United States
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Forest
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Environmental Assessment

Jazz Thinning

Clackamas River Ranger District, Mt. Hood National Forest
Clackamas County, Oregon
The project is located in T.6 S., R.6 E.; T.7 S., R.5 E.; T.7 S., R.6 E.; T.7 S., R.7 E.; T.8 S., R.7 E.; Willamette Meridian.

For Information Contact: James Roden
595 NW Industrial Way,
Estacada, OR 97023
503.630.6861
jroden@fs.fed.us

An example of post harvest plantation thinning

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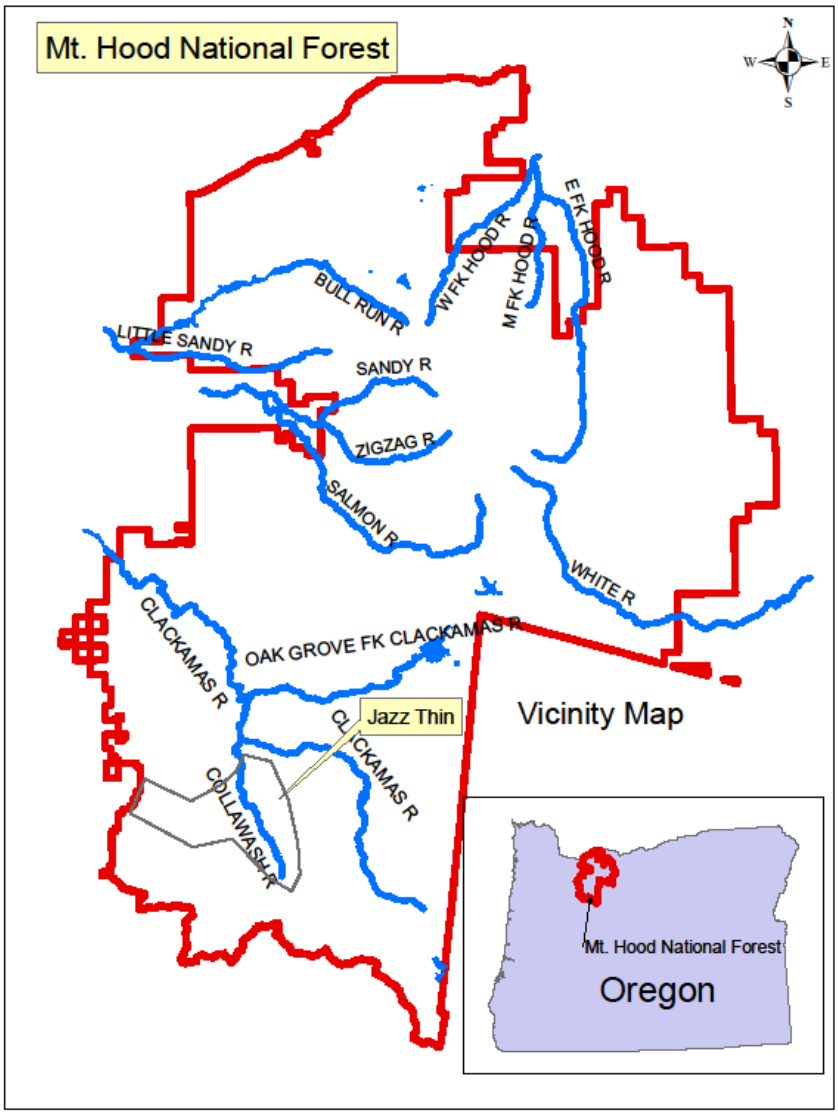
Summary

The project is located in the Clackamas River Ranger District, Mt. Hood National Forest, Oregon. The Mt. Hood National Forest proposes a thinning project in plantations ranging in age from 30 to 60 years old. The Mt. Hood National Forest is referred to as 'the Forest' in this document.

The purpose of this project is to increase the health and growth of trees and to enhance diversity within riparian reserves, late-successional reserves and matrix lands in the Collawash Watershed. Also, the purpose of this project is to provide forest products to the local economy. In order to achieve these objectives, this project proposes to thin second-growth plantations from approximately 2,053 acres. This acreage figure represents the sum of all of the plantations. It is estimated that approximately 1,588 acres would actually be thinned after accounting for stream protection buffers and other subtractions. The proposed action also includes road reconstruction and road decommissioning. Refer to section 1.3 for greater detail.



1.0 INTRODUCTION

1.1 Document Structure

The Forest Service has prepared this document in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This document discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. This document uses a section number system. This paragraph for example is in section 1.1 and may be referred to as s. 1.1. The document is organized into the following parts:

- *Summary*
- *Introduction:* This section includes the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This discussion also includes design criteria and Best Management Practices. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- *Alternatives:* This section provides a description of alternative methods for achieving the stated purpose. These alternatives are developed based on issues raised by the public and other agencies. Finally, this section provides a comparison of the environmental consequences associated with each alternative.
- *Environmental Consequences:* This section describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource. Within each section, the existing situation is described first, followed by the effects of the alternatives. The no-action alternative provides a baseline for evaluation and comparison of the other alternatives.
- *Consultation and Coordination:* This section provides a list of preparers and agencies consulted during the development of the assessment.
- *References and Appendices:* The appendices provide more detailed information to support the analyses presented in the assessment.

  Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Estacada Ranger Station in Estacada, Oregon.

1.2 Background

1.2.1 Watershed Analysis Overview

The Collawash Watershed Analysis (1995) contains an in-depth discussion with maps, of the setting, the ecological processes, the resource conditions and the history of management. Additional maps are found in this document's Appendix A. The following is a brief summary of those topics with updates for changes since then to help inform understanding of the Jazz project.

The proposed Jazz project area is located in the Collawash Watershed; a tributary of the Clackamas River. The watershed encompasses approximately 97,000 acres. It is on the west slope of the Cascade Mountain Range. The terrain is relatively rugged and steep, characterized by slopes ranging from 5 – 70% with elevations ranging from approximately 1,900 to 4,000 feet. It is a wet landscape with high stream density and large rivers and streams that drain down from the mountains of the Bull of the Woods Wilderness and connect to the Clackamas River. The climate is temperate, with high rain and snowfall in the winter months (ranging from 70-130 inches annually).

The Collawash Watershed is composed mainly of basalt and andesite lava flows and minor sedimentary units of volcanic origin. Landforms are dissected with deeply incised valley and sharp, steep-sloped ridges. Soils on the lower slopes and valley bottoms tend to be deeper and productive, while soils on the upper slopes and ridgetops tend to be shallower and less productive.

A portion of the watershed has a wide spectrum of stability issues ranging from landslides and debris flows to slow-moving dormant earthflows. Additional discussion of this topic can be found in the Geologic Stability section (s. 3.5). Landslides, some of which are quite large are very common. These unstable landforms affect the vegetation that grows there, the condition of streams and fish habitat, as well as roads and the cost of maintaining them. Dormant earthflows are relatively gently sloping and are very productive in terms of tree growth.

Much of the watershed is in the western hemlock plant association with Douglas-fir the primary tree species. This watershed contains much more contiguous, closed canopy forest than many of the surrounding watersheds in the Clackamas sub-basin. Most of the large conifer stands in the Collawash are between 200 and 350 years old. The stands of smaller trees are early and mid-seral stands ranging in age from 10 to 60 years that originated primarily from harvesting.

1.2.1.1 Disturbance Regime

Fire has been the dominant landscape pattern-forming disturbance agent in the Collawash Watershed. One series of major fire events in the Collawash watershed occurred one hundred years ago. The Forest has been divided into eleven fire ecology groups based on vegetation, fire frequency, and behavior (Evers et al., 1994). Two of these fire groups, Groups 8 and 9 represent the vegetation patterns distributed across the Collawash watershed.

Fire Group 8; the "warm moist western hemlock, Pacific silver fir" group has a stand replacement fire regime where most or all trees would be killed with a fire frequency of 50 – 300+ years. While fire frequency tends to be low because of moist habitats, when fires do occur they tend to be large and stand-replacing (killing all or most trees). Fires in this group prepare mineral-soil seedbeds, produce a mosaic of stand structures and age classes across the landscape, and affect within-stand species

diversity. The proposed harvest units fall within this fire group. Fire suppression in the past 100 years has not dramatically altered the structure of stands or increased fire hazard in this group. Fire suppression has resulted in a landscape where there are few large patches of young fire-created stands.

Fire Group 9; the "dry western hemlock, westside Douglas-fir" group has a mixed severity regime with a fire frequency of 25-125 years characterized by underburning and some crown fire. This group is found on south and west aspects, on steep slopes in the Collawash and Hot Springs Fork canyons and in areas with rock outcroppings and talus slopes. This fire group is characterized by steep slopes, wide spacing of trees, thin soils and a high percentage of exposed rock. Most of the recent fires in the Bull of the Woods Wilderness are in this fire group.

Natural variation is generally higher in the mixed fire group (Group 9) and lower in the stand-replacement group (Group 8). The combination of fire regime and terrain are the dominant factors that determine the typical patch or stand size within the natural mosaic. Fire-created patterns differ from current harvest created patterns in the size, shape, and distribution of patches.

Fire-created openings in Groups 8 and 9 tend to be large, irregularly shaped, and infrequently distributed (both spatially and temporally) across the landscape. Patch or stand sizes in flat to rolling terrain with a surface or replacement regime typically range from 100 to 300 acres, while sizes in steep and dissected terrain range from 10 to 50 acres. Fire-created openings generally contain abundant remnant live trees and snags.

While fire has played a role in influencing the macro-scale of forest structure, there are other disturbance factors that have influence at a smaller scale.

Micro-scale disturbance agents in the project area affect individual trees, small groups of trees or large areas of susceptible species. Disease, insects and wind have been the secondary disturbance agents in the proposed treatment area. Small (1/4 acre) to large (1-3 acre) isolated pockets of laminated root rot (*Phellinus weirii*) and armillaria root disease (*Armillaria ostoyae*), are present throughout these stands. Neither of the root diseases, when present at low to moderate levels seriously compromise timber productivity, however these diseases are creating openings of various sizes where highly susceptible species would never attain large size, mainly because they are being killed before they reach such size. Trees weakened are usually blown over or sheared by the wind and often sustain a secondary attack by bark beetles.

