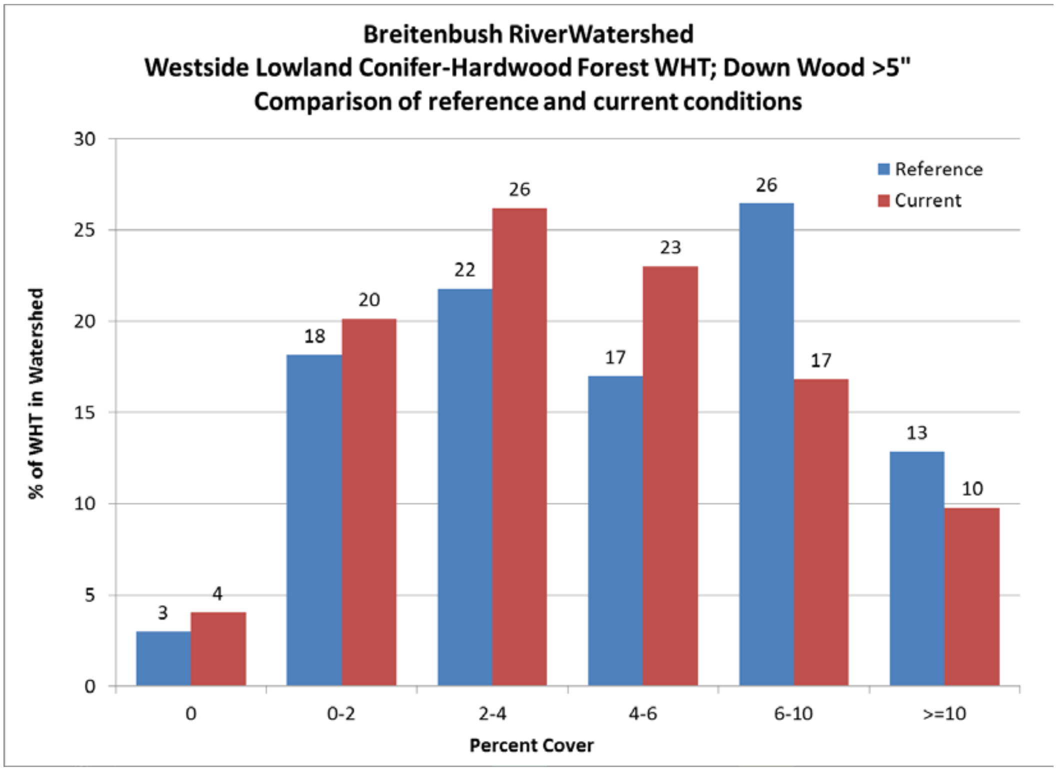


Figure 53.DecAID analysis showing estimated current and historic downed wood for the Breitenbush River watershed in Westside Lowland Conifer-Hardwood Forest habitat (Acker 2015).

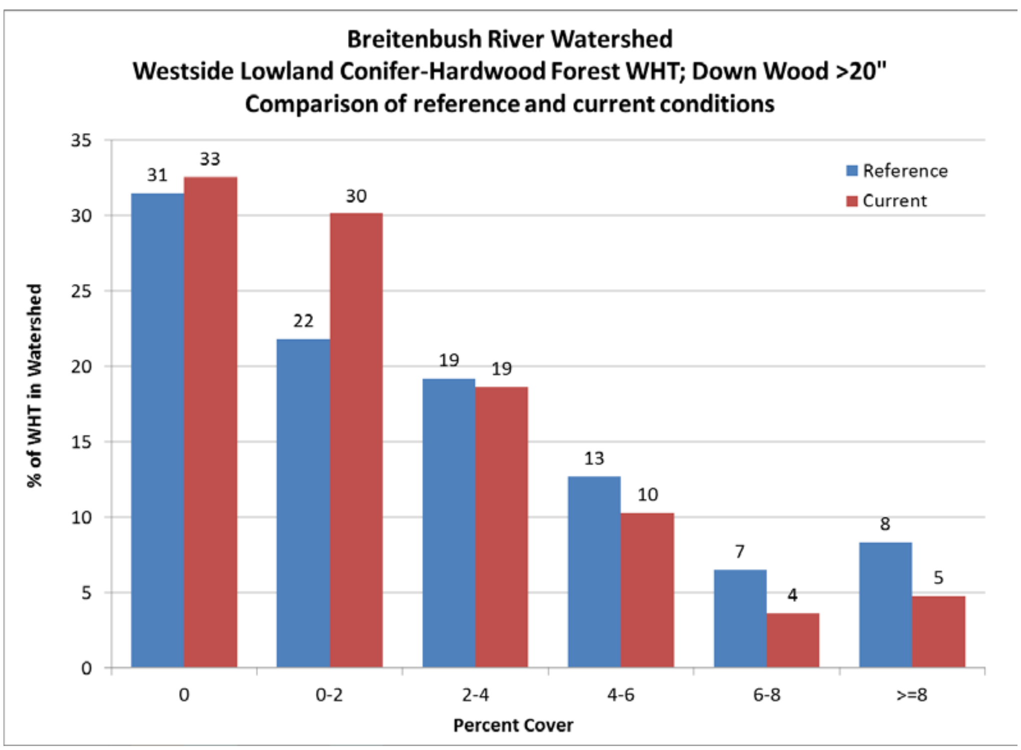


Figure 54 DecAID analysis showing estimated current and historic large-diameter downed wood for the Breitenbush River watershed in Westside Lowland Conifer-Hardwood Forest habitat (Acker 2015).

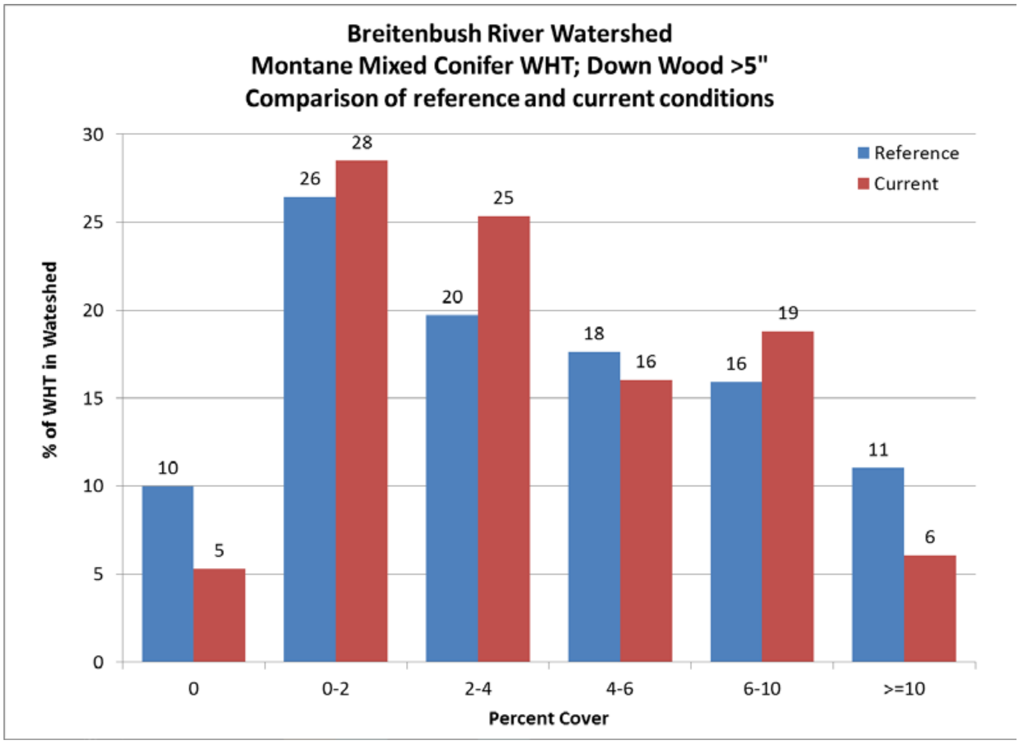
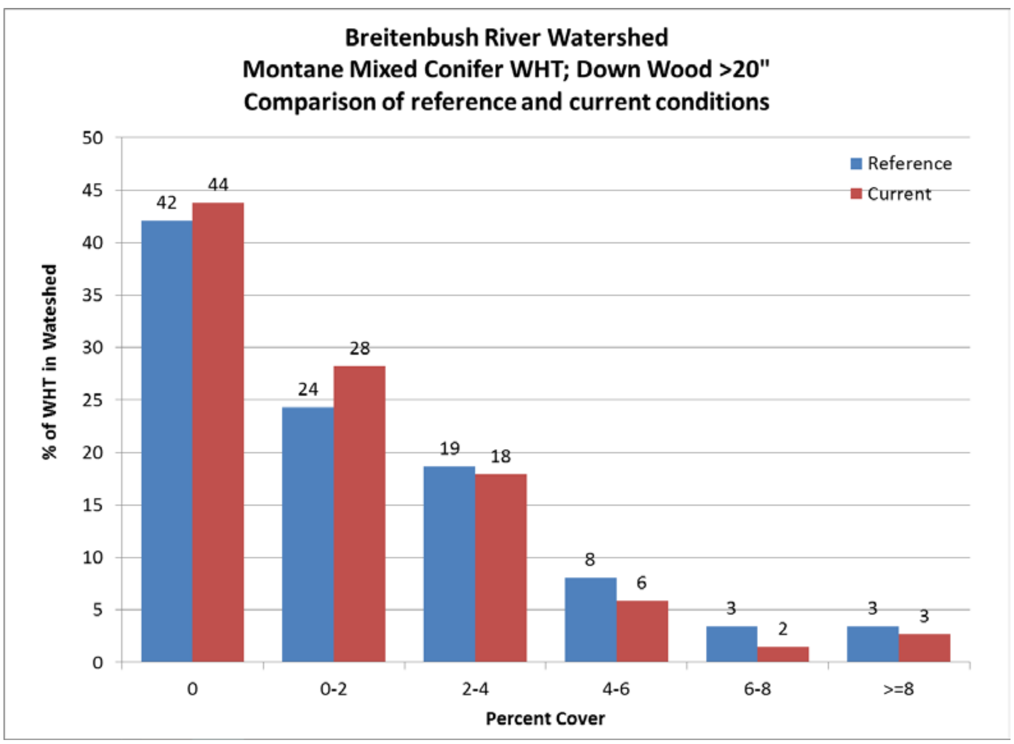


Figure 55. DecAID analysis showing estimated current and historic downed wood for the Breitenbush River watershed in Montane Mixed Conifer habitat (Acker 2015).



DecAID analysis showing estimated current and historic large-diameter downed wood for the Breitenbush River watershed in Montane Mixed Conifer habitat (Acker 2015).

<u>Snags:</u> DecAID analysis (Acker 2015) found that snags in both total size class (> 10 inches dbh) and large size class (>20 inches dbh) for both Westside Lowland Conifer-Hardwood Forest and Montane Mixed Conifer Forest were less than estimated historic median conditions. (Figures 5-8). In particular, the percent of area with no snags is much higher now than what historically occurred, according to the DecAID analysis. For snags greater than 10 inches dbh, 26% of the Westside Lowland Conifer-Hardwood Forest and 22% of the Montane Mixed Conifer Forest in the Breitenbush River watershed have no snags compared to an estimated historic median condition of 5% and 6%, respectively (Acker 2015). For snags greater than 20 inches dbh, 38% of the Westside Lowland Conifer-Hardwood Forest and 40% of the Montane Mixed Conifer Forest in the Breitenbush River watershed have no large snags compared to an estimated historic median condition of 11% and 15%, respectively. Past logging and fire suppression are likely important reasons why large areas in the watershed lack snags.

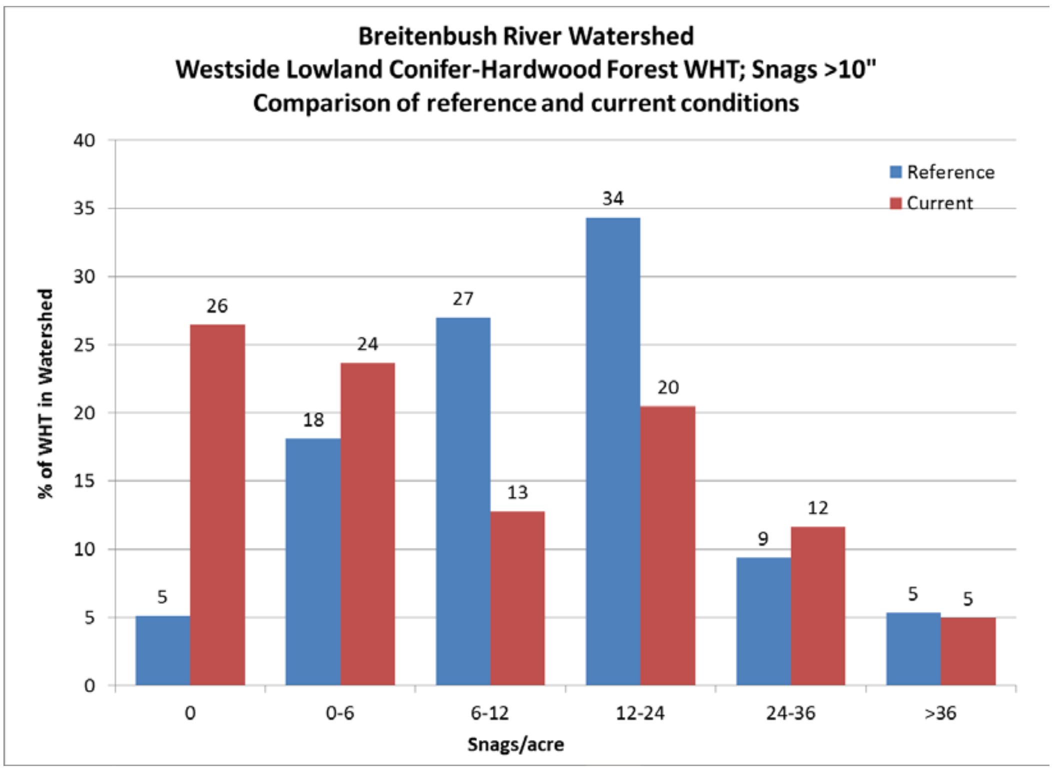


Figure 56. DecAID analysis showing estimated current and historic snags for the Breitenbush River watershed in Westside Lowland Conifer-Hardwood Forest habitat (Acker 2015).