Insect species that have substantially affected disturbance regimes within the forested areas of the Collawash watershed are Douglas-fir bark beetle (*Dendroctonus pseudotsugae* Hopkins) and spruce budworm (*Choristoneura fumiferana*). The last significant insect outbreak occurred following a windthrow event in 1989-90 that covered approximately 320 acres.

Windthrow is a term used to describe trees blown over by normal high-wind events. Some trees that have root diseases are blown down by wind, but as the infection spreads and the decay progresses they would eventually fall even in the absence of wind. Episodes of catastrophic windthrow in the Collawash watershed are not historically common. Generally, windthrow only involves a single tree or small groups of trees scattered over a wide area. The most notable windthrow event in recent history occurred in 1989-90 primarily along the edges of regeneration harvest units.

1.2.1.2 Past Management

Road construction and logging of old-growth forests began in the mid 1950s in the Collawash watershed. Since then approximately 24,600 acres of forest stands (25% of the watershed) have been converted to plantations. The watershed once contained approximately 372 miles of system roads, but 74 miles were decommissioned several years ago. Additionally, 123 miles have recently been approved for decommissioning (partially completed). A large power line transmission corridor crosses the watershed.

The Collawash watershed once contained large patches of mature Douglas-fir and western redcedar typical of the disturbance regime but now it is fragmented by plantations. The current vegetation pattern contains more edge habitat and less connectivity of mature forest than the pattern created by the natural disturbance regime. Plantations are uniform in size, regularly shaped, and evenly dispersed across the landscape. The plantations in the watershed have a wide range of ages and densities (from age 10 to 60). Some plantations have already been thinned, while many others have not received treatment.

1.2.1.3 Tree Growth and Health

The stands included in this project have been examined and have been found to be overstocked. When the plantations were created, trees were planted at relatively close spacing with the understanding that density management practices would occur over time to space the trees out sufficiently to give them adequate room to grow. When trees are too closely spaced they experience a slowing of growth due to competition for sunlight, moisture and nutrients. Suppressed, slow-growing trees have begun to die and have become susceptible to insects, diseases and wind damage.

The image below is a core taken from a Douglas-fir tree in Jazz unit 112 illustrating how growth has slowed in recent years. This tree was planted in 1971. The center of the tree is at the leftmost arrow and the most current growth, inside the bark, is to the right. The lightest colored wood represents the spring and early summer growth and the darker lines (rings) represent the latter portion of the growing season. These annual growth rings allow the measurement of tree age and changes in growth that occur over time. The core was taken at a height of 4 ½ feet: approximately five years of growth occurred before the tree got to this height. This tree grew approximately

four inches in radius or eight inches in diameter between 1980 and 1990; demonstrating the capability of this site. As this tree became crowded with its neighbors in the 1990s, growth slowed because the trees had to compete for sunlight, moisture and nutrients. In the past decade the tree grew only 5/8 inch in radius or 1¼ inches in diameter. The tree is currently 16½ inches in diameter (outside bark).

Trees that have been uniformly spaced during planting interact differently when developing through inter-tree competition of the stem-exclusion phase compared to stands seeded in after a fire or other stand-replacement disturbance. Trees have less of a chance to express dominance when they have been planted from genetically similar seed sources and maintained at relatively even spacing. Therefore, when these stands reach density levels in which individual trees are competing with each other for growing space it may take longer for individuals to express dominance. If trees are not thinned, competition would increase, stems would continue to grow in height, but diameter growth would drastically slow. These trees would become more dependent on neighboring trees for support. When trees develop in this manner they are more likely to blow down in large groups or be more susceptible to insects and disease.

Failure to provide trees sufficient spacing while they are young can have consequences lasting the life of the stand (Oliver 1996). The overstocked condition of current stands in the planning area would continue to result in stands with reduced vigor, small size, and increased susceptibility to stressors such as insects, diseases and weather.

One term used later in this document to describe the degree of crowdedness of individual trees within a stand is Relative Density (RD). It is a scale that ranges from 0 (no trees) to 100 (maximum biological potential) (Ellen 1983) (Curtis 1982). When a stand reaches or exceeds a RD of 55, suppression, mortality and stand decline is expected. Both tree and stand characteristics (tree growth rates, crown structure and mortality, as well as understory development and natural regeneration) are all closely related to relative density. Relative densities in the stands proposed for thinning range from 55 to 85 with an average diameter of approximately 12 inches.

1.2.1.4 Diversity

Diversity is the distribution and abundance of different native plant and animal communities and species. There are many ways to look at diversity and several scales to consider. Diversity in forests can be categorized by variations in genetics, structure and species composition. Biodiversity is a term sometimes used to describe the abundance of native plant and animal species. At the landscape scale, a mix of forest types and ages can provide habitat for a wide range of plants and animals. At the stand scale other elements become more relevant such as species composition, snag abundance or the number of canopy layers.

Both human actions and natural processes or events have the potential to alter diversity. Some actions or natural processes or events may seem to benefit one aspect of diversity while at the same time be detrimental to another. For example a wildfire may kill most of the trees in its path: it would create an abundance of snags and down logs which are very important for many species but at the same time the fire could reduce live tree canopy making the area unusable for species that depend on dense trees and shade. When examined at the stand scale, a wildfire seems to create winners and losers but if a broader landscape context is considered there would likely be sufficient habitats to provide for all native species.

Plantations sometimes lack certain elements of diversity and complexity. They often do not contain the mix of tree species that were present in the original stand and they are relatively uniform in terms of tree species, size and spacing. When the original clearcut harvesting occurred, all of the large trees and snags were removed. The plantations have minimal variability of vertical and horizontal stand structure and little sunlight reaches the forest floor resulting in low levels of diversity of ground vegetation.

At a landscape scale, the logging that created the plantations fragmented mature forest stands. Prior to the 1950s, the forests in the project area where relatively uniform mature forest but these forest stands were fragmented by clearcuts as plantations were created. This likely benefited certain species such as elk because of the temporary levels of forage created but likely harmed species such as spotted owls that require large blocks of contiguous mature habitat.

The age and density of stands, and management strategies affect a variety of ecosystem functions including: wildlife species use and migration, nutrient cycling, hydrologic function, production of snags and coarse woody debris, and disturbance processes (fire, insects, disease, and windthrow). Many species evolved to use the large snags and logs that were historically abundant in the landscape. While these structures are still abundant outside plantations, the loss of snag and log density from plantations affects species that depend on those structures such as woodpeckers and cavity nesters. The distribution of snags and fallen trees is partly a function of elevation, aspect, slope and other site factors that contribute to overall site productivity; but the history of stand disturbance and inter-tree competition have

perhaps even greater influence. Under natural conditions, disease, fire, insect infestation and the proximity of the trees to each other as the stand develops are factors that contribute to tree mortality, and create snags and/or down wood.

In the past, thinning focused primarily on tree growth and productivity and resulted in continued uniformity. There are opportunities however while designing a thinning project to both enhance growth and provide for greater diversity. The science behind the concepts of variable-density thinning has been evolving in recent years (Carey 2003) (Chan 2006) (Tappeiner 1999). Diversity can be enhanced by using techniques such as retaining minor species, retaining down wood and non hazardous snags, and creating snags, skips and gaps.

Plantations are relatively dense with one canopy layer (see s. 3.1). The plantations were planted primarily with Douglas-fir in the lower elevations; in some areas other species such as noble fir were planted. Some other tree species such as western hemlock, grand fir, Pacific silver fir or western redcedar are present but uncommon either because they survived the clearcutting and burning or because they seeded in from stand edges. Thinning while retaining minor species can result in greater representation of the minor species.

Gaps are small areas where most or all trees are removed in patches scattered through a thinned stand. Gaps can provide breaks in an otherwise uniform canopy allowing sunlight to reach the ground. Where gaps are created, seedlings would naturally regenerate resulting in a multi-storied canopy with both vertical and horizontal diversity.

Skips are small areas where no trees are cut in patches scattered through a thinned stand. Skips provide dense shade and a place to optimize snag development.

Thinning that incorporates these features can change a uniform plantation into one with greater vertical, horizontal and species diversity. These changes would be beneficial to a wide range of plants and animals. As the stands continue to grow they would acquire the characteristics of old-growth forests sooner than if left untreated. The fragmented nature of the landscape would become less evident as plantations blend in with surrounding mature forest stands. This is particularly important in LSRs and riparian reserves to restore them to the desired conditions for the key species that rely on unfragmented mature forest conditions.

Recent research (Carey 2003) (Chan 2006) (Tappeiner 1999) has compared variable density thinning with traditional thinning and no treatment and found that introducing variability resulted in greater numbers of species of birds, lichens, bryophytes, fungi, small mammals. Many species that are particularly at risk such as threatened species (including spotted owls and anadromous fish), sensitive species, and survey and manage species are at risk because their required habitats have been altered by clearcutting in the past (USDA USDI 1994b). Variable density thinning to enhance diversity would benefit these species.

1.2.1.5 Forest Products

The first two goals of the project are to increase health and growth of stands and to provide for greater variability of vertical and horizontal stand structure (s. 1.3). The Forest acting alone cannot achieve the thinning designed to meet these goals. The proposal is to auction the rights to remove and utilize the timber to qualified contractors in exchange for accomplishing the variable density thinning and other important work as prescribed in this document.

One of the goals of the Forest Plan as amended by the Northwest Forest Plan is to provide a sustainable level of forest products for local and regional economies and to provide jobs. Wood is used to make many important products needed by society. The value of wood drives rural economies as logs are removed from the forest and processed into a myriad of eventual products. Much of the wood from this project would be used to make houses. With an estimated 15 million board feet, this project would produce enough wood to build several thousand houses. Other products that would come from the removed trees include chips for paper manufacturing and firewood.

Even though timber harvest from Federal lands has declined in recent years, the forest product industry in Oregon remains an important component of rural economies and provides approximately 25,000 living wage jobs in forest management and manufacturing. Locally approximately 4,400 of these jobs are in Clackamas County. The annual incremental contribution of each million board feet of timber is approximately 8.3 jobs (Oregon 2012). At this rate the proposed thinning project would generate or maintain 125 jobs. Jobs include woods workers that cut and remove the timber, equipment operators that repair and maintain roads, mechanics that service equipment, mill workers that process the raw materials, and craftsman that assemble wood products into their final usable form. The Northwest Forest Plan (p. 3&4-297) contains an in-depth analysis of employment in the timber industry.

The project has the potential to generate approximately 15 million board feet of wood products which is approximately half of the Forest's goal for one year. For the State of Oregon, the project represents 0.5% of the State's annual timber production (Oregon 2012). In terms of one local sawmill in rural Clackamas County, this volume represents approximately 15% of their annual needs.

In addition to covering the cost of thinning and logging, the value of the wood also covers the cost of road repair, road maintenance and road decommissioning.

In addition to the generation of wood products and jobs now, there is also the opportunity to thin plantations to keep them healthy and productive to provide sustainable levels of wood products into the future.

1.2.2 Management Direction

The proposed action has been designed to meet the goals and objectives of the documents listed below. This assessment is tiered to the Environmental Impact Statements and the listed plans are incorporated by reference.

- The Mt. Hood National Forest Land and Resource Management Plan Record of Decision and Final Environmental Impact Statement (USDA 1990a) and Standards and Guidelines (USDA 1990b), as amended, are referred to as the **Forest Plan**. The FEIS discusses environmental effects for Forest-wide programs and sets the stage for project level analysis. The Forest Plan contains standards and guidelines applicable to this project. Consistency is addressed in each resource topic of section 3.0.

- The Forest Plan was amended by the Northwest Forest Plan Record of Decision and Final Supplemental Environmental Impact Statement (USDA, USDI 1994a) and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. (USDA, USDI 1994b) (hereafter referred to as the **Northwest Forest Plan** or NFP). The NFP contains standards and guidelines for Matrix, Riparian Reserves and Late-Successional Reserves. Consistency is addressed in certain resource topics of section 3.0.

1.2.2.1 Land Allocations

The project has many overlapping land allocations. Some units have two or three land allocations on the same ground. Appendix A contains maps showing the proposed actions, land allocations and other details.

Allocation	Approximate Acres
Riparian Reserve	734
Late-Successional Reserve	726
B1 - Wild and Scenic Rivers	74
B2 - Viewsheds	1,446
B6 – Special Emphasis Watershed	1,800
B8 - Earthflow	1,068
C1 – Timber Emphasis	9

For each of the land allocations, thinning is an appropriate tool to use to move the area towards the desired conditions. The following is a brief summary of the goals of these land allocations and their existing and desired conditions. These are all elaborated further in chapter 3.

- **Riparian reserves** are part of the Aquatic Conservation Strategy and are designed to protect the health of the aquatic system and its dependent species. Other land allocations including A9 – Key Site Riparian and B7 – General Riparian overlap riparian reserves and have similar objectives. Riparian reserves are located adjacent to streams and other water bodies and wetlands. The project area has many streams, some of which flow through or adjacent to plantations. Approximately 734 acres of the project are in riparian reserves. Plantations within riparian reserves are overstocked with relatively uniform tree size and distribution, have low to moderate amounts of small diameter coarse woody debris, lack understory development and have low levels of large snags. These stands do not exhibit mature or late-successional characteristics; they are not able to fully meet the needs of riparian dependent species. The trees do provide some shade to streams and provide some small size woody debris. Thinning with appropriate buffers, can move riparian reserves toward the desired condition by accelerating the development of mature and late-successional conditions.

- **Late-successional reserves** are designed to serve as habitat for late-successional and old-growth related species, including the northern spotted owl. The North Willamette LSR Assessment (1998) contains recommendations for management. Approximately 726 acres of the project are in late-successional reserves. Plantations within LSRs are overstocked with relatively uniform tree size and distribution, have low to moderate amounts of small diameter coarse woody debris, lack understory development and have low levels of large snags. These stands do not exhibit mature or late-successional characteristics; they are not able to fully meet the needs of dependent species. Variable density thinning, including skips and gaps, can move late-successional reserves toward the desired condition by accelerating the development of mature and late-successional conditions.

- The Collawash River has recreational and scenic segments under the **Wild and Scenic River** system. The objective is to design projects that are consistent with the river's outstandingly remarkable values. Approximately 74 acres of the project are in this land allocation. Thinning can move the river corridor toward the desired condition by accelerating the development of mature and late-successional conditions.

- The **Matrix** consists of the following land allocations.

    - The **viewshed** land allocation is designed to provide attractive, visually appealing forest scenery. It would ensure that vegetation management practices create and the desired landscape character. Approximately 1,446 acres of the project are in this land allocation. Thinning with skips and gaps to add variability can move the viewshed toward the desired condition by softening the edges of unnatural patchwork patterns and diversifying uniform dense stands.

- **Special Emphasis Watersheds** are designed to provide for the maintenance or enhancement of watershed, riparian and aquatic habitat conditions. Approximately 1,800 acres of the project are in this land allocation. Appropriate levels of thinning can move these watersheds toward the desired condition by enhancing the health of stands.

- The **earthflow** land allocation is designed to maintain hydrologic and physical balances to prevent reactivation or acceleration of large, slow-moving earthflow areas. Approximately 1,068 acres of the project are in this land allocation. Appropriate levels of thinning can move earthflows toward the desired condition by enhancing the health of stands. Density management allows individual trees to maintain healthy live crowns and increased root growth.

- The **timber emphasis** land allocation is designed to provide lumber, wood fiber, and other forest products. The other matrix land allocations also have secondary goals of maintaining healthy stands through a variety of timber management practices. Thinning provides an immediate source of forest products, while making stands more resilient, allowing for a sustainable supply of forest products in the future.

1.2.2.2 Forest Plan goals, standards and guidelines

The Forest Plan contains, at its core, management goals and desired future condition statements that direct how the Forest is to be managed (p. Four-1 to Four-44). It also contains a multitude of standards and guidelines that were designed to guide projects to meet management goals and move the landscape toward the desired future condition.

Each resource heading in section 4 contains a discussion of management goals and standards and guidelines applicable to that resource. The Forest Plan describes the process for documenting exceptions to "Should" standards and guidelines (p. Four-45). The Forest Plan does not require a Forest Plan amendment for project level exceptions to these standards and guidelines. Where exceptions are appropriate to achieve Forest goals, the interdisciplinary project planning environmental analysis would document the rationale.

1.2.2.3 Other Relevant Management Direction and Laws

Survey and Manage
The Forest Plan was 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, USDI 2001). The project is exempt from the provisions of survey and manage because the stands are less than 80 years old and fit within the Pechman exemptions.

Invasive Plants
The Forest Plan was amended by the 2005 Record of Decision for Preventing and Managing Invasive Plants (USDA 2005), and Site-Specific Invasive Plant treatments for Mt. Hood National Forest and Columbia Gorge Scenic Area in Oregon (USDA 2008). Consistency is addressed in section 3.14.

Watershed Analysis
The project area is covered by the Collawash/Hot Springs Watershed Analysis (1995) which is incorporated by reference. This document provides summaries of the resource conditions found in the watershed and make recommendations for management to meet the goals of the Forest Plan.

The purpose and need is consistent with the recommendations of that analysis (page 4-5).

This project has adopted the concepts for riparian reserve delineation described in the watershed analysis. The site-potential tree height for this project is 180 feet. Also included in riparian reserves are certain unstable geological features. While streams, rivers, ponds, wetlands and certain unstable geological features were shown on maps in the watershed analysis, they were conceptual based on data available at the time with limited field verification. For this project, maps were refined based on field inspections. For example, some streams shown on the watershed analysis maps were found to not be there while other unmapped streams were discovered. There is also newer information about fish presence. The project areas have been examined by a geologist to determine the presence or absence of unstable landforms. All of this field-verified information was used to create a more accurate riparian reserve map. This new map is not considered a change to the recommendations put forward in the watershed analysis or the Northwest Forest Plan but simply a more accurate refinement of the intent of those documents.

LSR Assessment
Approximately 726 acres of the proposed action are in late-successional reserves. The North Willamette LSR Assessment (1998) covers these units. This assessment recommends thinning plantations (p. 6-16). The Regional Ecosystem Office (REO) reviewed this project and found it to be consistent with LSR standards and guidelines (REO 2012).

Roads Analysis
A Forest-wide Roads Analysis was completed in 2003 (USDA 2003). Section 3.12 discusses roads for this project and how they relate to the Forest-wide analysis. Recommended road decommissioning has also been assessed in separate Environmental Assessments.

National Environmental Policy Act
The National Environmental Policy Act of 1969 establishes the process and content requirements of environmental analysis and documentation. Implementing

regulations are outlined in 40 CFR Parts 1500-1508 and Forest Service Handbook 1909.15. This document has been prepared in accordance with these regulations.

Endangered Species Act

Section 7(a)(2) of the Endangered Species Act of 1973, as amended, requires federal agencies to review actions authorized, funded, or carried out by them, to ensure such actions do not jeopardize the continued existence of federally listed species, or result in the destruction or adverse modification of listed critical habitat. Consultation has been completed where required. Listed species are addressed in sections 3.3 and 3.7.

National Forest Management Act

The National Forest Management Act (NFMA) of 1976 requires that the Agency develop land management plans. It also requires the Forest to determine the suitability of a specific land area for timber management and contains other requirements that are built into Forest Plan standards and guidelines. The proposed action was developed to be in full compliance with NFMA via compliance with the Forest Plan, as amended. This document contains numerous references as to how this project complies with Forest Plan, as amended, and the Silvicultural Prescription in the Analysis File contains a discussion of compliance with NFMA's requirement to identify lands unsuited for management.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996, requires federal action agencies to consult with the Secretary of Commerce (NMFS) regarding certain actions. Consultation is required for any action or proposed action authorized, funded, or undertaken by the agency that may adversely affect essential fish habitat (EFH) for species identified by the Federal Fishery Management Plans. See s. 3.3.

National Historic Preservation Act

Section 106 of the National Historic Preservation Act of 1966 requires documentation of a determination of whether each undertaking would affect historic properties. The Forest operates under a programmatic agreement between the Oregon State Historic Preservation Office (SHPO) and the Advisory Council on Historic Preservation for consultation on project determination. Consultation with SHPO was completed for this project. See s. 3.17.

Wild and Scenic Rivers Act

Section 7(a) of the 1986 Wild and Scenic Rivers Act prohibits agencies of the United States from assisting in any water resources project that "…would have a direct and adverse effect on the values for which such a river was established…" Section 7 provides authority to the Secretary of Agriculture to evaluate and make a determination on water resources projects that affect wild and scenic rivers. The authority for that determination for projects on National Forest System lands is delegated to the Forest Supervisor (Forest Service Manual 2350). The project is in

scenic and recreational sections of the Collawash Wild and Scenic River corridor. See s. 3.11.