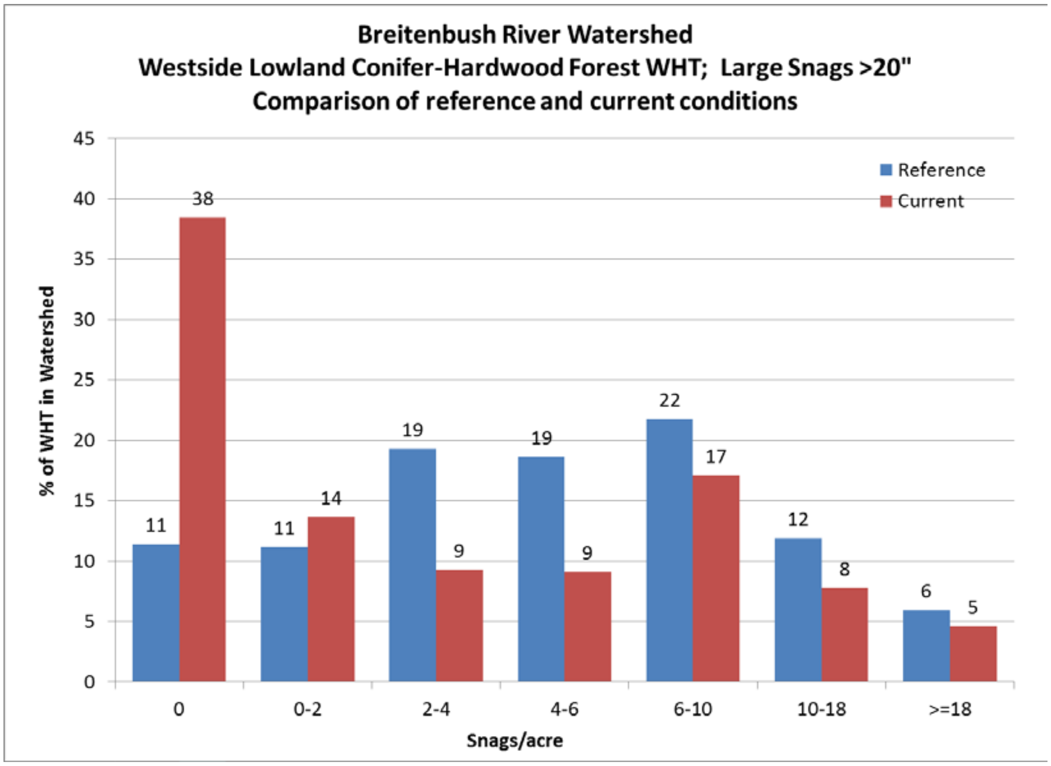


Figure 57. DecAID analysis showing estimated current and historic large snags for the Breitenbush River watershed in Westside Lowland Conifer-Hardwood Forest habitat (Acker 2015).

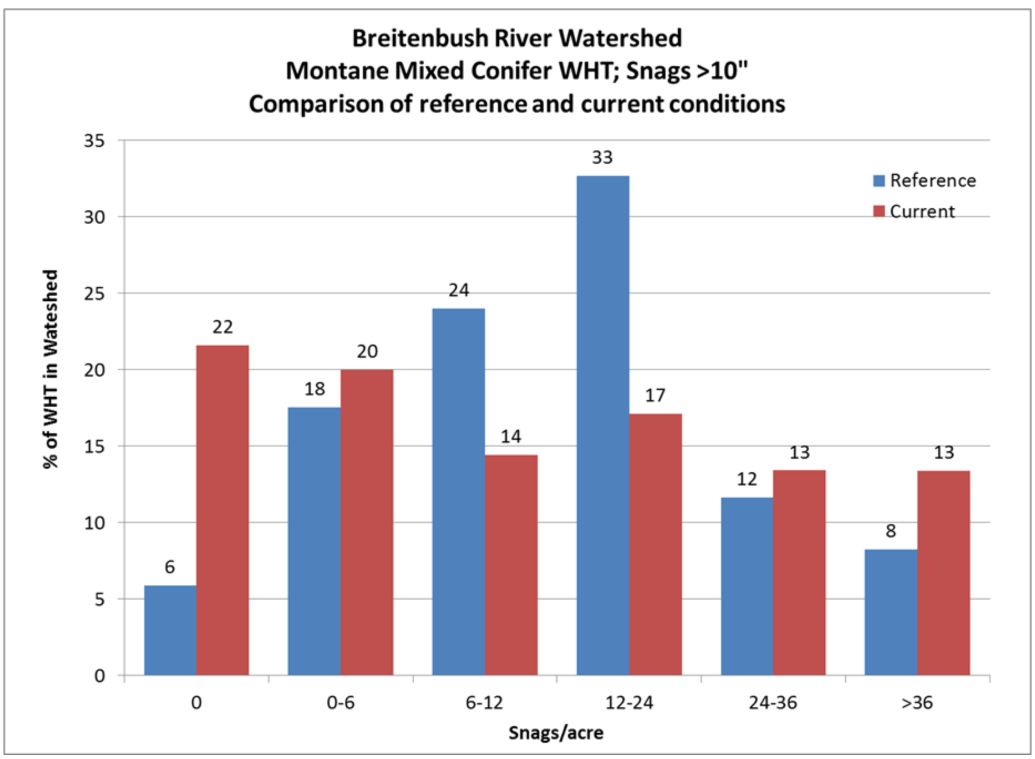


Figure 58. DecAID analysis showing estimated current and historic snags for the Breitenbush River watershed in Montane Mixed Conifer habitat (Acker 2015).

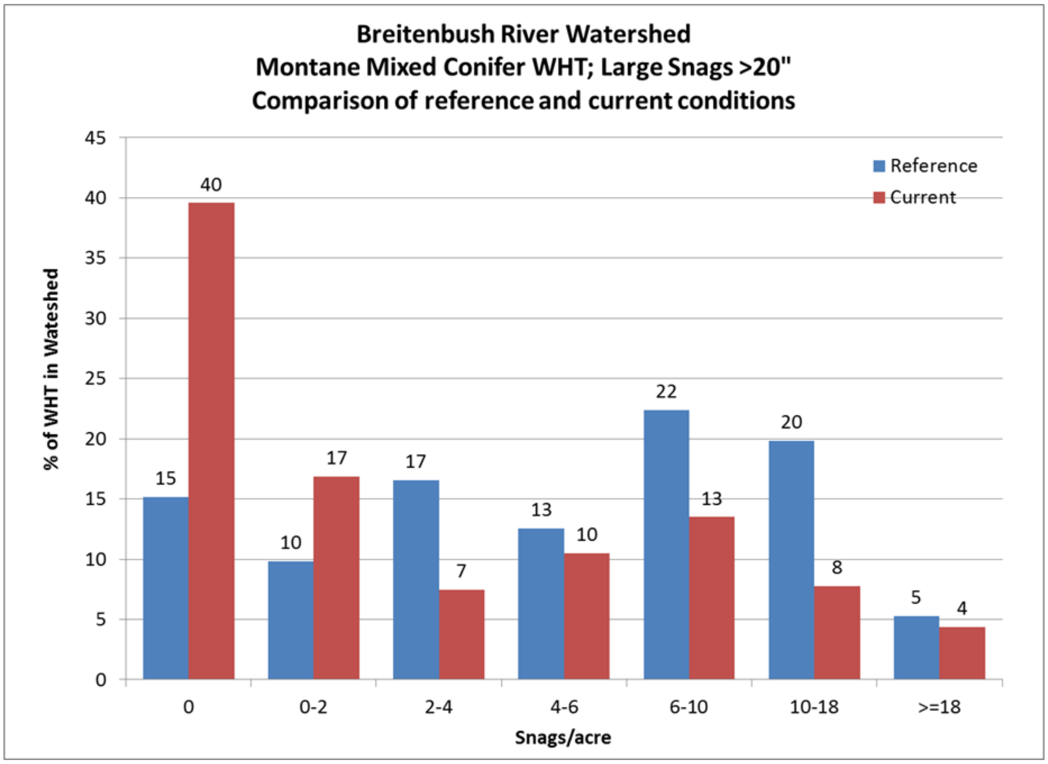


Figure 59. DecAID analysis showing estimated current and historic snags for the Breitenbush River watershed in Montane Mixed Conifer habitat (Acker 2015).

Cavity Excavator Snag Population Potential Analysis:

The Willamette National Forest Plan has a Standard and Guideline (FW-121) that states: “Habitat capability for primary cavity excavators shall be maintained to provide for at least 40% or greater potential populations. Habitat shall be provided and monitored at the subdrainage level.” The method that the Forest Plan used to calculate habitat population potential is no longer considered “best science” for determining that viable populations will be maintained but it does provide for a minimum number of snags at the watershed scale.

In order to determine the current distribution of large snags and the capability of the landscape to support primary cavity excavators, an analysis was conducted at the forest level for all 5th field watersheds using the DecAID snag estimates (Willamette SO, wildlife files).

The 20 inches dbh and above size class available in the DecAID snag analysis data was used in these calculations, while the snag population potential method is based on 18 inches dbh and above. Consequently, the results slightly underestimate population potential because snags 18-19.9 inches dbh are not counted. Snag habitat potential in each watershed did not include acres on private land since the population potential standard applies to Forest Service lands.

The calculations indicate that, on the Willamette National Forest, there is a current snag population potential of about 54% in the Westside Lowland Conifer Hardwood habitat type and 56% in the Montane Mixed Conifer habitat type. In the Breitenbush River watershed, the current snag population potential is estimated at about 50% in the Westside Lowland Conifer Hardwood habitat type and 46% in the Montane Mixed Conifer habitat type. The analysis suggests that the Hwy 46 project area is above the minimum snag population potential, but that snag abundance is lower than the average condition across the Forest.

Table 1. Estimated Snag Population Potential for the Westside Lowland Conifer Hardwood (WLCH) and Montane Mixed Conifer (MMC) Wildlife Habitat Types in the Breitenbush River Watershed and in Willamette National Forest.

Analysis Area	Habitat Type	Current	Historic
Breitenbush River Watershed	WLCH	50%	77%
Willamette National Forest	WLCH	54%	75%
Breitenbush River Watershed	MMC	46%	74%
Willamette National Forest	MMC	56%	74%

Total acres of land in the planning area are 31,081 acres which for this analysis is reduced by estimating acres in areas that are not capable of functioning as habitat in the future such as cliffs, talus, roads, lakes, rivers and private land. The estimated acres deducted included 160 acres of private land owned at Breitenbush Hot Springs, 311 acres of powerline corridor, 70 acres of cliffs and talus, 30 acres of river and 60 acres of roads. Total acres deducted from non-habitat acres is 631. Total acres capable of growing owl habitat is 31,081 – 631 = 30,450 acres.

Of the Hwy 46 planning area 24,552 acres are within a Critical Habitat Unit (CHU) for Northern Spotted Owl Recovery. This represents 78.99% of the planning area in CHU. The objective of this land use allocations is to provide primary constituent elements (the physical and biological features of critical habitat essential to a species' conservation) identified in the spotted owl critical habitat final rule include those features that support nesting, roosting, foraging, and dispersal (USFWS 1992b).

Of the Hwy 46 planning area 14,530 acres are within Late Successional Reserve RO214. This represents 47.72% of the planning area in LSR. The objective of this land use allocation is to protect and enhance conditions of late-successional forest species. Late-successional reserves are designed to maintain a functional, interacting ecosystem.

As overlap occurs with CHU and LSR when these allocations are combined with overlap considered they total 27,452 acres or 88.32% of the Hwy 46 planning area.

The 11.68% of the analysis area outside the LSR and CHU designations contains riparian reserves which add to mature forest habitat.

Growth models and existing condition models are designed to assist the decision maker with determining what options to choose. As higher level direction has already determined that over 88.32% of the analysis area is focused on developing older forest habitat a detailed growth model analysis is not needed.

DecAID analysis suggests the current snag and down wood levels are below historic levels and above minimum levels for population viability. In addition to the model information two factors should be mentioned. 1) A large fire occurred north of the Breitenbush River and was concentrated in the Western part of the analysis area. There were areas to the east of this concentration that were also burned extending to the forest boundary. The year of origin of the trees growing in the burned area is 1893 which in 2017 makes these trees 124 years old. The burned area is approximately 5,000 acres. Model results will show the burned area to be low in snag and down wood levels when in reality these trees have grown larger and have become mature forests. 2) The Eagle Rock fire south of the Breitenbush River at the western edge of the planning area occurred in 1967. The Eagle Rock stands are close to having large enough trees for commercial thinning. During the planning process it was decided that this area would be deferred into the future. The model would show this area to be low in snags and down wood when in reality it is contributing to smaller diameter material and would soon begin producing larger snags and down wood.

Snags and down wood are prescribed where regeneration harvest is proposed to occur in early seral habitat creation and gaps over one acre. The number of snags and down wood are listed in the Forest Plan Section of the Snags and Down Wood analysis. A detailed unit by unit prescription will be available in the project file.

Appendix G – Riparian Reserve Treatment Detail

Unit	Stand Age	Riparian Reserve Acres		Stream Class	Riparian Reserve Width (feet)	No-Harvest Buffer (feet)	Rationale for Treatment within Riparian Reserve
		Total in Unit	Proposed Treatment				
1	41	15.3	4.2	4	172	30	Thin to increase structural and vegetative diversity
3	53	2.4	2.0	4	172	30	Thin to increase structural and vegetative diversity
5	45	33.5	14.1	2	344	60	Thin to increase structural and vegetative diversity, opportunity for additional post-sale fall and leave along Humbug Cr. *Has large trees, hardwoods and cedars in riparian (meeting ACSO's, but needs more LWD,*
				4	172	60	Thin to increase structural and vegetative diversity
6	48	27.1	21.5	3	172	60	Very dense monoculture of DF with a thin strip of alders. No understory. Accelerate achievement of ACSO's by thinning in riparian area and increasing stand diversity.
7	54	6.2	3.8	2	344	100	Thin to increase structural and vegetative diversity
				4	172	30	Thin to increase structural and vegetative diversity
11	56	3.4	2.6	1	344	>125	Thin to increase structural and vegetative diversity, paved Hwy 46 between the unit and the Breitenbush River negate need for full RR buffer.
				4	172	30	Thin to increase structural and vegetative diversity
12	123	3.1	0.2	4	172	172	On way to achieving ACSO’s; No treatment in RR.
13	131	17.7	10.8	1	344	>172	Protect ACSO’s between river and paved Hwy 46 between the unit and the Breitenbush River. Beyond the highway does not contribute to riparian health.
				2	344	172	On way to achieving ACSO’s closer to stream. Thin to increase structural and vegetative diversity in outer riparian. Opportunity for additional hardwood release.
				4	172	30	Thin to increase structural and vegetative diversity
16	115	36.6	18.6	3	172	60-100	Thin to increase structural and vegetative diversity. South side of streams have larger buffer for shade protection.
				4	172	30	Thin to increase structural and vegetative diversity
17	110	2.3	0.0	4	172	30	Thin to increase structural and vegetative diversity
18	120	27.5	12.5	3	172	100-172	Much of RR is on way to achieving ACSO's with high amount of downed wood, cedars, diversity and canopy layers. Some alder pockets. Other areas in need of treatment. Thin to reduce density and increase structural and vegetative

<table>
<tr><th rowspan="2">Unit</th><th rowspan="2">Stand Age</th><th colspan="2">Riparian Reserve Acres</th><th rowspan="2">Stream Class</th><th rowspan="2">Riparian Reserve Width (feet)</th><th rowspan="2">No-Harvest Buffer (feet)</th><th rowspan="2">Rationale for Treatment within Riparian Reserve</th></tr>
<tr><th>Total in Unit</th><th>Proposed Treatment</th></tr>
<tr><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td></td><td></td><td></td><td>diversity. Variable buffer with hydrologist approval on layout.</td></tr>
<tr><td>4</td><td>172</td><td>30</td><td>Thin to increase structural and vegetative diversity</td></tr>
<tr><td>19</td><td>39</td><td>1.1</td><td>0.0</td><td>4</td><td>172</td><td>NA</td><td>No streams in unit (Class 4 outside of unit). Old plantation, needs thinning for diversity.</td></tr>
<tr><td>20</td><td>30</td><td>1.3</td><td>1.0</td><td>4</td><td>172</td><td>30</td><td>No streams in unit (Class 4 outside of unit). Old plantation, needs thinning for diversity.</td></tr>
<tr><td>21</td><td>113</td><td>8.2</td><td>6.8</td><td>4</td><td>172</td><td>30</td><td>Very dense stand. Thin to increase species and structural diversity with riparian thinning. Considered for additional riparian treatment (streamside hardwood release gaps) but low priority.</td></tr>
<tr><td rowspan="3">22</td><td rowspan="3">115</td><td rowspan="3">37.2</td><td rowspan="3">19.8</td><td>Short Lake</td><td>344</td><td>150+</td><td>Very dense stand. Increase species and structural diversity with riparian thinning and protect lake from additional user impact. Minimum 150’ buffer with no harvest between lake and road.</td></tr>
<tr><td>3</td><td>172</td><td>80-100</td><td>Very dense stand. Thin to increase species and structural diversity with riparian thinning. Considered for additional riparian treatment (streamside hardwood release gaps) but low priority. Buffers protect primary shade and shallow groundwater.</td></tr>
<tr><td>4</td><td>172</td><td>30</td><td>Thin to increase species and structural diversity with riparian thinning. Buffers protect primary shade and shallow groundwater.</td></tr>
<tr><td>23</td><td>36</td><td>19.8</td><td>2.6</td><td>4</td><td>172</td><td>100</td><td>Thin to increase species and structural diversity in outer RR. Protect wet areas, shallow groundwater and diversity. Considered for additional fall and leave treatment but not selected.</td></tr>
<tr><td rowspan="2">24</td><td rowspan="2">120</td><td rowspan="2">24.5</td><td rowspan="2">4.4</td><td>3</td><td>172</td><td>100-172</td><td rowspan="2">Much of RR is on way to achieving ACSO's with high amount of downed wood, cedars, diversity and canopy layers. Some alder pockets. Other areas in need of treatment to reduce density and Thin to increase structural and vegetative diversity. Variable buffer with hydrologist approval on layout.</td></tr>
<tr><td>4</td><td>172</td><td>100-172</td></tr>
<tr><td rowspan="2">25</td><td rowspan="2">105</td><td rowspan="2">13.9</td><td rowspan="2">10.0</td><td>3</td><td>172</td><td>>100</td><td>Thin to increase species and structural diversity. Shade and diversity protection in inner riparian. Large wood placement in stream. Instability concerns. Soils scientist to assist with layout to avoid areas of instability.</td></tr>
<tr><td>4</td><td>172</td><td>>30</td><td>Thin to increase species and structural diversity. Thin for Thin to increased tree vigor and stability. Soils scientist to assist with layout to avoid areas of instability.</td></tr>
</table>

Unit	Stand Age	Riparian Reserve Acres		Stream Class	Riparian Reserve Width (feet)	No-Harvest Buffer (feet)	Rationale for Treatment within Riparian Reserve
		Total in Unit	Proposed Treatment				
26	50	4.6	1.5	4	172	30	Thin to increase species and structural diversity. Consider adding LWD for sediment storage from above with fall and leave treatment under KV/stewardship.
27	122	15.0	5.1	3	172	100	Density reduction while protecting stream shade and diversity. Opportunity to Thin to increase large wood component instream.
				4	172	100	Thin to reduce density and increase diversity. Post-sale opportunity to increase large wood component instream.
28	117	18.3	3.8	2		172	Healthy riparian, no treatment needed 1st site tree potential. Thin outer RR to maintain diversity.
				4	172	172	Healthy riparian, no treatment needed 1st site tree potential
29	93	6.7	2.4	2	344	172	Healthy riparian, no treatment needed in 1st site tree potential. Trees to be used for fish logs (future restoration work).
				4	172	172	Healthy riparian, no treatment needed.
30	50	3.4	3.1	4	172	30	Thin to increase structural and vegetative diversity
31	114	10.4	3.6	2	344	172	Thin to increase structural and vegetative diversity in outer RR
32	112	8.7	6.1	3	172	80	Thin to increase structural and vegetative diversity. Protect primary shade zone, large wood recruitment and channel stability.
				4	172	30-60	Thin to increase structural and vegetative diversity. Protect large wood recruitment and channel stability.
32a	96	4.8	2.6	4	172	30-60	Meadow restoration and channel stability protection
33	36	9.3	7.1	3	172	60	Thin to increase structural and vegetative diversity. Protect primary shade zone.
				4	172	30	Thin to increase structural and vegetative diversity
34	31	3.4	3.0	4	172	30	Thin to increase structural and vegetative diversity. Protect groundwater and wet areas. Also has a wet meadow 100' buffer.
35	30	6.1	0.0	3	172	172	No treatment in RR. Protect diversity and shallow groundwater around streams. Includes 100' SHAB buffers.
38	34	4.6	0.0	4	172	172	No treatment in RR. Old plantation that could use treatment, but has stability concerns.
40	223	2.2	2.2	2	344	172	Minimum stream buffer. May need additional buffer width for stability. Consult with Soils Scientist at layout.
41	108	6.3	4.6	4	172	60	Very dense stand, Thin to increase structural and species diversity

Unit	Stand Age	Riparian Reserve Acres		Stream Class	Riparian Reserve Width (feet)	No-Harvest Buffer (feet)	Rationale for Treatment within Riparian Reserve
		Total in Unit	Proposed Treatment				
42	44	16.3	9.3	3-E	172	172	No treatment in RR. Mansfield Slide Unit: Minimum stream buffer. May need additional buffer width for stability. Soils/geology will assist with layout.
				3-SW	172	60	Thin to increase structural and vegetative diversity. Protect primary shade zone.
				4-E	172	172	No treatment in RR. May need additional buffer width for stability. Soils/geology will assist with layout.
				4-W	172	30	Minimum stream buffer. May need additional buffer width for stability. Soils/geology will assist with layout
44	51	5.4	0	2	344	100	Thin to increase structural and vegetative diversity. Protect primary shade zone and large wood recruitment for fish bearing stream.
				4	172	30	Not meeting ACSO’s. Thin to increase structural and vegetative diversity. Underplant with mixed conifer and hardwoods.
45	55	8.2	2.3	3	172	100	Very dense stand. Not meeting ACSO’s; Treat to Thin to increase stand vigor and structural and vegetative diversity while protecting water quality and stream channels from potential drainage concerns.
				4	172	100	
47	44	29.9	14.9	3	172	60	Thin to increase structural and vegetative diversity. Opportunity for post-sale fall and leave or tree-tipping to release hardwoods and increase large wood component.
				4	172	30	Thin to increase structural and vegetative diversity.
48	26	5.5	4.1	4	172	30	Thin to increase structural and vegetative diversity. Protect groundwater and wet areas. Also has a 100’ SHAB buffer.
51	42	12.5	10.1	4	172	30	Thin to increase structural and vegetative diversity. Good opportunity for small gaps w/in outer RR or post-sale project to release hardwoods.
52	28	3.7	2.5	3	172	60	Very dense stand. Thin to increase structural and species diversity.
53	40	10.8	3.7	3	172	172	No treatment in RR. Minimum full site tree potential buffer to protect against stability issues in NE part of unit. Soils/Geology may assist with layout if needed.
				4	172	60	Very dense stand. Thin to increase structural and species diversity and protect channel stability.
55	43	12.3	8.4	3	172	60	Thin to increase structural and vegetative diversity. Protect primary shade zone. Unit also includes a 100’ buffer around the seep.
				4	172	30	Thin to increase structural and vegetative diversity.

Unit	Stand Age	Riparian Reserve Acres		Stream Class	Riparian Reserve Width (feet)	No-Harvest Buffer (feet)	Rationale for Treatment within Riparian Reserve
		Total in Unit	Proposed Treatment				
58	42	0.7	0.7	3	172	60	Thin to increase structural and vegetative diversity. Protect primary shade zone. Stream and no-harvest buffer are outside of unit boundary.
60	29	2.1	1.9	4	172	30	Thin to increase structural and vegetative diversity.
61	39	13.6	11.3	4	172	30	Prior managed and very dense. In need of thinning for structural and species diversity.
62	41	22.5	14.2	3	172	60	Thin to increase structural and vegetative diversity. Protect primary shade zone and sediment filtration.
				4	172	30	Thin to increase structural and vegetative diversity.
64	52	48.8	29.2	3	172	60	Thin to increase structural and vegetative diversity. Protect primary shade zone and sediment filtration.
				4	172	30	Thin to increase structural and vegetative diversity.
69	54	8.0	3.9	3	172	60	Thin to increase structural and vegetative diversity, and protect primary shade zone. Addtl 100’ buffer on SHAB.
				4	172	30	Thin to increase structural and vegetative diversity.
71	37	4.8	4.0	4	172	30	Thin to increase structural and species diversity. Protect shallow water table.
73	48	29.2	23.2	4	172	30	Thin to increase structural and species diversity. Protect shallow water table.
74	50	36.6	17.1	3	172	100	No equipment or commercial harvest within 100’ of stream. Fall and leave or tree tipping recommended along Cultus Creek for sediment storage (separate KV or stewardship).
				4	172	60	Thin to increase structural and species diversity with thinning up to 60 feet from channel on the north side of channel, using the top of slope as a buffer edge. Do not treat the south slope. Recommend tipping some trees into stream channel to improve stability as post-sale opportunity.
75	33	14.5	7.3	4	172	30	Improve ACSO’s: Thin to increase structural and species diversity. Protect shallow groundwater. 100’ buffer on SHABs.
77	31	6.7	5.1	4	172	30	Thin to increase structural and vegetative diversity.
82	67	2.9	2.6	4	172	30	Thin to increase structural and vegetative diversity.
83	115	37.9	26.4	2	344	100	Thin to increase structural and vegetative diversity. Protect primary shade zone and LWD recruitment. Opportunity to add wood instream post-sale.
				3	172	60	
				4	172	30	Thin to increase structural and vegetative diversity (understory enhancement).

Unit	Stand Age	Riparian Reserve Acres		Stream Class	Riparian Reserve Width (feet)	No-Harvest Buffer (feet)	Rationale for Treatment within Riparian Reserve
		Total in Unit	Proposed Treatment				
84	125	52.9	28.9	2	172	172	Achieving ACSO's. Thin to increase structural and vegetative diversity in outer RR.
				3	172	60	Thin to increase structural and vegetative diversity. Protect primary shade zone
				4	172	30-60	Thin to increase structural and vegetative diversity.
89	450	1.4	1.2	4	172	30	Thin to increase structural and vegetative diversity (understory enhancement).
93	140	12.5	7.5	4*	172	60*	Thin to increase structural and vegetative diversity. Protect instability at lower end with SHAB buffer. **Stream recorded as intermittent during stream survey, but should be confirmed at layout if perennial or intermittent-->100' buffer if perennial.*
94	105	11.0	6.5	4*	172	60*	
95	110	23.6	2.6	3	172	100	Thin to increase structural and vegetative diversity. Protect primary shade and wood recruitment. Buffer may need to be wider to protect stability by slump area. Soils/Geology will assist with layout.
				4	172	60	Thin to increase structural and vegetative diversity and wood recruitment. Buffer may need to be wider to protect stability by slump area. Soils/Geology will assist with layout.
96	145	3.6	2.6	3	172	100	Thin to increase structural and vegetative diversity. Protect primary shade and wood recruitment.
100	45	45.8	26.8	3	172	100	East-West Class 3: Treat riparian on N-side of stream-clumpy gappy fall and leave to 70-90 tpa to Thin to increase structural and species diversity and lwd instream.
				3	172	60	Thin to increase structural and species diversity. Protect primary shade and accelerate wood recruitment. Treat Leone Crk and east trib Class 3's above road
				4	172	60	Thin to increase structural and species diversity. Protect primary shade and wood recruitment.
110	40	30.1	17.4	3	172	60	Thin to increase structural and species diversity, and protect primary shade.
				4	172	60	Thin to increase structural and species diversity.
120	45	9.1	4.8	3	172	60	Thin to increase structural and species diversity, and protect primary shade.
				4	172	30	Thin to increase structural and species diversity.
130	47	16.3	10.3	3	172	60	Thin to increase structural and species diversity. Protect primary shade.
				4	172	30	Thin to increase structural and species diversity.