Clean Water Act
The Clean Water Act of 1977 (CWA) and subsequent amendments established the basic structure of regulating discharges of pollutants into waters of the United States. The Environmental Protection Agency (EPA) has the authority to implement pollution control programs and to set water quality standards for all contaminants in surface waters. The EPA delegated implementation of the CWA to the States; the State of Oregon recognizes the Forest Service as the Designated Management Agency for meeting CWA requirements on National Forest System lands. The proposed action is in compliance with the Clean Water Act as described in s. 3.3 and s. 3.4. At this time it is uncertain whether this project will require a National Pollution Discharge Elimination System (NPDES) permit, due to ongoing judicial proceedings. Should it be determined that an NPDES permit is required for this project, the Forest Service will comply with any applicable NPDES permitting requirements (s. 3.4.3).

Clean Air Act
The Clean Air Act (CAA) as amended in 1977 addresses the air quality in Wilderness areas. All planned ignitions are conducted according to the Operational Guidance for the Oregon Smoke Management Program (OSMP). The Operational Guidance contains the direction for meeting the terms of the OSMP. The Environmental Protection Agency has approved the OSMP as meeting the requirements of the Clean Air Act, as amended. The OSMP, which is administered by the Oregon State Forester, regulates the amount of forestry related burning that could be done at any one time. Also, in compliance with the Clean Air Act, the Forest Service is operating under the Oregon Administrative Rule (OAR) 629-43-043. The proposed action is in compliance with the Clean Air Act as described in s. 3.15.

1.3 Purpose and Need for Action

The purpose of this project is to enhance the productive capacity of mid-aged stands in the Collawash watershed in order to provide for the sustainability of resources and forest uses as prescribed by the Forest Plan as amended. For more in-depth discussion, refer to sections 1.2.1.3, 1.2.1.4 & 1.2.1.5.

- There is a need to increase health and growth of stands because mid-aged stands within the project area are experiencing a slowing of growth due to overcrowding and some are experiencing suppression caused mortality. *This need is described in the Forest Plan on pages Four-5, Four-91, FW-372 & Four-292.* The accomplishment of this objective will be measured by acres treated, the change in average tree diameter in 40 years, and the change in tree growth rates in 40 years. See sections 1.2.1.3, 2.4 & 3.1.

- There is a need for greater variability of vertical and horizontal stand structure because mid-aged stands within the project area do not have a mix of tree species that were present in the original stand and they are relatively uniform in terms of tree size and spacing. Also, there is a need for more sunlight on the forest floor to create greater diversity of ground vegetation. *This need is described in the Forest Plan on page Four-67.* The accomplishment of this objective will be measured by acres treated, the change in tree species composition, the change in the abundance of other desired plants, the change in vertical canopy layers, the change in horizontal structure with skips and gaps, and the changes to snags and down logs. See sections 1.2.1.4, 2.4, 3.1, 3.2 & 3.8.

- There is a need is to keep forests healthy and productive to sustainably provide forest products now and in the future. *This need is described in the Northwest Forest Plan ROD page 26 and Forest Plan pages Four-3 & Four-26.* The accomplishment of this objective will be measured by the volume of wood products. See sections 1.2.1.5, 2.4, 3.1 & 3.16.

1.4 Proposed Action

To maintain and enhance long-term forest health and resiliency and to restore some elements of diversity, the Forest proposes to alter and restore vegetative structure, density, and composition. The three purpose and needs discussed above would receive a slightly altered emphasis based on the different objectives in the various land allocations. The Proposed Action would thin mid-aged stands and would repair, reconstruct and decommission associated roads. The proposed action is to thin and harvest wood fiber from approximately 2,053 acres of plantations in late-successional reserves, riparian reserves and matrix. This acreage figure represents the sum of all of the plantations considered for treatment at this time. It is estimated that approximately 1,588 acres would actually be thinned after accounting for stream protection buffers and other subtractions. Within the 2,053 acres of plantations, some non-thinning treatments are also proposed including the creation of snags and down logs and releasing conifers by cutting competing brush.

This action is proposed by the Forest Service in collaboration with the Clackamas Stewardship Partners.

1.4.1 Variability – Diversity and variability (s. 3.2) would be introduced in several ways:

- Leave-tree spacing would vary within units and between units. Tree density would be measured by basal area, trees per acre or relative density depending on the circumstances for each unit (s. 3.1). Where the objective is to delay the time at which the stand reaches the stem exclusion stage, a heavy variable-density thinning would be prescribed (wide leave-tree spacing). In other areas the objective would be to have stands reach the stem exclusion stage sooner and they would have moderate or light variable-density thinning.

- Skips and gaps would be created in a variety of sizes. The sizes and total quantity would vary within and between units. (Skips are areas where no trees would be removed; gaps are areas where most or all trees would be removed.)
- Skips may be placed where there are special features such as clumps of minor species, large snags, wet areas, or locations of rare or uncommon species.
- Gaps would be up to one acre in size.
- Areas of heavy thinning (25 to 50 trees per acre retained) would be created in a variety of sizes greater than 1 acre. Heavy thinning is proposed to benefit species such as deer and elk as well as to enhance diversity.
- Leave trees may include minor species.
- Leave trees may include trees with the elements of wood decay.
- All non-hazardous snags would be retained.
- Existing down logs would be retained.
- Some snags and down logs would be created (s. 1.4.9.2&3).

1.4.2 Streamside Riparian Reserves - For this project, riparian reserve widths are 180 feet for non-fish-bearing streams and 360 feet for fish-bearing streams. In riparian reserves the thinning outside the protection buffers would be designed to create conditions suitable for tree growth and to enhance diversity while providing sufficient quantities of large wood recruitment. The intention is to enhance riparian reserves by accelerating the development of mature and late-successional stand conditions. Protection buffer widths are discussed in section 1.4.9.4.

Skips & Gaps - The protection buffers along streams may be considered skips. Skips would be created outside of protection buffers that would vary in size and would be up to 5% of each unit. Gaps would be created within riparian reserves but they would be 100 feet or farther from a stream. For units adjacent to listed fish habitat (LFH), gaps would be 180 feet or farther from listed fish habitat. Gaps would be 0-10% of the available riparian component.

1.4.3 Other Riparian Reserves – There are some small seeps and wet areas. Riparian features that are not perennial or intermittent streams such as seeps, springs, ponds or wetlands would be protected by the establishment of protection buffers that incorporate the riparian vegetation. The protection buffers along ponds, seeps and wet areas may be considered skips. The active ancient landslides landform type is also included in riparian reserves.

1.4.4 Late-Successional Reserve - The thinning would be designed to accelerate the development of mature and late-successional stand conditions and to enhance diversity. Where riparian reserves overlap late-successional reserves, the relative densities, protection buffers, and skips/gaps as described for riparian reserves would be used. Outside of skips, riparian buffers and gaps, trees would be retained at a relative density of approximately 30. Trees would be retained so that the average canopy cover including riparian reserves, skips and gaps equals at least 40% canopy cover. In late-successional reserves, trees would not be cut if they are greater than

20 inches in diameter (at a height of 4.5 feet). If larger trees need to be cut for skyline corridors, skid trails, landings or temporary roads they would be left in place. (The LSR units contain few trees of this size.) Hardwood trees across a range of size classes would be favored, including large trees that occupy mid-canopy and higher positions.

Skips & Gaps - Skips would be created that would vary in size and would comprise a minimum of 10% of each unit. Where riparian reserves overlap late-successional reserves, the protection buffers adjacent to streams may be counted as skips. Gaps would be created on 3 to 10% of each unit.

1.4.5 Matrix - In the matrix, thinning would be designed to increase health and growth that results in larger wind-firm trees and to enhance diversity and forage. Trees would be retained at a relative density of 20 to 25 (s. 1.2.1.3 & s. 3.1).

Skips & Gaps - Skips would be created that would vary in size and would comprise up to 5% of each unit. Where riparian reserves cross through matrix, the protection buffers adjacent to streams may be counted as skips. Gaps would be created on up to 5% of each unit. Local and regional experience has shown that these levels help create variability and diversity while still meeting other project objectives.

Forage & Other Treatments - Heavy thins would be created on up to 10% of each unit. Certain units have been identified for additional forage enhancement based on observed vegetation and use by deer and elk. These include units 90, 100, 116, 118 and 140. In these units, 3 to 5 acre forage areas would be created leaving approximately 40 trees per acre. Certain plantations have sparse areas where thinning is not viable but silvicultural treatments are proposed to release trees so they can grow to their full potential and to stimulate forage. Brushing and cutting of small trees would occur in parts of units 94, 100, 104, 106, 108, 116 and 118.

1.4.6 Roads

To facilitate safe use, several roads are in need of repair including deep patch repairs and leveling courses added over poly fabric. In addition, most haul roads would receive road maintenance including ditch and culvert cleaning and brushing. Gravel roads would have rock added in spots and would be bladed and shaped where needed. This work is within the road prism.

1.4.6.1 System Road Repairs and Maintenance

Road Number	Length (miles)	Cost $	Notes
6300	3.7	63,164	220 ton AC Level & Patch, 1 Roll Poly Grid, 2 Roll Glass Grid,100 cubic yards Spot Rock; Road Failures (at MP 9.19, 10.93, and 11.93): Sawcut & Remove AC, Excavate, Fill (50, 110, and 40 cubic yards)
6300170	0.56	2,000	
6300180	0.12	1,280	
6310	9.77	30,045	16 cubic yards Spot Rock 5 cubic yards Pit Run and 2 cubic yards Surface Rock to Repair Edge Failure @ MP 7.27
6310240	0.5	1,250	
6311	5.12	16,360	Repair at Cap creek funded by other contract.
6311120	0.3	1,050	
6311150	0.66	1,650	
6320	3.3	3,850	2.0 mi. of Pavement Grinding by other contract. Repair at Fan Cr. By other contract, 15 cubic yards of Spot Rock
6330	5.54	14,250	Repair of slide by other contract. 10 cubic yards of Spot Rock
6330014	0.2	3,520	100 cubic yards Pit Run rock
6330130	0.25	650	
6330200	0.53	1,378	
6330240	0.33	858	
6340	7.94	27,509	115 cubic yards Spot Rock, 5 Water Bars, 1 Drain Dip, Regrade Roadway with 30 cubic yards Pit Run
6340017	0.15	390	
6340019	0.18	486	
6340140	0.97	2,522	
6340150	0.17	450	
6340164	0.3	1,680	30 cubic yards Pit Run
6340170	0.56	1,456	
6340230	0.5	1,550	
6340240	0.58	1,450	
6340290	0.81	2,187	
6341	.34	850	
6341011	0.11	1,215	
6350	4	38,632	200 ton AC Level & Patch, 1 Roll Poly Grid, 1 Roll Glass Grid, 15 cubic yards Spot Rock
6350120	0.63	1,575	
6350150	0.1	260	
6350160	3.78	16,606	15 cubic yards Spot Rock, 100 cubic yards Sluff Removal
6350180	0.1	260	
6350200	0.25	275	
6360	2.12	5,300	
6370	1.2	4,390	
6380	1.9	6,250	25 cubic yards Spot Rock
6380120	0.57	4,462	30 cubic yards Spot Rock, 1 Water Bar, 1 Drain Dip
7010	6	16,600	40 cubic yards Spot Rock, Damage at MP 5.3 not funded by this project.
7010016	0.08	540	
7010019	0.25	3,025	50 cubic yards Spot Rock
7010020	0.15	1,935	30 cubic yards Spot Rock
7010120	0.82	3,650	40 cubic yards Spot Rock
7015	1.53	4,625	20 cubic yards Spot Rock
	67 miles		