Unit	Stand Age	Riparian Reserve Acres		Stream Class	Riparian Reserve Width (feet)	No-Harvest Buffer (feet)	Rationale for Treatment within Riparian Reserve
		Total in Unit	Proposed Treatment				
140	47	31.2	10.5	3	172	172	On way to achieving ACSO's. Protect slope and channel stability. No treatment in RR.
150	118	10.5	6.8	2	344	172	On way to achieving ACSO's in 1st STP. Thin to increase structural and species diversity in outer RR.
160	45	8.1	6.4	4	172	30	Thin to increase structural and species diversity. Stream location may need additional verification at layout.
170	No data	73.8	46.4	1	172	100*	Fuels unit: reduce fuel loading in RR near communities. Protect riparian features. Work with hydro/fish at layout where in RR fire can back into.
180	35	8.5	6.8	2	344	172	Meeting ACSO's along most of Hill Creek. Unit boundary is right around 1st STP. At unit boundary stand is old plantation, very dense monoculture and needs treatment to increase diversity.
190	45	33.4	21.5	2	344	100	Meeting ACSO's in places and not in others, like north part. Treat streamside area along Hill Creek lightly for hardwood release with fall and leave. Protect stream shade and areas meeting ACSO's. Thin to increase structural and species diversity in RR and streamside treatment areas.
				3	172	60	Thin to increase structural and species diversity. Protect primary shade.
				4	172	30-200*	Minimum buffer to increase structural and species diversity. *Stream buffer connected to 100' buffers around skunk cabbage swamps. Likely very little treatment inside RR.
200	45	11.8	6.5	3	172	60	Thin to increase structural and species diversity. Protect primary shade and wood recruitment.
210	No data	0.4	0.4	2	344	172	Fuels unit: Allow low intensity fire to back into RR.
				4	172	50	
220	45	40.8	17.9	2	344	172	Achieving ACSO's in 1st STP of Hill Creek. Thin to increase structural and species diversity in 2nd STP.
				4	172	60	Thin to increase structural and species diversity. Protect LWD source.
250	44	0.2	0.0	4	172	200+	Class 4 stream protected from harvest by 100' SHAB buffer around wet meadow.
270	275	2.9	2.1	1	344	250-344	Fuels unit: Allow low intensity fire to back into RR.
				3	172	100	
				4	172	50	
290	47	34.0	3.5	3	172	172	Achieving ACSO's. No treatment in RR.

Unit	Stand Age	Riparian Reserve Acres		Stream Class	Riparian Reserve Width (feet)	No-Harvest Buffer (feet)	Rationale for Treatment within Riparian Reserve
		Total in Unit	Proposed Treatment				
				4	172	60	Not achieving ACSO's; Thin to increase species and structural diversity. Protect near channel stability.
300	40	41.2	20.3	3	172	60-172	Skunk Creek Riparian area functioning in 1st STP. Protect ACSO's. Thin to increase structural and species diversity in outer RR.
				4	172	30	Thin to increase structural and species diversity and channel stability and LWD source.
310	50	4.1	2.8	3	172	172	Skunk Creek Riparian area functioning in 1st STP; Protect ACSO's.
				4	172	30	Thin to increase species and structural diversity.
320	30	19.8	10.3	3	172	172	Full STP buffer on Skunk Creek, protect riparian achieving ACSO's – keep harvest above the road. No treatment in RR.
				3	172	60	Thin to increase species and structural diversity.
				4	172	30*	Thin to increase species and structural diversity. Northern-most Class 4 stream requires Hydrologist and Soil Scientist input at layout to avoid unstable slopes.
340	45	14.8	8.7	2	344	172+	No harvest w/in first STP, where achieving ACSO's and rocky. Thinning in 2nd STP in southern part of unit where trees are smaller and denser to increase structural and species diversity.
350	39	13.7	5.8	2	344	172	Full STP on fish bearing Devils Creek. Thin to increase stand health in outer RR.
				3	172	100	Plantation, not achieving ACSO's. Thin to increase species and structural diversity in outer RR. Protect stream shade and large wood recruitment.
				4	172	60	Thin to increase species and structural diversity, while protecting steep slopes and channel stability.
360	40	12.2	8.5	2	344	172	Increasing structural diversity in 2nd STP.
				4	172	30	Not achieving ACSO's. Thin to increase riparian area species and structural diversity.
370	34	23.1	15.3	2	344	172	Achieving ACSO's, protect 1st STP. Thin to increase species and structural diversity om outer RR.
				4	172	30	Not achieving ACSO's, Thin to increase species and structural diversity.
380	39	24.1	16.8	2	344	172	Full STP buffer to protect ACSO's in Devil's Creek riparian. Thin to increase species and structural diversity in outer RR.
				3	172	60	Thin to increase species and structural diversity

Unit	Stand Age	Riparian Reserve Acres		Stream Class	Riparian Reserve Width (feet)	No-Harvest Buffer (feet)	Rationale for Treatment within Riparian Reserve
		Total in Unit	Proposed Treatment				
				4	172	30	Thin to increase species and structural diversity. *Several streams go subsurface mid-way down the unit, indicating shallow groundwater. Restrict equipment use in lower part of unit. Rec'd some hardwood release along Class 3 stream as post-sale opportunity.
390	37	8.0	3.8	3	172	172	Achieving ACSO's. No treatment in RR.
				4	172	30	Thin to increase species and structural diversity. *See Unit 380
400	47	20.8	10.9	4	172	30	Thin to increase species and structural diversity. *See Unit 380
420	40	2.5	1.4	2	344	172	Full site tree potential on N. Fk Breitenbush River. Protect ACSO's. Thin to increase species and structural diversity in outer RR.
				4	172	60	Thin to increase species and structural diversity. Protect channel stability.
430	40	5.1	3.3	2	344	172	Full site tree potential on N. Fk Breitenbush River. Protect ACSO's. Thin to increase species and structural diversity in outer RR.
				3	172	100	Historic and re-occurring debris flow 100' no-harvest buffer depending on debris. Fall and leave within NH buffer for lwd recruitment source to NFk Breit downslope. Also thin to increase species and structural diversity.
440	35	8.9	1.3	2	344	220+	Minimum buffer of 60 ft. from edge of alder patch along the N.Fork Breitenbush riparian area, plus additional 100 ft. buffer around SHAB/swamp.
450	34	5.6	4.5	4	172	30	Thin to increase species and structural diversity.
460	43	3.9	2.5	3	172	60	Thin to increase species and structural diversity. Class 3 streams go subsurface above road. All streams to be treated as perennial. Thin to increase riparian species and structure. Protect shallow groundwater/subsurface flow.
				4	172	60	
470	44	6.9	2.7	2	344	100	Crown Creek achieving ACSO's in inner riparian. Thin to increase structure and species diversity in outer RR.
				3	172	60	Thin to increase structural and species diversity. Protect primary shade, wood recruitment, and shallow groundwater.
				4	172	60	
480	43	7.0	2.7	3	172	60-172*	Lower part near road meeting ACSO's or close to ->full STP buffer. Upper section is heading towards ACSO's but should have 'treatment to 60' no-harvest buffer to reduce density and Thin to increase stand vigor. Variable buffer on layout.

Unit	Stand Age	Riparian Reserve Acres		Stream Class	Riparian Reserve Width (feet)	No-Harvest Buffer (feet)	Rationale for Treatment within Riparian Reserve
		Total in Unit	Proposed Treatment				
490	45	7.1	5.0	3	172	60	Additional 60' buffer around wetlands in between units. Thin to increase species and structural diversity in RR outside of buffers, promote understory growth and protect primary shade and microclimate.
				4	172	30	Thin to increase species and structural diversity, promote understory growth.
510	40	4.0	2.8	3	172	60	Additional 60' buffer around wetlands in between units. Thin to increase species and structural diversity in RR outside of buffers, promote understory growth and protect primary shade and microclimate.
				4	172	30	Thin to increase species and structural diversity, promote understory growth.
520	45	33.3	21.3	3	172	60	Fall and leave and hardwood release treatment within no commercial harvest buffer to thin to increase diversity of stand and large wood component instream.
				4	172	30	
540	40	1.4	1.4	4	172	172	Very diverse stand with small trees and good species diversity. No treatment needed at this time.

Appendix H – Road Status and Anticipated Road Work Activities

Road Status

The Road Investment Strategy (RIS) recommended roads Remain Closed (RC), Analyze for Closure (AC), Analyze for Decommissioning (AD), Defer Recommendation for later analysis (DR), and Remain Open (RO). The RIS also identified many forest roads as Priority Roads (PR).

Maintenance Levels. Defines the level of service provided by, and maintenance required for, a specific road, consistent with road management objectives and maintenance criteria. (FSH 7709.58, 12.3)

> **Maintenance Level 1.** Assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period must exceed 1 year. Basic custodial maintenance is performed to keep damage to adjacent resource to an acceptable level and to perpetuate the road to facilitate future management activities. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Appropriate traffic management strategies are "prohibit" and "eliminate". Roads receiving level 1 maintenance may be of any type, class or construction standard, and may be managed at any other maintenance level during the time they are open for traffic. However, while being maintained at level 1, they are closed to vehicular traffic, but may be open and suitable for non-motorized uses. (FSH 7709.58, 12.3)
>
> **Maintenance Level 2.** Assigned to roads open for use by high clearance vehicles. Passenger car traffic is not a consideration. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses. Log haul may occur at this level. Appropriate traffic management strategies are either to (1) discourage or prohibit passenger cars or (2) accept or discourage high clearance vehicles. (FSH 7709.58, 12.3)
>
> **Maintenance Level 3.** Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities. Roads in this maintenance level are typically low speed, single lane with turnouts and spot surfacing. Some roads may be fully surfaced with either native or processed material. Appropriate traffic management strategies are either "encourage" or "accept." "Discourage" or "prohibit" strategies may be employed for certain classes of vehicles or users. (FSH 7709.58, 12.3)
>
> **Maintenance Level 4.** Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced. However, some roads may be single lane. Some roads may be paved and/or dust abated. The most appropriate traffic management strategy is "encourage." However, the "prohibit" strategy may apply to specific classes of vehicles or users at certain times. (FSH 7709.58, 12.3)
>
> **Maintenance Level 5.** Assigned to roads that provide a high degree of user comfort and convenience. These roads are normally double-lane, paved facilities. Some may be aggregate surfaced and dust abated. The appropriate traffic management strategy is "encourage." (FSH 7709.58, 12.3)

Table 63 Road Status within Hwy 46 Planning Area

Road # (Haul Routes in bold)	Haul Miles Alt. 2	Haul Miles Alt. 3	Existing Road Status	Current Mtc. Level	System Miles Analyzed	RIS Recommendation	Hwy 46 EIS Alt 2 & 3 Proposal	Proposed Mtc. Level	Remarks
2231000	13.35	13.35	Open	2	13.54	PR	RO	2	
2231730	3.12	3.12	Open	2	3.40	PR	RO	2	
2231731			Open	2	0.21	RO	RO	2	
2231732	0.24	0.24	Closed	1	0.40	RC	RC	1	Road will be used then stored again for resource protection.
2231733	0.22	0.22	Closed	1	0.22	RC	RC	1	Road will be used then stored again for resource protection.
2231734			Closed	1	0.28	RC	RC	1	
2231735			Closed	1	0.40	RC	RC	1	
2231736	0.05	0.05	Closed	1	0.16	RC	RC	1	Road will be used then stored again for resource protection.
2231738			Closed	1	0.12	RC	RC	1	
2231739			Open	2	0.13	RO	RO	2	
2231740	0.10	0.10	Closed	1	0.10	RC	RC	1	Road will be used then stored again for resource protection.
2231741			Closed	1	0.08	RC	RC	1	
2231742			Closed	1	0.30	RC	RC	1	
2231743			Closed	1	0.15	RC	RC	1	
2231744			Open	2	0.06	RC	RO	2	Road to remain open for resource administration
2231745			Open	2	0.07	RC	RO	2	Road to remain open for resource administration.
2231746	0.17		Closed	1	0.55	RC	RC	1	Road will be used then stored again for resource protection.
2231747	0.44		Closed	1	0.44	RC	RC	1	Road will be used then stored again for resource protection.
2231748			Open	2	0.06	RC	RO	2	Road to remain open for resource administration.
2231749	0.09	0.09	Closed	1	0.09	RC	RC	1	Road will be used then stored again for resource protection.
2231750	0.05	0.05	Open	2	0.50	RO	RO	2	
2231751			Closed	1	0.37	RC	RC	1	
2231752			Closed	1	0.20	RC	RC	1	
2231753			Open	2	0.08	RO	RO	2	