1.4.6.2 Temporary Roads

Temporary roads are roads that are built or reconstructed to access landings and are decommissioned upon completion of logging until they are needed again. Maps in Appendix A show the location of these roads. Existing road alignments were assessed to determine whether they are needed for the current thinning proposal. Approximately 12 miles of existing road alignments would be reused as temporary roads and decommissioned again upon project completion. Of these 12 miles, approximately 5 miles were never actually actively decommissioned in the field but would be decommissioned after use. The reuse of existing alignments is consistent with Forest Service policy as described in Forest Service Manual 7703.22.

Even though all of the proposed units were clear cut logged before, there are cases where it is not feasible or desirable to use the same roads, landings or logging methods used before. In some cases new temporary roads are proposed to access landings where the existing system roads and old road alignments do not adequately access the ground. Approximately 0.4 mile of new temporary roads would be constructed and decommissioned upon project completion.

For this document, the term decommission is used to describe the type of closure that is standard practice now for temporary roads. After use, temporary roads are bermed at the entrance, water barred, decompacted and roughened as needed with the jaws of a loader or excavator, and debris such as rootwads, slash, logs or boulders are placed near the entrance and along the first portion of the road.

1.4.6.3 Temporary Road Construction and Reconstruction

Unit #	Temporary Roads (miles)	notes
6 to 14	0.73	*
10	0.06	
12&14	0.1	New
12&14	0.68	
18	0.15	*
24,26,30,38	1.08	
32	0.16	*
34	0.04	
46	0.19	New
58	0.62	
64,66	0.62	*
64	0.18	
70	0.50	
74	0.54	
78	0.03	
80	0.14	
84	0.05	
86	0.07	
88	0.06	New

Unit #	Temporary Roads (miles)	notes
90	0.11	
94	0.2	
98	0.11	
100	0.35	
104	0.1	
108	0.1	
110	0.31	
112	0.43	*
118	0.7	*
126	0.13	
128	0.02	New
130	0.08	
132	0.74	*
137, 138, 140	1.01	
138	0.02	New
144	0.45	*
146	0.4	*
148	0.04	
154	0.28	*
156	0.11	
158	0.2	
Total New	**0.4**	
Total Old	**12**	

* indicates additional notes below

- Units 6 to 14: Between the time of the preliminary assessment and this environmental assessment, an error was discovered that relates to the road to units 6 through 14. In the Preliminary Assessment the road was listed as a system road - 6311.130 with a length of 0.73 mile. It should have been listed as a temporary road no longer on the Forest's transportation system.

  This road was closed with a guard rail barrier in the 1990s. The interdisciplinary team presumed that the road decommissioning for this road authorized in 2007 had not yet occurred because: 1/ no action had been taken in the field to effectively block the entrance with a berm, 2/ no scarification or roughing of the road surface had occurred, and 3/ the system road number sign post remained at the road entrance.

  The decision for the 2007 Clackamas Restoration Projects EA however, indicated that the road could be removed from the Forest's data base with no treatment in the field.

  In the preliminary assessment, the proposed action erroneously described temporarily opening a system road after performing brushing and blading, using it to haul the logs from units 6, 8, 10, 12 and 14 (80 acres), and reclosing the road with the existing guard rail barrier. The current proposed action in this document recognizes the road as decommissioned even though active treatments did not

occur. The current proposal is to open the existing alignment as a temporary road. It would be opened by performing brushing and blading and it would be used to haul the logs from these same units. After completion of thinning, the road would be decommissioned by establishing an effective berm at the entrance, decompacting the first 1/8 mile and installing drainage dips where necessary do divert water off the road.

This document as been adjusted to reflect the new proposed action numbers, however the numbers have not been changed in resource specialist reports or other related documents. The map on page A18 of the appendix shows the original road number.

The environmental effects of this change would be similar to what was already assessed. After completion, the road would be more effectively decommissioned.

- Unit 18: The existing temporary road was never decommissioned. The road crosses a seep with an existing log ford that has decayed. The proposed action is to construct a temporary crossing utilizing a log ford (new logs) and pit run rock.

- Unit 32: The existing temporary road was never decommissioned. A culvert failed at a crossing of a perennial stream. The proposed action is to construct a temporary crossing using a log ford and pit run rock.

- Unit 64: The existing road alignment crosses a seep. The proposed action is to reconstruct as a temporary road and use a French drain with pit run rock at the seep.

- Unit 112: The existing road alignment crosses two seeps. The proposed action is to reconstruct as a temporary road using French drains with pit run rock.

- Unit 118: The existing road alignment crosses an intermittent stream. The proposed action is to reconstruct as a temporary road using a 36 inch temporary culvert and pit run rock.

- Unit 132: The existing road alignment crosses three small seeps. The proposed action is to reconstruct as a temporary road using French drains with pit run rock.

- Unit 144: The existing road alignment crosses an intermittent stream which has a culvert. The proposed action is to reconstruct as a temporary road. The culvert would be removed when the road is decommissioned.

- Unit 146: The existing temporary road was never decommissioned. It crosses an intermittent stream that is causing erosion. The proposed action is to reconstruct as a temporary road using pit run rock at the crossing.

- Unit 154: The existing temporary road alignment has an existing log crossing over a seep. The logs were never removed and are decayed. The proposed action is to reconstruct as a temporary road utilizing a log ford (new logs) and pit run rock.

1.4.7 Logging Systems

Logging systems are estimated based on aerial photo interpretation and field visits. Further detailed field analysis is needed particularly for skyline systems to verify that the system would work as desired. The project design criteria would be used with this further analysis to adjust and validate logging systems.

	acres
Ground Based	440
Skyline	939
Helicopter	209

1.4.8 Unit Table

				Alternative B		
UNIT #	**Total Size Acres**	**Likely Net Size Acres**	**LSR**	**Ground Based Acres**	**Skyline Acres**	**Helicopter Acres**
2	2.3	1.3				1.3
4	4.7	4.4				4.4
6	1.5	1.5		1.5		
8	15.1	15.1		15.1		
10	7.1	5.5		1.5	4	
12	51.4	45.7		15.6	30.1	
14	12.9	12.4			12.4	
16	8.6	7.2				7.2
18	17	13		8		5
20	2.9	2.5				2.5
22	1.1	1	Y		1	
24	10.9	10.9	Y	3.4	7.5	
26	32.4	31	Y	5	26	
28	33	28	Y			28
30	38.3	21.4	Y	6	7	8.4
32	26.8	15	Y	2	13	
34	38.5	25	Y		12	13
36	31.8	25	Y			25
38	24.7	22	Y	4	18	
40	31.5	22	Y			22
42	4.5	4			4	
44	21.8	13		4	9	
46	23.6	16		4	12	
48	21	9.4			2.6	6.8
50	30.8	30.8			20	10.8
52	38.9	30		5	20	5

				Alternative B		
UNIT #	**Total Size Acres**	**Likely Net Size Acres**	**LSR**	**Ground Based Acres**	**Skyline Acres**	**Helicopter Acres**
54	27	12.3	Part	2	4.3	6
56	7.9	2.8	Y		2.8	
58	27.6	24.3		10	14.3	
60	26.9	18	Y	1		17
62	32.9	32	Y	1	31	
64	33.5	29	Y	5	24	
66	9	9	Y		9	
68	12.6	7.5	Y		7.5	
69	14.3	14.3		3	11.3	
70	33.4	30	Y	4	26	
72	4.1	4		4		
74	38.2	33	Y	6	23	4
76	13.5	10				10
78	24	20	Y	2	18	
80	59.8	57		51	6	
82	26.7	21.5	Y	2	19.5	
83	27.1	15		15		
84	24	14.4			14.4	
86	31.6	26			26	
88	22.6	20		12	8	
90	25	25		13	12	
92	3.8	3			3	
94	18.4	14.6		10.6	4	
96	3.2	3		3		
98	16.6	16		2	14	
100	47	40		35	5	
101	0.8	.8			.8	
102	2.2	2.2			2.2	
104	45.5	27		5	22	
106	29.4	12.2			12.2	
108	38.9	25			25	
110	26.6	17	Y		17	
112	20.9	11	Y		11	
114	23.5	13		13		
116	29.2	23.5				23.5
118	67.3	50		25	25	
120	11.9	11	Y	11		
122	48.3	30	Y	10	20	
124	44.8	38	Y	8	30	
126	46.7	46	Y	10	36	
128	40.8	30		22	8	
130	65.4	35		12	23	
132	50	40		8	32	
134	46.1	40		10	30	
136	2.7	2.7		2.7		

				Alternative B		
UNIT #	Total Size Acres	Likely Net Size Acres	LSR	Ground Based Acres	Skyline Acres	Helicopter Acres
137	1.8	1.8		1.8		
138	36.9	31		4	27	
140	34	28		5	23	
142	2.4	2.4		2.4		
144	28	24		6	18	
146	46.2	38		10	28	
148	24.6	23		6	17	
150	7.2	6				6
152	2.1	2.1				2.1
154	38.9	34		3	31	
156	38.3	21		2	19	
158	6.6	6.6		6.6		
	2,053	1,588		440	939	209

1.4.9 Best Management Practices (BMPs) and Design Criteria

These are practices that are part of the proposed action. The effects and benefits of these practices are included in the analyses of effects in s. 3. In some cases they are standard practices that are used in all similar projects and in other cases they are specifically tailored to this project based on site-specific factors such as the underlying land allocation and associated standards and guidelines.