Road # (Haul Routes in bold)	Haul Miles Alt. 2	Haul Miles Alt. 3	Existing Road Status	Current Mtc. Level	System Miles Analyzed	RIS Recommendation	Hwy 46 EIS Alt 2 & 3 Proposal	Proposed Mtc. Level	Remarks
2231755			Open	2	0.09	RO	RO	2	
2231757			Closed	1	0.63	RC	RC	1	
2231758	0.07	0.07	Open	2	0.07	RO	RO	2	
2231759	0.61	0.61	Closed	1	0.61	RC	RC	1	Road will be used then stored again for resource protection.
2231760			Closed	1	0.38	RC	RC	1	
2231761	0.06	0.06	Closed	1	0.06	RC	RC	1	Road will be used then stored again for resource protection.
2231763	0.41	0.41	Closed	1	0.54	RC	RC	1	Road will be used then stored again for resource protection.
2231764	0.30	0.30	Closed	1	0.88	RC	RC	1	Road will be used then stored again for resource protection.
2231765	0.18	0.18	Closed	1	0.48	RC	RC	1	Road will be used then stored again for resource protection.
2231768			Closed	1	0.22	RC	RC	1	
2231809			Closed	1	0.12	RO	RC	1	Road to remain stored for resource protection.
2231828			Open	2	0.14	RO	RO	2	
2231835			Closed	1	0.61	RC	RC	1	
2231836			Closed	1	0.13	RC	RC	1	
2231837			Closed	1	0.04	RC	RC	1	
2231838			Closed	1	0.84	RC	RC	1	
2231839	0.28		Closed	1	0.28	RC	RC	1	Road will be used then stored again for resource protection.
2231840	0.69		Open	2	3.25	PR	RO	2	
2231841			Closed	1	0.28	RC	RC	1	
2231842			Closed	1	0.24	RC	RC	1	
2231843			Open	2	1.22	RO	RO	2	
2231844			Open	2	0.08	PR	RO	2	
2231845			Closed	1	0.24	RC	RC	1	
2231846			Closed	1	0.42	PR	RC	1	Road to remain stored for resource protection.
2231847	0.53	0.53	Closed	1	0.88	PR	RC	1	Road will be used then stored again for resource protection.
2231848			Closed	1	0.25	RC	RC	1	

Road # (Haul Routes in bold)	Haul Miles Alt. 2	Haul Miles Alt. 3	Existing Road Status	Current Mtc. Level	System Miles Analyzed	RIS Recommendation	Hwy 46 EIS Alt 2 & 3 Proposal	Proposed Mtc. Level	Remarks
2231849	0.22	0.22	Closed	1	0.22	RC	RC	1	Road will be used then stored again for resource protection.
2231850	1.61	1.61	Open	2	4.88	PR	RO	2	
2231851			Closed	1	0.27	RO	RC	1	Road to remain stored for resource protection.
2231852			Closed	1	0.11	RC	RC	1	
2231853			Closed	1	0.25	RC	RC	1	
2231854			Closed	1	0.77	RC	RC	1	
2231855	1.06	1.06	Closed	1	1.06	RC	RC	1	Road will be used then stored again for resource protection.
2231856			Closed	1	0.21	RC	RC	1	
2231857	0.24	0.24	Closed	1	0.41	RC	RC	1	Road will be used then stored again for resource protection.
2231858			Closed	1	0.08	RC	RC	1	
2231859			Closed	1	0.10	RC	RC	1	
2231860			Open	2	0.34	RC	RO	2	Road to remain open for resource administration.
2231861			Open	2	0.11	RO	RO	2	
2231862			Open	2	0.05	RO	RO	2	
2231863			Open	2	0.21	DR	RO	2	Road to remain open for resource administration.
2231864			Open	2	0.12	DR	RO	2	Road to remain open for resource administration.
2231865			Open	2	0.08	RO	RO	2	
2231866			Open	2	0.05	RC	RO	2	Road to remain open for resource administration.
2231867			Closed	1	0.12	RC	RC	1	
2231868			Closed	1	0.29	RC	RC	1	
2231869			Closed	1	0.13	RC	RC	1	
2231870	4.99	4.99	Open	2	7.77	PR	RO	2	
2231871	0.02	0.02	Closed	1	0.06	AD	RC	1	Road will be used then stored again for resource protection. Needs to remain on system for resource administration.
2231872			Closed	1	0.11	RC	RC	1	
2231873	0.14	0.14	Open	2	0.14	RO	RO	2	
2231874	0.16	0.16	Closed	1	0.16	RC	RC	1	Road will be used then stored again

Road # (Haul Routes in bold)	Haul Miles Alt. 2	Haul Miles Alt. 3	Existing Road Status	Current Mtc. Level	System Miles Analyzed	RIS Recommendation	Hwy 46 EIS Alt 2 & 3 Proposal	Proposed Mtc. Level	Remarks
									for resource protection.
2231875	0.70	0.70	Closed	1	0.92	RC	RC	1	Road will be used then stored again for resource protection.
2231876			Closed	1	0.15	RC	RC	1	
2231877	0.40	0.40	Closed	1	1.05	RC	RC	1	Road will be used then stored again for resource protection.
2231878	0.10	0.10	Open	2	0.09	RO	RO	2	
2231879			Closed	1	1.19	RC	RC	1	
2231880			Closed	1	0.82	RC	RC	1	
2231881			Closed	1	0.51	RC	RC	1	
2231883	0.09	0.09	Closed	1	2.20	RC	RC	1	Road will be used then stored again for resource protection.
2231884			Closed	1	0.10	RC	RC	1	
2231885			Closed	1	1.6	RC	RC	1	
2231886			Closed	1	0.08	RC	RC	1	
2231887	0.04	0.04	Open	2	0.04	AC	RO	2	Road to remain open for resource administration.
2231888			Open	2	0.37	DR	RO	2	Road to remain open for resource administration.
2231889			Open	2	0.09	DR	RO	2	Road to remain open for resource administration.
2231890			Open	3	1.92	PR	RO	3	
2231891			Open	2	0.15	PR	RO	2	
2231892			Closed	1	0.11	RC	RC	1	
2231893			Open	2	0.32	PR	RO	2	
2231894			Open	2	0.04	PR	RO	2	
2231895			Open	2	0.04	PR	RO	2	
2231896			Open	2	0.47	PR	RO	2	
2231897			Open	2	0.05	PR	RO	2	
2231898			Open	2	0.16	PR	RO	2	
2231899			Closed	1	0.18	RC	RC	1	
2231900	0.13	0.13	Open	2	0.13	RO	RO	2	
2231901			Closed	1	0.10	RC	RC	1	
2231902			Open	2	0.08	RC	RO	2	Road to remain open for resource administration.
2233000			Open	2	11.60	PR	RO	2	
2233635			Closed	1	0.75	RC	RC	1	
4600000	16.55	16.55	Open	5	16.5	PR	RO	5	

Road # (Haul Routes in bold)	Haul Miles Alt. 2	Haul Miles Alt. 3	Existing Road Status	Current Mtc. Level	System Miles Analyzed	RIS Recommendation	Hwy 46 EIS Alt 2 & 3 Proposal	Proposed Mtc. Level	Remarks
4600011	0.16	0.16	Open	2	0.23	DR	RO	2	Road to remain open for resource administration.
4600012	1.28	1.28	Open	2	1.73	DR	RO	2	Road to remain open for resource administration.
4600013			Closed	1	0.67	RO	RC	1	
4600014	0.57	0.57	Open	2	0.57	RO	RO	2	
4600015			Closed	1	0.30	DR	RC	1	
4600016			Open	2	0.10	DR	RO	2	Road to remain open for resource administration.
4600017			Open	2	0.13	PR	RO	2	
4600018			Open	2	0.13	DR	RO	2	Road to remain open for resource administration.
4600021	0.29	0.29	Open	2	0.76	DR	RO	2	Road to remain open for resource administration.
4600022	0.55	0.55	Open	2	0.55	DR	RO	2	Road to remain open for resource administration.
4600023	0.21	0.21	Open	2	0.38	RO	RO	2	
4600024	0.50	0.50	Open	2	0.50	RO	AC	1	Road to be stored with berm/gate after use for resource protection.
4600025	0.13	0.13	Open	2	0.31	DR	RO	2	Road to remain open for resource administration.
4600026	0.12	0.12	Open	2	0.12	RO	RO	2	
4600027	017		Closed	1	0.20	RC	RC	1	Road will be used then stored again for resource protection.
4600028	0.23		Closed	1	1.05	RC	RC	1	Road will be used then stored again for resource protection.
4600030	2.27	2.27	Open	2	2.27	RO	RO	2	
4600031			Closed	1	0.10	RC	RC	1	
4600032			Open	2	0.12	DR	RO	2	Road to remain open for resource administration.
4600033	1.88	1.88	Open	2	2.43	RO	RO	2	
4600034			Closed	1	0.09	RC	RC	1	
4600035	0.30	0.30	Closed	1	0.10	RC	RC	1	Road will be used then stored again for resource protection.
4600036	0.30	0.30	Closed	1	0.52	RC	RC	1	Road will be used then stored again

Road # (Haul Routes in bold)	Haul Miles Alt. 2	Haul Miles Alt. 3	Existing Road Status	Current Mtc. Level	System Miles Analyzed	RIS Recommendation	Hwy 46 EIS Alt 2 & 3 Proposal	Proposed Mtc. Level	Remarks
									for resource protection.
4600037	0.06	0.06	Open	2	0.06	AC	RO	2	Remain open for resource administration.
4600038	0.04	0.04	Open	2	0.04	DR	RO	2	Road to remain open for resource administration.
4600039			Open	2	0.06	RC	RO	2	Road to remain open for resource administration.
4600040	4.23	3.10	Open	2	4.52	RO	RO	2	Short Lake Reroute. Decommission 1.02 miles around Lake. Reroute through 4600045 and 4600059.
4600041			Closed	1	0.96	RC	RC	1	
4600042			Closed	1	0.12	AD	AD	—	Road will be decommissioned and taken off the system
4600043			Open	2	0.56	RC	RO	2	Road to remain open for resource administration.
4600044	0.21	0.21	Closed	1	0.36	RC	RC	1	Road will be used then stored again for resource protection.
4600045	3.15	3.15	Open	2	3.10	RO	RO	2	Keep road open after sale. Short Lake Reroute.
4600046	0.30		Closed	1	0.32	RC	RC	1	Road will be used then stored again for resource protection.
4600047	0.20	0.20	Closed	1	0.51	RC	RC	1	Road will be used then stored again for resource protection.
4600049	0.16	0.16	Open	2	0.16	RO	RO	2	
4600050			Open	2	1.46	RO	RO	2	
4600051			Closed	1	0.09	RC	RC	1	
4600052			Open	2	0.11	DR	RO	2	Road to remain open for resource administration.
4600053	0.23		Closed	1	0.23	AD	RC	1	Road will be used then stored again for resource protection but needed for administration.
4600054	0.26		Closed	1	0.31	AD	AD	—	Road will be decommissioned and taken off the system

Road # (Haul Routes in bold)	Haul Miles Alt. 2	Haul Miles Alt. 3	Existing Road Status	Current Mtc. Level	System Miles Analyzed	RIS Recommendation	Hwy 46 EIS Alt 2 & 3 Proposal	Proposed Mtc. Level	Remarks
4600055	0.53	0.53	Closed	1	0.53	AD	AD	—	Road will be decommissioned and taken off the system
4600056	0.24		Open	2	0.24	RC	RO	2	Road to remain open for resource administration.
4600057			Open	2	0.42	RC	RO	2	Road to remain open for resource administration.
4600058	0.09		Closed	1	0.30	AD	AD	—	Road will be decommissioned and taken off the system
4600059			Closed	1	0.31	RC	RO	2	Short Lake Reroute. Decommission 0.30 miles and use new realignment of 0.30 miles. Keep road open.
4600060			Open	3	014	RO	RO	3	
4600061	0.12		Closed	1	0.15	RC	RC	1	Road will be used then stored again for resource protection.
4600062			Closed	1	0.24	RC	RC	1	
4600063			Open	3	0.37	PR	RO	3	
4600064			Open	3	0.23	PR	RO	3	
4600066	0.02		Closed	1	0.04	RC	RC	1	Road will be used then stored again for resource protection.
4600067			Closed	1	0.04	AD	RC	1	Road to remain stored for resource administration.
4600069			Open	2	0.02	RO	RO	2	
4600070			Open	2	0.27	RO	RO	2	
4600071	0.45	0.45	Open	2	0.45	RO	RO	2	
4600072			Open	2	0.47	RO	RO	2	
4600073			Open	2	0.11	AC	RO	2	Road to remain open for resource administration.
4600074			Open	2	0.44	AC	RO	2	Road to remain open for resource administration.
4600075			Open	3	0.40	PR	RO	3	
4600076			Open	2	0.27	AC	RO	2	Road to remain open for resource administration.
4600078	0.10	0.10	Open	2	0.10	AD	RO	2	Road to remain open for resource administration.

Road # (Haul Routes in bold)	Haul Miles Alt. 2	Haul Miles Alt. 3	Existing Road Status	Current Mtc. Level	System Miles Analyzed	RIS Recommendation	Hwy 46 EIS Alt 2 & 3 Proposal	Proposed Mtc. Level	Remarks
4600079			Open	2	0.29	DR	RO	2	Road to remain open for resource administration.
4600081			Open	2	0.03	AD	RO	2	Road to remain open for resource administration.
4600082			Open	2	0.06	DR	RO	2	Road to remain open for resource administration.
4600084			Closed	1	0.36	RC	RC	1	
4600085			Open	2	0.24	RO	RO	2	
4600086			Open	2	0.73	RO	RO	2	
4600087			Open	2	0.13	RO	RO	2	
4600088	0.28	0.28	Open	2	0.28	RO	RO	2	
4600090			Open	2	0.66	RO	RO	2	
4600091			Open	2	0.40	RO	RO	2	
4600092			Open	2	0.48	AD	RO	2	Road to remain open for resource administration.
4600093			Open	2	0.72	AC	RO	2	Road to remain open for resource administration.
4600094	0.21	0.21	Open	2	0.16	AC	RO	2	Road to remain open for resource administration.
4600095	0.32	0.32	Open	2	0.32	AC	RO	2	Road to remain open for resource administration.
4600096			Closed	1	0.15	AD	RC	1	Road to remain stored for resource administration and access to gauging station.
4600097	0.63	0.63	Open	2	0.63	RO	RO	2	
4600098			Open	2	0.18	AC	RO	2	Road to remain open for resource administration.
4600099			Open	3	0.19	AC	RO	3	Road to remain open for resource administration.
4600111			Open	2	0.12	AD	RO	2	Road to remain open for resource administration.
4600113			Open	2	0.07	AD	RO	2	Road to remain open for resource administration.
4600114			Open	2	0.07	AD	RO	2	Road to remain open for resource administration.
4600115			Open	2	0.14	AD	RO	2	Road to remain open for resource administration.
4600116			Open	2	0.13	RO	RO	2	

Road # (Haul Routes in bold)	Haul Miles Alt. 2	Haul Miles Alt. 3	Existing Road Status	Current Mtc. Level	System Miles Analyzed	RIS Recommendation	Hwy 46 EIS Alt 2 & 3 Proposal	Proposed Mtc. Level	Remarks
4600117	0.07		Open	2	0.08	AD	RO	2	Road to remain open for resource administration and access to helicopter landing.
4600287			Open	2	0.15	AD	RO	2	Road to remain open for resource administration.
4600289	0.06	0.06	Closed	1	0.08	RC	RC	1	Road will be used then stored again for resource protection.
4600297	0.23		Closed	1	0.30	RC	RC	1	Road will be used then stored again for resource protection.
4685000	8.39	8.39	Open	2	8.71	RO	RO	2	
4685111			Open	2	0.13	DR	RO	2	Road to remain open for resource administration.
4685301			Closed	1	0.47	RO	RC	1	
4685302	3.73	3.73	Open	2	3.82	RO	RO	2	
4685307			Closed	1	0.47	RO	RC	1	
4685310	1.75	1.75	Closed	1	4.75	RO	RC	1	Road will be used then stored again for resource protection.
4685312			Open	2	1.70	RO	RO	2	
4685313			Closed	1	1.20	RC	RC	1	
4685315	0.22	0.22	Closed	1	0.53	RC	RC	1	Road will be used then stored again for resource protection.
4685316			Open	2	0.23	RC	RO	2	Road to remain open for resource administration.
4685317	0.22	0.22	Closed	1	0.28	RC	RC	1	Road will be used then stored again for resource protection.
4685318			Closed	1	0.14	AD	RC	1	Road to remain stored for resource administration.
4685319			Closed	1	0.18	RC	RC	1	
4685320			Closed	1	1.77	RC	RC	1	
4685321			Open	2	1.28	AD	RO	2	Road to remain open for resource administration.
4685322			Closed	1	0.13	AD	RC	1	Road to remain stored for resource administration.
4685323			Closed	1	0.29	AD	RC	1	Road to remain stored for resource administration.