1. **Seasonal restrictions**

Soils: No operation of off-road ground-based equipment would be permitted between November 1 and May 31. This restriction applies to the ground-based portions of harvest units. It also applies to ground-based equipment such as harvesters or equipment used for fuels treatment. This restriction may be waived if soils are dry, frozen or snow covered. The District or Forest soil scientist would be consulted.

If soil moisture exceeds 20%, waivers may be considered for operations on approved skid trails as long as ruts do not exceed 12 inches in depth over more than 10 percent of a designated skid trail system.
For frozen conditions waivers may be considered if the following conditions are met:

Soil not frozen	Need 10 inches of machine-packed snow
2 inches of frozen soil	Need 6 inches of machine-packed snow
4 inches of frozen soil	No snow cover necessary

Northern Spotted Owl: There are restrictions during the breading season for certain activities based on the type of activity and the distance to activity centers.

Details on the restrictions and rationale are in the U.S. Fish and Wildlife Service's Letter of Concurrence. There is a restriction for the use of large Type 1 helicopters (other than KMAX). Their use is restricted within 768 yards of an activity center between March 1 and September 30. This applies both during yarding and transit to other sites. The helicopter portions of units 28, 34, 40 and 48 are within this distance zone. Fewer restrictions would apply if operators opt to use smaller helicopters. Restrictions also apply to the use of chainsaws (393 yards) and heavy equipment (363 yards) between March 1 and July 15. A portion of Unit 46 is within these distance zones.

Deer and Elk Winter Range: No harvest operations, road construction, use of motorized equipment or blasting would be permitted in Crucial or High Value winter range areas between December 1 and March 31. The restriction would be waived in the High Value zone if snow accumulation levels are less than 12 inches or if it is determined that the area is not being used by elk. Units 20, 110, 112, 114, 116, 118, 136, 137, 138, 140, and 158 are in the crucial zone. Units 28, 36, 40 and 62 are in the High Value zone.

No log haul or snow plowing would be permitted on roads 6300170, 6311, 6320, 6330 or 7010 between December 1 and March 31. For some units alternate haul routes are available including roads 6350, 6355, 4600 and 4670 that have no restriction. *This implements Forest Plan standard and guideline FW-211.*

Peregrine Falcon: No helicopter use below 1,500 feet Above Ground Level would be permitted from January 15th to July 31st. This applies to units 2, 4, 16, 18 and 20. These restrictions may be waived if the nest site is unoccupied or if nesting efforts fail and there is not possibility of re-nesting. Documentation of nesting failures can be finalized no earlier than June 30th due to the possibility of re-nesting.

2. **Snags & wildlife trees:** To enhance diversity, variable-density thinning would include the retention of snags and wildlife trees. The snags within plantations are small planted trees that have died. Few if any legacy snags are present.

   Snags would be retained in all units where safety permits. If snags must be cut for safety reasons they would be left on site.

   To increase the likelihood that snags would be retained, they may be included in skips.

   Certain live trees would also be selected as leave trees that have the "elements of wood decay" as described in the DecAID advisor. This may include trees with features such as dead tops, broken tops and heart rot. They may be retained in skips.

Except in certain root rot patches where snags are abundant, live trees would be treated to provide future snags and future cavities. Techniques include but would not be limited to topping. **Three trees per acre would be treated in LSR units and one per acre would be treated elsewhere.** Snags would be created farther than one tree height from system roads to minimize safety issues. If funding is limited, the LSR units would be the priority.

3. **Down Woody Debris:**
   Old down logs currently on the forest floor would be retained.

   Additional down woody debris would be generated by thinning. This would include the retention of cull logs, tree tops, broken logs and any snags that would be felled for safety reasons.

   Except in certain root rot patches where down woody debris is abundant, live trees would be felled or girdled to provide future habitat. **In the LSR units, five trees per acre would be girdled and two per acre would be felled. Elsewhere two trees per acre would be treated with either method.** Trees would be treated farther than one tree height from system roads to minimize safety issues and potential losses from firewood gathering. If funding is limited, the LSR units would be the priority. *This implements Forest Plan standards and guidelines as amended.*

4. **Riparian and Aquatic –** Specific Riparian practices are described in sections 1.3.1 to 1.3.4. In this section the "dry season" is generally June 1 to October 31 dependent upon soil moisture conditions, and the "wet season" is the rest of the year. *The following design criteria were developed in consultation with the National Marine Fisheries Service.*

   A1. The projects would be designed to be consistent with riparian reserve standards and guidelines found in the Northwest Forest Plan, and the appropriate Best Management Practices for the protection of water quality.

   A2. Timber harvest within riparian reserves would retain all legacy trees where safety permits (legacy trees include snags and live trees left from previous harvest that are typically larger than the remaining trees in the stand). Variable density thinning would be used in riparian reserves. Thinning would be primarily a "thin from below" to retain the dominant and/or co-dominant trees with the introduction of skips and gaps. Hazard or Danger trees may be cut for safety reasons but would be left on site. Gaps are allowed in riparian reserves, only if each resulting opening is 1/4 acre or less in size.

   A3. Streams within the project area would be protected with buffers as shown in the following table. These minimum widths may be expanded based on the criteria described below.

	Within 1,000 feet of LFH	1,000 feet to 1 mile from LFH	Greater than 1 mile upstream from LFH
Perennial Streams	100 feet	Buffer would vary from 60 to 100 feet wide based on site-specific conditions.*	50 feet
Intermittent Streams	50 feet	50 feet	30 feet

* Buffer widths in most cases would be 100 feet except in units 20, 40, 72 and 74 where they would be 60 feet on the north side of the stream.

Within these buffers, tree felling or yarding would generally not occur (with the exception of felling and yarding through skyline corridors, see specific PDC under Yarding). Stream buffers are measured using slope distance from the edge of active channel (stream banks) on both sides of the stream. The minimum buffers would be expanded to include the following features, where recommended by the unit fisheries biologist:

a. Slope break = the point of topographic change below which management would result in active erosion or introduction of material into the stream channel or floodplain area.

b. Floodprone area = area accessed by the stream during medium to large peak flow events, typically defined as 2 times the bankfull depth.

c. High water table area = wetlands, seasonally saturated soils, standing water, seeps, bogs, etc.

A4. Unstable slopes (areas adjacent to streams with indicators of active erosion such as ravel on the surface or jack-strawed trees), or sensitive stream reaches (such as streams where the dominant channel substrate is sand), or channels with high residual impacts (i.e. bank erosion, downcutting, heavy fine sediment load) would have protection buffers of at least 100 feet unless a site-specifically designed buffer is prescribed by the unit fisheries biologist and the unit slope stability specialist.

A5. Limit ground disturbing activities, such as ground-based yarding, road construction/reconstruction/renovation, road decommissioning and landing construction, to the dry season when the soil is more resistant to compaction and soil moisture is low. Operation outside this season would be evaluated by a soil scientist.

B. Tree Felling

B1. Trees would not be felled within the Stream Protection Buffer associated with any perennial stream (with the exception of hazard trees and trees within skyline yarding corridors; see below).

B2. Thinning within the riparian reserve on perennial streams would occur; however, approximately 50% canopy closure would remain in this treated zone.

B3. Harvested trees that would be yarded would be felled away or parallel to the stream buffer. Trees that are inadvertently felled into the stream buffer, or trees felled to create yarding corridors within the stream buffer, would be left on site.

B4. Felling in riparian reserves would not create openings greater than 1/4 acre in size.

B5. The distance separating a gap from LFH would be greater than the height of a site potential tree. The distance separating a gap from all other streams would be at least 100 feet.

C. Yarding

C1. Skyline or ground based yarding would not occur within the buffers associated with LFH. Skyline yarding over streams with LFH is acceptable if the logs can be fully suspended above the existing stream buffer tree canopy.

C2. Require full suspension when yarding logs over non-LFH stream channels and within their protection buffers. Require full or one-end suspension when yarding in the remaining (outer) portion of the riparian reserve. Use one-end suspension with lateral skyline yarding, to the extent practicable.

C3. Limit the establishment of skyline yarding corridors over perennial streams to no more than five corridors per 1,000 lineal feet of stream. Individual corridor widths would not exceed 15 feet. Corridors would be spaced at least 100 feet apart (along the stream).

C4. The use of ground based yarding and felling equipment is prohibited on slopes exceeding 35%, within riparian reserves.

C5. Do not use existing landings if they are:
a) within 200 feet of LFH,
b) within 200 feet of a non-LFH stream, if the potentially affected stream reach is within 0.5 miles of LFH, or
c) within 100 feet of any stream channel;
without the approval of the District or Forest fisheries biologist. Appropriate mitigation measures would be included to minimize erosion or sediment transport to streams.

C6. If an existing landing is less than the distances in C5, erosion control measures would be installed prior to use where appropriate to prevent soil movement downslope from the landing. Erosion control measures may include,

but are not limited to, use in the dry season, straw bales around landing perimeter, and rock surfacing. The landing would be rehabilitated (compacted soils fractured, seeded) after use.

C7. Landings planned for use in the wet season, may need to be surfaced with aggregate material, dependent upon soil moisture conditions.

C8. Use existing landings and skid trails to the maximum extent possible. Within riparian reserves, the maximum amount of new soil compaction (defined as management-caused crowding of soil particles which causes a decrease in soil porosity of 50% or more, and an increase in soil density) caused by skid trails, corridors, and landings associated with activities in the proposed action would not be more than 10% of the harvest unit area.

C9. Skid trails would not be constructed through areas with a high water table, or be located in areas that would channel water onto unstable headwall areas.

C10. Where feasible, harvesters would place logging slash in their path.

D. Temporary Road and Landing Construction and Reconstruction

D1.Construction of new temporary roads or landings within 500 feet of LFH or within 200 feet of any other stream, would not occur.

D2. Emphasize the reuse of existing road alignments rather than the construction of new roads where appropriate. Where stream crossings are needed on existing alignments, they would be designed to minimize impacts to listed fish using techniques such as French drains, log fords and temporary culverts that would be used and removed the same season.

D3. New temporary road construction would generally occur on or near stable ridgetop locations, or on stable, relatively flat topography. Do not allow sidecast road construction when the hill slope exceeds 30%.