Road # (Haul Routes in bold)	Haul Miles Alt. 2	Haul Miles Alt. 3	Existing Road Status	Current Mtc. Level	System Miles Analyzed	RIS Recommendation	Hwy 46 EIS Alt 2 & 3 Proposal	Proposed Mtc. Level	Remarks
4685324			Open	2	0.06	DR	RO	2	Road to remain open for resource administration.
4685325			Open	2	0.58	DR	RO	2	Road to remain open for resource administration.
4685326			Closed	1	0.17	RC	RC	1	
4685327			Open	2	0.12	RO	RO	2	
4685328			Closed	1	0.37	RC	RC	1	
4685329			Closed	1	0.67	RC	RC	1	
4685330	0.57	0.57	Open	2	1.13	RO	RO	2	
4685331			Open	2	0.08	RC	RAC	21	Road to be stored with berm/gate for resource protection.
4685332			Open	2	0.30	RC	RAC	21	Road to be stored with berm/gate for resource protection.
4685452	0.20	0.20	Closed	1	0.22	RC	RC	1	Road will be used then stored again for resource protection.
4688000	6.50	6.50	Open	2	6.73	PR	RO	2	
4688099			Open	2	0.27	AC	RO	2	Road to remain open for resource administration.
4688100			Closed	1	0.2	RC	RC	1	
4688107	0.63	0.63	Closed	1	0.78	RO	RC	1	Road will be used then stored again for resource protection.
4688111	0.17	0.17	Closed	1	0.20	RC	RC	1	Road will be used then stored again for resource protection.
4688112			Open	2	0.06	RO	RO	2	
4688120	0.58	0.58	Closed	1	0.74	RC	RC	1	Road will be used then stored again for resource protection.
4688124	0.09	0.09	Closed	1	0.09	RC	RC	1	Road will be used then stored again for resource protection.
4688125			Closed	1	0.04	AD	AD	—	Road will be decommissioned and taken off the system
4688130	0.45	0.45	Closed	1	0.45	RC	RC	1	Road will be used then stored again for resource protection.

Road # (Haul Routes in bold)	Haul Miles Alt. 2	Haul Miles Alt. 3	Existing Road Status	Current Mtc. Level	System Miles Analyzed	RIS Recommendation	Hwy 46 EIS Alt 2 & 3 Proposal	Proposed Mtc. Level	Remarks
4688131	0.04	0.04	Open	2	0.04	RC	RO	2	Road to remain open for resource administration.
4688132	0.06	0.06	Open	2	0.06	RC	RO	2	Road to remain open for resource administration.
4688133			Open	2	0.11	RO	RO	2	
4688134			Open	2	0.07	RO	RO	2	
4688135	0.01		Closed	1	0.29	RC	RC	1	Road will be used then stored again for resource protection.
4688210	0.10		Closed	1	0.59	RC	RC	1	Road will be used then stored again for resource protection.
4688220	0.44	0.44	Open	2	1.59	AC	RO	2	Road to remain open for resource administration.
4688221			Closed	1	0.33	RC	RC	1	
4688222	0.25	0.25	Closed	1	0.25	RC	RC	1	Road will be used then stored again for resource protection.
4688223	0.05	0.05	Open	2	0.05	DR	AC	1	Road to be stored with berm/gate after use for resource protection.
4688224			Open	2	0.15	RO	RO	2	
4688229			Closed	1	0.78	RC	RC	1	
4688240	0.14	0.14	Open	2	1.92	RO	RO	2	
4688241			Open	2	0.26	RO	RO	2	
4688242			Closed	1	0.45	AD	AD	—	Road will be decommissioned and taken off the system
4688243			Open	2	0.26	RO	RO	2	
4693000	2.20	2.20	Open	2	5.59	PR	RO	2	
4693502	0.84	0.84	Closed	1	1.20	RC	RC	1	Road will be used then stored again for resource protection.
4693503	0.08	0.08	Open	2	0.17	RC	RAC	21	Road to be stored with berm/gate after use for resource protection.
4693507			Open	2	0.15	DR	RO	2	
4693508	0.41	0.41	Closed	1	0.67	RC	RC	1	Road will be used then stored again for resource protection.

Road # (Haul Routes in bold)	Haul Miles Alt. 2	Haul Miles Alt. 3	Existing Road Status	Current Mtc. Level	System Miles Analyzed	RIS Recommendation	Hwy 46 EIS Alt 2 & 3 Proposal	Proposed Mtc. Level	Remarks
4693509	0.09	0.09	Open	2	0.09	DR	RAC	21	Road to be stored with berm/gate after use for resource protection.
4693619			Closed	1	0.21	RC	RC	1	
4693620	0.18	0.18	Closed	1	1.02	RC	RC	1	Road will be used then stored again for resource protection.
4693639	0.24	0.24	Open	2	0.24	RO	RO	2	
4693640	0.28	0.28	Open	2	2.85	PR	RO	2	
4693641	0.43	0.43	Closed	1	1.00	RC	RC	1	Road will be used then stored again for resource protection.
4693643			Closed	1	0.38	RC	RC	1	
4693645			Closed	1	0.29	RC	RC	1	
4693647			Closed	1	0.78	RC	RC	1	
4693690			Closed	1	0.21	RC	RC	1	
4693692			Open	2	0.07	RC	RAC	21	Road to be stored with berm/gate for resource protection.
4696000	2.20	2.20	Open	2	10.21	PR	RO	2	
4698000	3.49	1.35	Open	2	6.62	RO	RO	2	
4698807	0.25	0.25	Closed	1	0.32	RC	RC	1	Road will be used then stored again for resource protection.
4698810	0.73	0.73	Closed	1	0.83	RC	RC	1	Road will be used then stored again for resource protection.
4698811	0.20		Open	2	0.20	RO	AC	1	Road to be stored with berm/gate after use for resource protection.
4698812	1.78		Open	2	2.06	RO	RO	2	
4698813			Closed	1	0.14	RC	RC	1	
4698814	0.24		Closed	1	0.24	RC	AD	—	Road will be used then decommissioned and taken off the system
4698815	0.16		Closed	1	0.19	RC	RC	1	Road will be used then stored again.
4698820	0.16		Closed	1	0.38	RC	RC	1	Road will be used then stored again for resource protection.
4698821			Open	2	0.33	RO	RO	2	

Road # (Haul Routes in bold)	Haul Miles Alt. 2	Haul Miles Alt. 3	Existing Road Status	Current Mtc. Level	System Miles Analyzed	RIS Recommendation	Hwy 46 EIS Alt 2 & 3 Proposal	Proposed Mtc. Level	Remarks
4698835	0.45		Closed	1	0.45	RC	RC	1	Road will be used then stored again for resource protection.
4698836			Open	2	0.16	RC	RO	2	
4698862			Closed	1	0.25	RC	RC	1	
Total Haul Route Miles (Alt. 2)	108.0								
Total Haul Route Miles (Alt. 3)		98.2							
Total Miles Analyzed					2231.52				
Total proposed stored miles						01.37			
Total decommission miles							1.99		

Road Investment Strategy and IDT Recommendations

The following table displays the Willamette Road Investment recommendation and the IDT recommendations.

RIS Recommendations	RIS Recommendations (Miles)	Hwy 46 Analysis (Stored Roads)	Hwy 46 Analysis (Open Roads)
Analyze for Closure (AC)	4.35	0.0	01.37
Remain Closed (RC)	51.05	57.62	(30.55 stored roads will be used then stored after use)
Remain Open (RO)	772.25	0.0	1170.54
Defer Recommendation (DR)	6.58	0.0	0.0
Prime Road (PR)	91.98	0.0	0.0
Analyze for Decommissioning (AD)	5.31	1.99	0.0
Total Miles Analyzed	2231.52	59.61	1171.91

Anticipated Road Work Activities

The following table displays an estimate of anticipated road work activities for Hwy 46. Actual specific type of work, costs or location may change.

Road #	Haul Mileage		Reconstruction	Maintenance	Estimated $/Mile	Estimated Total $		Estimated Total $ with wet weather haul (if permitted)		Road Work Activity and Remarks
	Alt. 2	Alt. 3				Alt. 2	Alt. 3	Alt. 2	Alt. 3	
2231000	13.35	13.35	☒	☒	$20,000	$267,000	$270,800	$471,200	$471,200	Expected asphalt repairs. Road and ditch rehabilitation, spot rock/surfacing. Culvert replacements. Additional 4" of surface rock needed for wet weather haul. All haul volume off 2231 system to Hwy 22.
2231730	3.12	3.12	☒	☒	$20,000	$62,400	$62,400	$163,627	$163,627	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Deep patch repairs. Culvert Replacements. Additional 4" of surface rock needed for wet weather haul.
2231732	0.24	0.24	☒	☒	$15,000	$3,600	$3,600	$11,387	$11,387	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
2231733	0.22	0.22	☒	☒	$15,000	$3,300	$3,300	$10,438	$10,438	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock.Additional 4" of surface rock needed for wet weather haul.
2231736	0.05	0.05	☒	☒	$15,000	$750	$750	$2,372	$2,372	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
2231740	0.10	0.10	☒	☒	$15,000	$1,500	$1,500	$4,744	$4,744	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
2231746	0.17	-	☒	☒	$20,000	$3,400	-	$8,916	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
2231747	0.44	-	☒	☒	$15,000	$6,600	-	$20,876	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
2231749	0.09	0.09	☒	☒	$15,000	$1,350	$1,350	$4,270	$4,270	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
2231750	0.05	0.05	☒	☒	$15,000	$750	-	$2,372	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
2231758	0.07	0.07	☒	☒	$15,000	$1,050	$1,050	$3,321	$3,321	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
2231759	0.61	0.61	☒	☒	$20,000	$12,200	$12,200	$31,991	$31,991	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
2231761	0.06	0.06	☒	☒	$15,000	$900	$900	$2,847	$2,847	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
2231763	0.41	0.41	☒	☒	$20,000	$8,200	$8,200	$21,502	$21,502	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
2231764	0.30	0.30	☒	☒	$15,000	$4,500	$4,500	$14,233	$14,233	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
2231765	0.18	0.18	☒	☒	$15,000	$2,700	$2,700	$8,540	$8,540	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Rolling dip

Road #	Haul Mileage		Reconstruction	Maintenance	Estimated $/Mile	Estimated Total $		Estimated Total $ with wet weather haul (if permitted)		Road Work Activity and Remarks
	Alt. 2	Alt. 3				Alt. 2	Alt. 3	Alt. 2	Alt. 3	
										recommended. Additional 4” of surface rock needed for wet weather haul.
2231839	0.28	-	☒	☒	$20,000	$5,600	-	$14,685	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. Additional 4” of surface rock needed for wet weather haul.
2231840	0.69	-	☒	☒	$20,000	$13,800	-	$36,187	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. Additional 4” of surface rock needed for wet weather haul.
2231847	0.53	0.53	☒	☒	$25,000	$13,250	$13,250	$30,446	$30,446	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Reconstructed turnaround north of road to facilitate haul to south. Minor additional clearing may be required. Additional 4” of surface rock needed for wet weather haul.
2231849	0.22	0.22	☒	☒	$12,000	$2,640	$2,640	$9,778	$9,778	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. Additional 4” of surface rock needed for wet weather haul.
2231850	1.61*	1.61*	☒	☒	$30,000	$48,300	$48,300	$100,536	$100,536	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. New constructed approach to NFSR# 2231-000 to facilitate haul to south. Less than 0.1 miles anticipated. Additional 4” of surface rock needed for wet weather haul.
2231855	1.06	1.06	☒	☒	$15,000	$15,900	$15,900	$50,291	$50,291	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4” of surface rock needed for wet weather haul.
2231857	0.24	0.24	☒	☒	$15,000	$3,600	$3,600	$11,387	$11,387	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4” of surface rock needed for wet weather haul.
2231870	4.99 *	4.99*	☒	☒	$30,000	$149,700	$149,700	$311,599	$311,599	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. New constructed approach to NFSR# 2231-000 to facilitate haul to south. Less than 0.1 miles anticipated. Additional 4” of surface rock needed for wet weather haul.
2231871	0.02	0.02	☒	☒	$15,000	$300	$300	$949	$949	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4” of surface rock needed for wet weather haul.
2231873	0.14	0.14	☒	☒	$15,000	$2,100	$2,100	$6,642	$6,642	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4” of surface rock needed for wet weather haul.
2231874	0.16	0.16	☒	☒	$12,000	$1,920	$1,920	$7,111	$7,111	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4” of surface rock needed for wet weather haul.
2231875	0.70	0.70	☒	☒	$18,000	$12,600	$12,600	$35,311	$35,311	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. Additional 4” of surface rock needed for wet weather haul.
2231877	0.4	0.4	☒	☒	$20,000	$8,000	$8,000	$20,978	$20,978	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. Additional 4” of surface rock needed for wet weather haul.
2231878	0.10	0.10	☒	☒	$15,000	$1,500	-	$4,744	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4” of surface rock needed for wet weather haul.