D4. Require an aggregate of rock or wood chips, or paved surface for all temporary roads or landings that would be used in the wet season dependent upon soil moisture conditions).

D5. Road construction would not increase the permanent stream drainage network (i.e. roads would be outsloped, or the outflow of new ditch relief culverts or other drainage structures would not drain to streams).

D6. Cross drains discharge to stable vegetated slopes where the outflow would quickly infiltrate the soil and not develop a channel to a stream.

D7. When constructing or reconstructing roads, the width of the compacted surface and ditch line would not be wider than 24 feet except at landings.

D8. Implement erosion control measures to prevent offsite movement of disturbed or exposed soil associated with road and landing construction (including cutbanks, fills, ditches, etc.) on road segments that have the potential to directly or indirectly deliver sediment to any stream channel. Erosion control measures include silt fences, straw bales, matting, mulch, slash, water bars, grass seed [or other products], etc. This work would occur prior to the wet season.

E. System Road Renovation, Reconstruction, and Maintenance

E1. Limit scheduled soil disturbing renovation and reconstruction activities to the dry season, unless the road segment has no hydrologic connection.

E2. No Road renovation or reconstruction within 200 feet of LFH.

E3. For road renovation and reconstruction, the width of the compacted surface and ditch line would not be wider than 24 feet except at landings. Road work on existing roads that are wider than 24 feet would not result in an increase in the road width.

E4. Implement erosion control measures to prevent offsite movement of disturbed or exposed soil associated with road renovation and reconstruction (including cutbanks, fills, ditches, etc.) on road segments that have the potential to directly or indirectly deliver sediment to any stream channel. Erosion control measures include silt fences, straw bales, matting, mulch, slash, water bars, grass seed [or other products], etc. This work would occur prior to the wet season.

E5. Existing desirable vegetation (e.g. grass) in ditchlines that discharge to streams would not be removed unless an effective sediment trap is installed and maintained until vegetation is reestablished. This does not restrict brush or tree cutting that leaves roots intact.

E6. Do not grade material removed from ditchlines onto the road surface where the road surfaces are within 200 feet of LFH or 100 feet of non-LFH. Material that must be removed from ditch lines within these distances would be removed and stored farther than 200 feet of LFH or 100 feet of non-LFH and where they cannot flow directly to a stream.

E7. The installation of cross drain culverts would result in a culvert which drains to a stable hill slope with porous soils, allowing for water infiltration, with a low probability of erosion, and subsequent new channel formation that connects to an existing stream.

E8. Woody material removed from stream channels during culvert maintenance would be retained in the stream network. Typically this would entail repositioning wood located upstream from a culvert to a location downstream of the culvert. This activity is prohibited in LFH.

E9. Close and waterbar native surfaced roads prior to the wet season and between operating seasons to prevent use and reduce erosion.

E10. At the termination of the contract, native surfaced roads would have drainage structures (e.g., waterbars) installed, and the road closed to prevent use, if the road is hydrologically connected to any stream.

F. Timber Transport

There are no restrictions on the transport of timber over paved roads.

F1. Avoid haul routes that require travel over unstable road segments, if road use or failure would result in sediment delivery to any stream.

F2. Timber transport operations would be stopped immediately if road use is causing rutting of the road surface, ponding of water on the road, failure of any drainage structure, or any other action occurs which increases the sediment delivery to a stream. Actively implement restorative work to reduce or eliminate the erosion. The road surface would be repaired before haul can resume.

Dry Season Haul:
F3. Timber transport on aggregate surfaced and natural surfaced roads is allowed during the dry season if the following criteria are met:
a) The approach and crossing of each LFH stream is paved or has a high quality, well drained, and recently maintained aggregate surface.
b) Approaches and crossings for all other streams: The ditch lines draining to these streams are fully vegetated with grass, mowable ground cover or have other effective sediment retaining structures in place.
c) The fill slopes on all haul route stream crossings would be vegetated or otherwise stabilized such that road surface sediments are retained prior to entering the stream channel.
d) Adequate cross drainage has been installed so that there is less than 200 feet of road draining to any stream/road crossing.

Wet Season Haul:
F5. Timber transport is not allowed on native surfaced roads during the wet season.

F6. Timber transport is allowed during the wet season on aggregate surfaced roads if the following criteria are met:

a) Aggregate surfaced haul routes would not cross LFH, or cross other streams that are within 1,000 feet from LFH. The haul route would not be closer than 500 feet of LFH at any given point. Road 6310 and 6340 are exempt because they are determined to not be hydrologically connected. These roads can be used in the wet season if approved by a district fish biologist, hydrologist or soil scientist and inclusion of erosion control measures such as silt fences, straw bales, matting, mulch, slash, water bars, grass seed [or other products], etc. This work would occur prior to the wet season.
b) Haul routes would be inspected weekly, or more frequently if weather conditions warrant. Inspections would focus on road surface condition, drainage maintenance, and sources of soil erosion and sediment delivery to streams.
c) Do not allow timber haul during periods of daily alternating freezing and thawing periods over a several day period. Haul is allowed on completely frozen or snow covered roads.
d) Hauling is not allowed when conditions exist (e.g. during intense or prolonged rainfall), that may cause generation of road related runoff to streams.
e) Spot rocking and/or sediment traps would be employed to reduce potential sediment inputs to streams. Sediment traps would be inspected weekly during the wet season and entrained soil would be removed when the traps have filled to ¾ capacity. Dispose of these materials in a stable site which is not hydrologically connected to any stream.

5. **Other Logging Systems and Roads**

A. Within 50 feet of the stream protection buffers, (measured slope distance in the direction of the slope aspect) only low impact harvesting equipment such as, but not limited to, mechanical harvesters or skyline systems, which have minimal ground disturbance would be allowed. Exceptions may be made for the use of existing skid trails closer than 50 feet where recommended by the unit fisheries biologist.

B. **Skid trails** - All ground-based skidding equipment would be confined to pre-approved skid trails, temporary roads and landings during yarding. Existing skid trails would be reused where possible unless they are hydrologically connected.

Where new skid trails are needed: skid trails would be spaced a minimum of 150 feet apart except where converging; skid trails would be located to minimize the alteration of surface hydrology; uphill skidding would generally be on slopes less than 20% except on short pitches; and downhill skidding would generally be less than 35%. These are the slopes where skid trails are approved: the units may contain steeper slopes but equipment would stay on approved skid trails and directional felling and winching of logs would occur on steeper sections. Refer to PDC C4 for riparian reserves.

Some ground-based logging is proposed for slopes steeper than 35% where existing skid trails are available and not hydrologically connected. Skid trails in these situations are typically contouring or diagonally constructed skid roads with cut and fill. In these areas, equipment would stay on approved skid trails and directional felling and winching of logs would occur. Refer to PDC C4 for riparian reserves. *Applicable BMP: T-11: Tractor Skid Trail Location and Design.*

C. **Harvesters** - Mechanical harvesting equipment would be required to operate on slash-covered paths except when moving on approved skid trails. The layer of slash would be thick enough to prevent visible soil damage. Mechanical harvesting equipment would generally operate on slopes less than 40%. Harvesters would generally be limited to a single pass on each pathway.

D. **Rutting** - Rutting within skid trails should not exceed 12 inches in depth over more than 10 percent of a designated skid trail system. *Applicable BMP: T-13. Erosion Prevention and Control measures during Timber Sale Operations.*

E. **Rock** - Rock would be used when necessary to reduce erosion, puddling and compaction on landings and temporary roads. To provide an efficient substrate for vegetative growth and water infiltration, rock would be removed and/or incorporated into the roadbed by ripping or scarification following harvest activities.

F. **Temporary Roads** - Temporary roads and landings on temporary roads would be subsoiled to a depth of at least 18 inches or scarified with a loader or excavator. Cross-drains or water bars would be installed every 150 feet, or more frequently where slopes exceed 5%. Actual placement distances may vary with topography to ensure proper drainage. Available logging slash, logs or root wads would be placed across the road or landing surface. Post harvest motorized access to temporary roads would be prevented by construction of a berm. *Applicable BMP: T-13: Erosion Prevention and control measured during timber sale operations; T-14: Revegetation of area disturbed by harvesting activities; T-16: Erosion control on skid trails.*

6. **Erosion:** Areas of soil displacement on steep slopes resulting from yarding systems would be treated to prevent rill and gully erosion and possible sediment delivery to stream courses. Where appropriate, erosion control treatment on bare soils may include water bar placement, hillslope contouring, scattering slash on disturbed soils, placement of mulch, and application of approved seed. Mulch may be used on slopes greater than 20%. Effective ground cover would be installed prior to October 1 of each year. *Applicable BMPs: T-6: Protection of unstable lands, T-13: Erosion Prevention and Control Measured During Timber Sale Operations. Forest Plan standard and guideline FW-025.*

Native plant materials are the first choice in revegetation of bare soils, [e.g., blue wildrye (*Elymus glaucus),* California brome (*Bromus carinatus*), and broadleaf lupine (*Lupinus latifolius*)]. Non-native, non-invasive plant species may be used if native plant materials are not available or as an interim measure designed to aid in the re-establishment of native plants.[e.g., annual ryegrass (*Lolium multiflorum)* and Madsen sterile wheat.] Non-native invasive plant species would not be used. *This implements Forest Plan standard and guideline FW-148 and standard 13 of the Regional Invasive Plants Record of Decision.*

Seed would preferably be grown under government-supervised contracts, or certified by the state of Oregon to assure noxious weed free status. In certain cases, non-certified seed may be used if it is deemed to be free of Oregon State Class A & B noxious weeds. *This implements Forest Plan standard and guideline FW-148.*

When **straw and mulch** are utilized, it would be annual ryegrass straw or spring wheat straw certified by the State of Oregon, or would originate from fields which grow State of Oregon certified annual ryegrass seed, or originate from Willamette Valley Oregon fields which grow only annual ryegrass seed for large-scale commercial seed production. In place of straw, wood fiber mulch may be used. *This implements Forest Plan standard and guideline FW-148, and standard 3 of the Regional Invasive Plants Record of Decision.*

7. **Invasive species:** *This implements Executive Order 13112 dated February 3, 1999, and standards and guidelines of the Regional Invasive Plants Record of Decision.*

   All off-road equipment is required to be free of soil, seeds, vegetative matter, or other debris that could contain or hold seeds prior to coming onto National Forest lands. Contracts would include provisions to minimize the introduction and spread of invasive plants. These provisions contain specific requirements for the cleaning of off-road equipment.