Road #	Haul Mileage		Reconstruction	Maintenance	Estimated $/Mile	Estimated Total $		Estimated Total $ with wet weather haul (if permitted)		Road Work Activity and Remarks
	Alt. 2	Alt. 3				Alt. 2	Alt. 3	Alt. 2	Alt. 3	
2231883	0.09	0.09	☒	☒	$15,000	$1,350	$1,350	$4,270	$4,270	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
2231887	0.04	0.04	☒	☒	$15,000	$600	$600	$1,898	$1,898	Clearing & Grubbing. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
2231900	0.13	0.13	☒	☒	$15,000	$1,950	$1,950	$6,168	$6,168	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600000	16.55	16.55	☒	☒	$35,000	$579,250	$579,250	$579,250	$579,250	Asphalt pothole and surface repairs anticipated. Ditch Rehabilitation. Portions of the pavement structure may need rehabilitation to be acceptable for wet weather haul.
4600011	0.16	0.16	☒	☒	$20,000	$3,200	-	$3,200	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. No wet weather haul.
4600012	1.28*	1.28*	☒	☒	$30,000	$38,400	$38,400	$38,400	$38,400	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Anticipated 0.1 mile realignment to eliminate steep grade. No wet weather haul.
4600014	0.57	0.57	☒	☒	$20,000	$11,400	$11,400	$11,400	$11,400	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. No wet weather haul.
4600021	0.29	0.29	☒	☒	$20,000	$5,800	$5,800	$5,800	$5,800	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. No wet weather haul.
4600022	0.55	0.55	☒	☒	$20,000	$11,000	$11,000	$11,000	$11,000	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. No wet weather haul.
4600023	0.21	0.21	☒	☒	$20,000	$4,200	$4,200	$4,200	$4,200	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. No wet weather haul.
4600024	0.50	0.50	☒	☒	$20,000	$10,000	$10,000	$10,000	$10,000	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. No wet weather haul.
4600025	0.13	0.13	☒	☒	$20,000	$3,600	$3,600	$3,600	$3,600	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. No wet weather haul.
4600026	0.12	0.12	☒	☒	$20,000	$2,400	$2,400	$6,293	$6,293	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600027	0.17	-	☒	☒	$15,000	$2,550	-	$8,066	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600028	0.23	-	☒	☒	$15,000	$3,450	-	$10,912	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600030	2.27	2.27	☒	☒	$22,000	$49,940	$49,940	$123,589	$123,589	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert replacements. Additional 4" of surface rock needed for wet weather haul.
4600033	1.88	1.88	☒	☒	$20,000	$37,600	$37,600	$98,596	$98,596	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert replacements. Additional 4" of surface rock needed for wet weather haul. Alt 3 haul miles = 0.73.
4600035	0.30	0.30	☒	☒	$15,000	$4,500	$4,500	$14,233	$14,233	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.

Road #	Haul Mileage		Reconstruction	Maintenance	Estimated $/Mile	Estimated Total $		Estimated Total $ with wet weather haul (if permitted)		Road Work Activity and Remarks
	Alt. 2	Alt. 3				Alt. 2	Alt. 3	Alt. 2	Alt. 3	
4600036	0.30	0.30	☒	☒	$20,000	$6,000	$6,000	$15,733	$15,733	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert replacements. Additional 4" of surface rock needed for wet weather haul.
4600037	0.06	0.06	☒	☒	$20,000	$1,200	$1,200	$3,147	$3,147	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600038	0.04	0.04	☒	☒	$20,000	$800	$800	$2,098	$2,098	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600040	4.23	3.10	☒	☒	$40,000	$169,200	$169,200	$306,441	$306,441	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert replacements. Additional 4" of surface rock needed for wet weather haul. Short Lake reroute. Decommission approx. 1.02 mile around Short Lake after sale.
4600044	0.21	0.21	☒	☒	$18,000	$3,780	$3,780	$10,593	$10,593	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. Additional 4" of surface rock needed for wet weather haul.
4600045	3.15	3.15	☒	☒	$30,000	$94,500	$94,500	$196,701	$196,701	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. Proposed Short lake reroute. Tie in new road to NFSR# 4600-059. Approx. 1 mile of new road. Curve widening needed and reshaping needed due to steep grades. Additional 4" of surface rock needed for wet weather haul.
4600046	0.30	-	☒	☒	$12,000	$3,600	-	$13,333	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600047	0.20	0.20	☒	☒	$15,000	$3,000	$3,000	$9,489	$9,489	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600049	0.16	0.16	☒	☒	$15,000	$2,400	$2,400	$7,591	$7,591	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Short Lake reroute. Additional 4" of surface rock needed for wet weather haul.
4600050	0.51	0.51	☒	☒	$15,000	$7,650	-	$24,197	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600053	0.23	-	☒	☒	$12,000	$2,760	-	$10,222	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600054	0.26	-	☒	☒	$15,000	$3,900	-	$12,336	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600055	0.53	0.53	☒	☒	$20,000	$10,600	$10,600	$27,796	$27,796	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. Additional 4" of surface rock needed for wet weather haul.
4600056	0.24	-	☒	☒	$20,000	$4,800	-	$12,587	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600058	0.09	-	☒	☒	$15,000	$1,350	$1,350	$4,270	$4,270	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.

Road #	Haul Mileage		Reconstruction	Maintenance	Estimated $/Mile	Estimated Total $		Estimated Total $ with wet weather haul (if permitted)		Road Work Activity and Remarks
	Alt. 2	Alt. 3				Alt. 2	Alt. 3	Alt. 2	Alt. 3	
4600061	0.12	-	☒	☒	$15,000	$1,800	-	$5,693	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600066	0.02	-	☒	☒	$12,000	$240	-	$889	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600071	0.45	0.45	☒	☒	$18,000	$8,100	$8,100	$22,700	$22,700	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600078	0.10	0.10	☒	☒	$15,000	$1,500	-	$4,744	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600088	0.28	0.28	☒	☒	$18,000	$5,040	$5,040	$14,125	$14,125	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600094	0.21	0.21	☒	☒	$20,000	$4,200	-	$11,013	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600095	0.32	0.32	☒	☒	$18,000	$5,760	$5,760	$16,142	$16,142	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600097	0.63	0.63	☒	☒	$18,000	$11,340	$11,340	$11,340	$11,340	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. No wet weather haul.
4600117	0.07	-	☒	☒	$12,000	$840	-	$3,111	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600289	0.06	0.06	☒	☒	$12,000	$720	$720	$2,667	$2,667	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4600297	0.23	-	☒	☒	$12,000	$2,760	-	$10,222	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4685000	8.39	8.39	☒	☒	$25,000	$209,750	$209,750	$209,750	$209,750	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. No wet weather haul.
4685302	3.73	3.73	☒	☒	$25,000	$93,250	$93,250	$93,250	$93,250	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. No wet weather haul.
4685310	1.75	1.75	☒	☒	$25,000	$43,750	$43,750	$43,750	$43,750	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. No wet weather haul.
4685315	0.22	0.22	☒	☒	$15,000	$3,300	$3,300	$3,300	$3,300	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. No wet weather haul.
4685317	0.22	0.22	☒	☒	$15,000	$3,300	$3,300	$3,300	$3,300	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. No wet weather haul.
4685330	0.57	0.57	☒	☒	$20,000	$11,400	$11,400	$11,400	$11,400	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. No wet weather haul.
4685452	0.20	0.20	☒	☒	$20,000	$4,000	$4,000	$4,000	$4,000	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. No wet weather haul.
4688000	6.50*	6.50*	☒	☒	$35,000	$227,500	$227,500	$438,390	$438,390	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. Open end of road and extend an

Road #	Haul Mileage		Reconstruction	Maintenance	Estimated $/Mile	Estimated Total $		Estimated Total $ with wet weather haul (if permitted)		Road Work Activity and Remarks
	Alt. 2	Alt. 3				Alt. 2	Alt. 3	Alt. 2	Alt. 3	
										additional 0.22 miles. Additional 4" of surface rock needed for wet weather haul.
4688107	0.63	0.63	☒	☒	$15,000	$9,450	$9,450	$29,890	$29,890	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4688111	0.17	0.17	☒	☒	$12,000	$2,040	$2,040	$7,556	$7,556	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4688120	0.58	0.58	☒	☒	$15,000	$8,700	$8,700	$27,518	$27,518	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4688124	0.09	0.09	☒	☒	$12,000	$1,080	$1,080	$4,000	$4,000	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4688130	0.45	0.45	☒	☒	$15,000	$6,750	$6,750	$21,350	$21,350	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4688131	0.04	0.04	☒	☒	$15,000	$600	$600	$1,898	$1,898	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4688132	0.06	0.06	☒	☒	$15,000	$900	$900	$2,847	$2,847	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4688135	0.01	-	☒	☒	$15,000	$150	-	$474	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4688210	0.10	-	☒	☒	$12,000	$1,200	-	$4,444	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4688220	0.44	0.44	☒	☒	$12,000	$5,280	$5,280	$19,556	$19,556	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4688222	0.25	0.25	☒	☒	$12,000	$3,000	$3,000	$11,111	$11,111	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4688223	0.05	0.05	☒	☒	$12,000	$600	$600	$2,222	$2,222	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4688240	0.14	0.14	☒	☒	$12,000	$1,680	$1,680	$6,222	$6,222	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4693000	2.20	2.20	☒	☒	$20,000	$44,000	$44,000	$115,378	$115,378	Asphalt approach repair. Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. Additional 4" of surface rock needed for wet weather haul.
4693502	0.84	0.84	☒	☒	$18,000	$15,120	$15,120	$42,374	$42,374	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4693503	0.08	0.08	☒	☒	$25,000	$2,000	$2,000	$4,596	$4,596	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. Additional 4" of surface rock needed for wet weather haul.
4693508	0.41	0.41	☒	☒	$15,000	$6,150	$6,150	$19,452	$19,452	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.
4693509	0.09	0.09	☒	☒	$15,000	$1,350	$1,350	$4,270	$4,270	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4" of surface rock needed for wet weather haul.

Road #	Haul Mileage		Reconstruction	Maintenance	Estimated $/Mile	Estimated Total $		Estimated Total $ with wet weather haul (if permitted)		Road Work Activity and Remarks
	Alt. 2	Alt. 3				Alt. 2	Alt. 3	Alt. 2	Alt. 3	
4693620	0.18	0.18	☒	☒	$15,000	$2,700	$2,700	$8,540	$8,540	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4” of surface rock needed for wet weather haul.
4693639	0.24	0.24	☒	☒	$25,000	$6,000	$6,000	$13,787	$13,787	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. Additional 4” of surface rock needed for wet weather haul.
4693640	0.28	0.28	☒	☒	$22,000	$6,160	$6,160	$15,245	$15,245	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. Additional 4” of surface rock needed for wet weather haul.
4693641	0.43	0.43	☒	☒	$15,000	$6,450	$6,450	$20,401	$20,401	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. Additional 4” of surface rock needed for wet weather haul.
4696000	2.20	2.20	☒	☒	$20,000	$44,000	$44,000	$115,378	$115,378	Asphalt pothole and surface repairs anticipated. Ditch Rehabilitation. Pavement structure acceptable for wet weather haul.
4698000	3.49	1.35	☒	☒	$25,000	$87,250	$33,750	$200,482	$74,802	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. Grade sag repair at MP 0.45. Additional 4” of surface rock needed for wet weather haul.
4698807	0.25	0.25	☒	☒	$15,000	$3,750	$3,750	$11,861	$11,861	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4” of surface rock needed for wet weather haul.
4698810	0.73	0.73	☒	☒	$15,000	$10,950	$10,950	$34,635	$34,635	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Reshaping needed due to steep grade. Additional 4” of surface rock needed for wet weather haul.
4698811	0.20	-	☒	☒	$15,000	$3,000	-	$9,489	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4” of surface rock needed for wet weather haul.
4698812	1.78	-	☒	☒	$20,000	$35,600	-	$93,352	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Culvert Replacements. Grade sag repairs. Additional 4” of surface rock needed for wet weather haul.
4698814	0.24	-	☒	☒	$15,000	$3,600	-	$11,387	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4” of surface rock needed for wet weather haul.
4698815	0.16	-	☒	☒	$15,000	$2,400	-	$7,591	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4” of surface rock needed for wet weather haul.
4698820	0.16	-	☒	☒	$15,000	$2,400	-	$7,591	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4” of surface rock needed for wet weather haul.
4698835	0.45	-	☒	☒	$15,000	$6,750	-	$21,350	-	Clearing & Grubbing. Road Rehabilitation. Ditch Rehabilitation. Surfacing/Spot Rock. Additional 4” of surface rock needed for wet weather haul.
Alt 2 Haul Miles	**108.0**									
Alt 3 Haul Miles		**98.2**								
Alt 2 Total $						**$2,715,750**				

Road #	Haul Mileage		Reconstruction	Maintenance	Estimated $/Mile	Estimated Total $		Estimated Total $ with wet weather haul (if permitted)		Road Work Activity and Remarks
	Alt. 2	Alt. 3				Alt. 2	Alt. 3	Alt. 2	Alt. 3	
Alt 3 Total $							$2,536,050			
Alt 2 Total $ with wet weather haul								$4,826,722		
Alt 3 Total $ with wet weather haul									$4,327,059	
* -includes realignment mileage										

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Glossary

A

Advanced Regeneration - Small trees, usually less than 1 inch in diameter, which are growing under mature trees prior to planned harvest activities.

Air Quality - The composition of air with respect to quantities of pollution therein; used most frequently in connection with "standards" of maximum acceptable pollutant concentrations. Used instead of "air pollution" when referring to programs.

Ambient Air Quality - defined under the Clean Air Act as the air quality outside of industrial site boundaries

C

Canopy - The uppermost spreading branchy layer of a forest.

Canopy Cover - Canopy cover is a measure of the percentage of ground covered by a vertical projection of the tree canopy.

Canopy Closure - Canopy closure is the proportion of the sky hemisphere (measured from all angles) obscured by vegetation when viewed by a single point. Closure is affected by tree heights and canopy widths and takes into account light interception and other factors that influence microhabitat.

Chain – A standard measurement equal to 66 feet.

Cohort – A group of trees developing after a single disturbance, commonly consisting of trees of similar age, although it can include a considerable range of tree ages of seedling or sprout origin and trees that predate the disturbance.

Contiguous- In close proximity to or near.

Core Area - 0.5 mile (radius circle) around a known or predicted owl site, which delineates the area most heavily used during the nesting season for nesting, foraging and rearing young. Bingham and Noon (1997) defined the core area as that portion of a northern spotted owl home range that received disproportionately high use for nesting, roosting and access to prey; they suggested that 60-70% of owl reproducing season activity occurred in about 20% of the home range. Although Courtney et al. (2004:5-5) observed that core area sizes varied greatly among owls, Thrailkill (pers. com.) determined that Bingham and Noon 1997, Wagner and Anthony 1999, Franklin et al. 2000 and Irwin et al. 2004 collectively suggested a core area of about 500 acres.

Critical Habitat – The critical habitat designation is conducted by the U.S. Fish and Wildlife Service and is based on the current status and recent scientific research on northern spotted owl populations. Critical habitat was identified for specific areas within the geographical area occupied by the species at the time it was listed, on which are found those physical or biological features essential to the conservation of the species, and which may require special management considerations or protection. For the northern spotted owl, these features include particular forest types that are used or likely to be used by northern spotted owls for nesting, roosting, foraging, or dispersing habitat. In addition, the best available information was used to identify those areas that are otherwise determined to be essential to the conservation of the species. A habitat network was identified that meets the following criteria: • Ensures sufficient habitat to support stable, healthy populations across the range, and also within each of the 11 recovery units; • Ensures distribution of northern spotted owl populations across the range of habitat conditions used by the species; • Incorporates uncertainty, including potential effects of barred owls, climate change., and wildfire disturbance risk; and • Recognizes that these protections are meant to work in concert with other recovery actions, such as barred owl management.

Cycle - As applied to uneven-aged management, it is the time interval between harvest entries. It should be noted that harvest entries in uneven-aged management are to leave residual levels of growing stock which should not need treatment for at least one cycle length.

D

Desirable Species - Any species of plant or animal which is considered to be compatible with meeting management goals and objectives.

Discounted Cost - Value of all cost associated with a project over its lifetime multiplied by a discount rate to determine the costs at today's worth.

Discounted Revenue - Value of all revenue associated with a project over its lifetime multiplied by a discount rate to determine the value today.

Disturbance - Events that disrupt the stand structure and/or change resource availability or the physical environment (Oliver 1996).

Diameter Breast Height (dbh) – Diameter of a tree measured 4.5 feet up from the ground on the uphill side.

E

Early Seral - Plants which inhabit a disturbed site within the first few years subsequent to the disturbance.

Early Seral Habitat – A forest structural condition that lasts 15-20 years after a human disturbance such as timber harvest, or natural disturbance such as wildfire. This structural condition can provide valuable wildlife habitat components including grasses, flowering forbs, hardwoods and dead wood habitat structures.

Emissions - A release of combustion gases and aerosols into the atmosphere.

F

Fire Behavior – The manner in which a fire reacts to the influences of fuel, weather, and topography.

Fire Intensity -The product of the available heat of combustion per unit of ground and the rate of spread of the fire, interpreted as the heat released per unit of time for each unit length of fire edge. The primary unit is Btu per second per foot (Btu/sec/ft) of fire front. Also, the rate of heat release per unit time per unit length of fire front. Numerically, it is the product of the heat yield, the quantity of fuel consumed in the fire front, and the rate of spread.

Fire Regime - A function of the historical frequency of fire and the degree of severity of those fires.

Fire Severity - Degree to which a site has been altered or disrupted by fire; loosely, a product of fire intensity and residence time.

Fuels - Vegetative matter, dead or alive, that burns in a fire. It is broadly characterized by the following categories:

- Surface or ground fuels are within a foot or so of the ground surface.
- Ladder fuels exist when you have a continuous vertical arrangement of fuel that allows fire to easily go from ground level into the tree canopy.
- Crown fuels are the tree limbs and leave that can burn with enough heat and/or wind.
- Live fuels are the green (live) herbs and shrubs.

Fuel Models - Simulated fuel complex for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified.

H

Habitat Modification; Habitat Downgraded: Refers to silvicultural activities that change spotted owl suitable habitat to dispersal habitat Habitat Removed: Refers to silvicultural activities that 1) Alter spotted owl suitable habitat such that it no longer supports nesting, roosting, foraging, and dispersal (i.e., suitable habitat becomes non-habitat after treatment) or 2) Alter spotted owl dispersal habitat so that the habitat no longer supports dispersal (i.e., dispersal habitat becomes non-habitat after treatment).

Home Range - An estimated area for habitat use of a spotted owl pair. For the Oregon Cascades, this estimate is 1.2 miles (radius circle) around a known or predicted owl site (Thomas et al. 1990, USDI et al. 2008).

Hyporheic Flow - Hyporheic flow is the mixing of shallow groundwater and surface beneath and alongside a stream bed.

I

Incidental Take (ESA) – Take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity

Invasive Weed – see Noxious Weeds

K

Known Owl Site - A site that was or is occupied by a pair or resident single as defined by the survey protocol (1990-2012). The specific site location is determined by the unit biologist based on the best and/or most recent information. A known site may be determined to be inactive only in accordance with the

L

Ladder Fuels – Fuels that provide vertical continuity between the ground and tree crowns which create a pathway for a surface fire to move into the overstory tree crowns.

Local Road – A forest road that connects terminal facilities with forest collector, forest arterial or public highways. Usually forest local roads are single purpose transportation facilities. (FSH 7709.54, no longer in print)

M

Mechanical Treatment – Fuels reduction work completed by tracked or rubber tired equipment that may include grapple piling in slash concentrations, mastication, or any other mechanical device.

Motor Vehicle Use Map (MVUM) – A map reflecting designated roads, trails and areas on an administrative unit or a Ranger District of the National Forest System. (36 CFR 261.2)
Multi-Cohort – a stand with two or more age classes or cohorts.

N

Nest Patch (or Stand) - 300 meters (radius circle) around a known or predicted owl site, where a spotted owl would be likely to select a nest tree. This is based on habitat usage of spotted owls within the Central Cascades Study Area, located on the Willamette National Forest.

Net Future Value - Difference in Discounted Revenue and Discounted Cost to evaluate if a project will have a positive or negative return on investment.

No Cut Buffer – Riparian buffer where no trees can be cut.

No Harvest Buffer – Riparian buffer where trees may not be commercially cut and milled, but may be cut and felled for other purposes, such as streamside restoration treatment where specified and stream crossings or equipment access.

Noxious Weeds (Invasive species) - Non-native plants listed by the State that generally have either economic or ecosystem impacts, or are poisonous to wildlife and/or livestock. They aggressively invade disturbed areas such as fires, road sides, and construction areas.

O

Obligate Predator - When the word is used as an adjective, obligate means "by necessity" (the antonym is *facultative*) and is used mainly in biology. An obligate predator is an organism whose survival is dependent on a diet consisting of animal flesh. In the case of aquatic insects these organisms would primarily eat other insects.

Off-Highway Vehicle (OHV) – Describes all those vehicles designed for off-highway use and which are classified as one of four classes of ATV in Oregon. (OHV Guide 2014)

P

Phytophagous - Feeding on plant material. This term is typically used when referring to insects.

Predicted Owl Site - An area able to support resident spotted owls (i.e. a potential breeding pair) as determined by the USDI et al. (2008) northern spotted owl occupancy template. This is used for determining effects to spotted owls where survey data are insufficient.

R

Remnant trees - Large to giant-diameter trees within younger-aged stands, that lived through past natural fire disturbances, or were retained after logging. Amounts and distribution of remnant trees within younger stands may be highly variable.

Road – A motor vehicle route over 50 inches wide, unless identified and managed as a trail. (36 CFR 212.1)

Road Decommissioning – Activities that result in the stabilization and restoration of unneeded roads to a more natural state. (36 CFR 212.1)

S

Sag Pond - A sag pond is a body of water collected in the lowest parts of a depression formed either near the head scarp of rotational landslides or between two strands of an active strike-slip fault. Hidden Lake sits on a deep seated earthflow and is technically a sag pond.

Salvage - Activity, usually removal or chipping, of material killed by a disturbance event such as insects, fire, wind, etc. Where possible, this material is used as some form of forest product of commercial value, such as firewood, pulp, and/or chips.

Seral Stages - Seral stage describes the phase of development of a plant community. Early seral species are those species you would expect to find on a site soon after a major disturbance, like fire. These are species such as pines, Douglas-fir, snowbrush, fireweed, etc. They are generally shade intolerant species. Late seral are the species that can come in under a fully developed vegetative canopy, such as true firs, prince's pine, lichens, etc.

Silviculture -The theory and practice of directing forest establishment, composition, and growth for the production of forest resources to meet specific management objectives. The word is derived from the Latin word silva, which means "forest" and from cultura, which means "to develop and care for." So, it is the development and caring for the forest.

Silviculturist - One, who plans, assists in and supervises the implementation of silviculture projects. The Silviculturist determines (prescribes) the vegetative treatments necessary to meet the objectives for vegetation on a given site.

Site - A specific location where management activity is considered, planned, or operating.

Site Potential - The specific ability of a site to grow vegetation. It includes the soil, topographic, and climatic conditions that determine the resources available for growing vegetation.

Site Preparation - The removing or rearranging of vegetation or woody debris to meet specific management objectives. Most often it is used to describe the process(es) used to expose mineral soil areas suitable for planting or seeding desirable species of plants.

Slash - Debris resulting from such natural events as wind, fire, or snow breakage; or such human activities as road construction, logging, pruning, thinning, or brush cutting. It includes logs, chunks, bark, branches, stumps, and broken understory trees or brush.

Soundscape- Geographic region as defined by the audible sounds associated within it.

Spotted Owl Habitat Types – **Suitable habitat** consists of forested stands used by spotted owls for nesting, roosting and foraging. Features that support nesting and roosting typically include a moderate to high canopy closure (60-90%); a multi-layered, multi-species canopy with large overstory trees (with dbh of greater than 30 inches); a high incidence of large trees with various deformities (large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for spotted owls to fly.
Foraging habitat generally has attributes similar to those of nesting and roosting habitat, but such habitat may not always support successfully nesting pairs (USFWS 2011c, p. A-10).
At a minimum, **dispersal habitat** consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities (USFWS 2011c, p. A-10). It consists of conifer and mixed mature conifer-hardwood habitats with a canopy cover greater than or equal to 40% and conifer trees greater than or equal to 11 inches average diameter at breast height (dbh) with open space beneath the canopy to allow spotted owls to fly. Generally, spotted owls use younger stands to move between blocks of suitable habitat, roost, forage and survive until they can establish a nest territory. Juvenile owls also use dispersal habitat to move from natal areas. Dispersal habitat thus includes habitat that will provide some roosting and foraging opportunities during the colonization phase of dispersal, but not at a scale that would support nesting pairs (in which case it would be classified as suitable habitat). Suitable habitat can also function as dispersal habitat as it supports both territorial and dispersing spotted owls. However, in this document, dispersal habitat generally refers to stands that are 40-79 years old.

Stand - A group of trees of similar canopy structure, species composition, and/or size growing on a continuous area. A stand is distinct from neighboring stands in structure, growing conditions, or management objectives. Stand age for this project is averaged and based on trees of commercial size which is seven inch dbh and greater.

Stand Density Index – SDI – A relative density measure based on the relationship between mean tree size and number of trees per unit area in a stand (Reineke 1933).

Stand Dynamics - The changes in forest stand structure with time, including stand behavior during and after disturbances (Oliver 1996).

Stand Structure - The physical and temporal distribution of trees and other plants in a stand (Oliver 1996).

Stream Classes - Class 1 and 2 = perennial fish bearing streams; Class 3 = perennial non-fish bearing streams; Class 4 = intermittent, seasonally flowing streams.

Suppression - All the work of extinguishing or confining a fire beginning with its discovery.

T

"Take" of ESA listed species - Take: to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct. Harm is further defined by USFWS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by

USFWS as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering.

Thinning - Any cutting or removal of vegetation (trees, brush, etc.) resulting in a reduction of competition for water, light, and/or nutrients between individual plants.

- Commercial thinning refers to removing material that has an established dollar value on the open market and can be sold with at least a minimal net value sufficient to pay for the thinning activity.

Torching - The burning of the foliage of a single tree or a small group of trees, from the bottom up. Also, single tree torching is one tree and group torching is more than one tree often a patch of multiple trees torching.

Treatment - A term used to broadly refer to the management actions made to meet management objectives. It may include thinning cutting of undesirable trees, prescribed fire, salvage, or any manipulation of the vegetative conditions. In addition, intentionally excluding a portion of a stand from harvest is a management action, or treatment.

Trees per Acre (TPA) – The number of trees on an acre of land.

U

Underburn - Using prescribed fire under the canopy of an existing stand of trees.

Undesirable Species - Any species of plant or animal which is NOT considered to be compatible with meeting management goals and objectives.

V

Vegetation Recovery- Period of time that allows for sufficient re-growth in harvested areas to make evidence of harvest activity largely unnoticeable to the casual observer.

W

Woody Debris - Dead pieces of woody vegetation such as stems, limbs, or leaves which are on a site.

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