   Gravel or rock used for roads would come from weed free sources.

   Road blading, brushing and ditch cleaning in areas with high concentrations of invasive plants would be conducted in consultation with invasive plant specialists.

8. Contracts would contain provisions for the protection of **heritage resource** sites found during project activities. In the event that sites are located during implementation, project activities would be halted until consultation with the Forest Archeologist can determine appropriate site-specific mitigation. Protection measures would be developed in consultation with the Oregon State Historic Preservation Officer (SHPO), appropriate Tribes, and, if necessary, the Advisory Council on Historic Preservation.

9. **Firewood** would be made available to the public at landings where feasible. *This is an opportunity to contribute to Forest Plan - Forest Management Goal #19, and*

provide forest products consistent with the NFP goal of maintaining the stability of local and regional economies.

10. **Monitoring**: *This Implements Forest Plan and NFP monitoring requirements.*

    Prior to advertisement of a contract, the provisions of the contract and other implementation plans would be reviewed to insure that required elements are properly accounted for.

    During implementation, Contract Administrators monitor compliance with the contract which contains provisions for resource protection including but not limited to: seasonal restrictions, snag and coarse woody debris retention, stream protection, erosion prevention, soil protection, road closure and protection of historical sites.

    Post harvest reviews would be conducted where needed prior to post harvest activities such as slash treatment and firewood removal. Based on these reviews, post harvest activities would be adjusted where needed to achieve project and resource objectives.

    Monitoring of noxious weeds and invasive plants would be conducted where appropriate to track changes in populations over time and corrective action would be prescribed where needed.

    Monitoring is also conducted at the Forest level. For example, water quality is monitored for both temperature and turbidity at several locations across the Forest. Monitoring reports can be found on the Forest's web site at http://www.fs.usda.gov/mthood/ under Land & Resources Management.

1.4.10 Fuels Treatments

The project area is not in an area of high fire hazard or near a wildland urban interface. Branches and tops and other debris created by the thinning would be retained on the ground to decompose naturally to enhance soils and site productivity. In units operated with a harvester machine, branches and tops would be placed in front of the machine and compressed. Previous experience with similar thinning has shown that snow pack and natural processes of decay cause the debris to break down and compress quickly to the point where fire hazard is not a concern. Some incidental quantities of debris typically end up coming to the landing where it would be piled. If it is not removed for firewood or as biomass it would be burned. Based on previous experience with similar stands, approximately 27 tons per acre of debris would be retained in the units.

1.5 Decision Framework

The deciding official, the Forest Supervisor, will review this document in order to make the following decisions and determinations:

- What the optimal method of accomplishing the purposes and needs for this project should be;
- Whether or not a Forest Plan amendment is necessary, or whether exceptions are appropriate for standards and guidelines;
- Whether the selected alternative should be modified in any way;
- What design criteria or mitigating measures should occur;
- Whether this action is in compliance with the Forest Plan as amended and Forest Service policies and procedures.

1.6 Public Involvement

For this project, the Forest Service began a process of collaboration with the Clackamas Stewardship Partners in 2009; a process that built on years of collaboration on similar thinning projects dating back to 2004. A scoping process to request public input for this project was conducted. A letter describing the proposed project and requesting comments was sent out on September 27, 2010. The Forest publishes a schedule of proposed actions (SOPA) quarterly. The project first appeared in April 2010 and in subsequent issues. Several public field trips were conducted to visit the project area and discuss the purpose and need and issues. The legal notice for the 30-day comment period for this project was published in the Oregonian on November 18, 2011. Responses to substantive comments are included in Appendix B. A list of persons and organizations that were sent notice is in the analysis file along with a list of commenters and the complete text of comments.

1.6.1 Issues

While many concerns were raised with scoping, field trips and the 30-day comment period, they are not considered key issues for the purpose formulating fully developed alternatives. The following highlights some of the concerns raised by the public:

1.6.1.1 Temporary Roads: Comments raised a concern about the reopening of old road alignments and the construction of new temporary roads. They feel the ground disturbance associated with this work particularly where it is in close proximity to streams could affect aquatic resources. They asked for an in-depth analysis of each road.

Specifically a comment stated, *"Avoid road construction. Where road building is necessary, ensure that the realized restoration benefits far outweigh the adverse impacts of the road. Carefully consider the effects of roads on connectivity, especially at road/stream crossings, across ridge tops, and midslope hydrological processes (such as large wood delivery routes)."*

In order to avoid any potentially undesirable impacts to aquatic resources, new temporary roads would be strategically located on gentle slopes and would not cross any streams. The existing road alignments proposed for reconstruction have some stream crossings; however, they have been designed to minimize impacts to aquatic resources (s. 1.4.6.3). The proposed action would decommission the temporary road alignments after project completion. There were some roads originally proposed for reconstruction (accessing units 16, 20, 28 and 116) that were dropped due to the potential effects to aquatic resources. Road work included in the proposed action includes only those road segments that do not pose an adverse impact on aquatic resources and are needed to efficiently achieve the vegetation health and diversity objectives discussed in section 1.3.

Sections 1.4.6.2&3 discuss the details for these roads and section 3.3.4.2 discusses the impacts to aquatic resources. The analysis found the impacts to be sufficiently mitigated by project design criteria (s. 1.4.9). Forest Plan standards and guidelines would be met (s. 3.3.4.5-6) and the project would be consistent with the Aquatic Conservation Strategy (s. 3.3.4.7). Some of the requested detail can be found in section 3.12.7. This concern is not considered a key issue because there are no substantive unresolved resource impacts.

1.6.1.2 Decadence (dead trees, down logs and trees with disease): Comments raised a concern about decadence and recent scientific findings. They feel there is an excessive emphasis on the health of trees and would like greater attention paid to the value of dead and down trees. They feel that healthy ecosystems should have an abundance of large decaying live trees, large snags and coarse woody debris all of which are lacking in plantations. They are concerned that thinning captures future mortality, and that those potential dead trees are important for wildlife and as sources of down wood in streams.

Specifically a comment stated, "*We are concerned that thinning captures mortality which reduces and delays recruitment of large wood needed to meet ACSO #8 among others. Thinning is often conducted in riparian areas based on the false assumption that thinning accelerates the recruitment of large trees and therefore large snags, but rigorous analysis using stand simulation software clearly shows that assumption to be false."*

The proposed action includes design criteria that would protect and enhance snags and down woody debris (s. 1.4.9.2&3). Down wood would not be removed and all snags would be retained where safety permits. New snags and down wood would be created after thinning. Skips and riparian protection buffers would provide abundant quantities of down wood (s. 3.8.2.3).

Stand data has been collected for this project and stand simulation modeling has been done showing that sufficient quantities of dead and down wood would occur with the proposed action (s. 3.8.2.3). Forest Plan standards and guidelines would be met (s.

3.8.2.5) and the project would be consistent with the Aquatic Conservation Strategy (s. 3.3.4.7). Wood recruited into streams would occur over time at sufficient levels, primarily from the stream protection buffers (s. 3.3.4.3). The National Marine Fisheries Service was consulted for impacts to fish and riparian reserves including the recruitment of wood to streams and the project was found to not likely adversely affect listed fish species (s. 3.3.4.6). This concern is not considered a key issue because there are no substantive unresolved resource impacts.

1.6.1.3 LSR, Riparian Reserves, and Earthflow Areas: Comments raised a concern about thinning in areas that they consider inappropriate. They suggest that thinning captures mortality that would be better left in LSRs and riparian reserves. They suggest that thinning impacts adjacent old-growth stands. They suggest that logging equipment would create unacceptable impacts to the land particularly in earthflows.

Specifically a comment stated, "*On one recent visit to Unit 4, we saw a great horned owl flying into the unit. This predator of the northern spotted owl utilizes the increased edge habitat for access to prey. Logging operations will increase the definition of the boundaries around the mature forests that are currently providing ideal habitat for the northern spotted owl and create opportunity for species like the horned and barred owl to move in on the territory of the spotted owl."*

The project includes thinning in the listed land allocations to enhance the associated resource values (s. 1.2.2.1). The proposed action would meet the standards and guidelines for these land allocations (LSRs are discussed in s. 3.7.5.2; Riparian reserves are discussed in s. 3.3.4.4; Earthflows are discussed in s. 3.5.6. The U.S. Fish and Wildlife Service was consulted and the project was found to not likely adversely affect spotted owls (s. 3.7.5.2). The Regional Interagency Ecosystem Office was consulted and the project was found to meet the standards and guidelines for Late-successional Reserves (s. 3.7.5.4). The National Marine Fisheries Service was consulted for impacts to fish and riparian reserves and the project was found to not likely adversely affect listed fish species (s. 3.3.4.6). The interdisciplinary team of specialists did not find any substantial impacts to adjacent old growth but found that over time, the proposed action would soften the edge between plantation and old growth (s. 1.2, s. 1.2.2.1, s. 3.7.5.2, s. 3.7.5.4). The analysis shows that sufficient quantities of dead and down wood would occur with the proposed action (s. 1.6.1.2 & s. 3.8.2.3). This concern is not considered a key issue because there are no substantive unresolved resource impacts.

1.6.1.4 Thinning Prescriptions for Late-Seral Habitat: Comments suggest using the LSRs prescription in certain matrix units to enhance long-term connectivity between the Collawash watershed and adjacent watersheds.

Specifically a comment stated, *"In order to promote the development of late-seral habitat in the Late-Seral Species Key Connecting Areas shown on Map 24 (p. 3-41) of*

the Collawash Watershed Assessment, we recommend using similar variable density thinning approaches in the following non-LSR Jazz Thin units…"

Because the matrix plantations and LSRs have different management objectives, the proposed action includes different prescriptions for matrix units compared to units in LSRs. Generally, LSRs would have lighter thinning treatments with more skips. Additionally, the recommendations of the Collawash/Hot Springs Watershed Analysis are not applicable to this project because they relate to late-successional habitats. The project is consistent with the Collawash /Hot Springs Watershed Analysis recommendation on page 1-3 that suggests the retention of late-seral habitat in key connectivity areas, the promotion of late-seral structure in riparian reserves and LSRs, the creation of snags and down logs in plantations, and delayed degradation of larger connected matches of mature forest. This concern is not considered a key issue because there are no substantive unresolved resource impacts.

1.6.1.5 Thinning Prescriptions for Early-Seral Habitat: Comments suggest specific forage enhancements to provide forage in an area where forage has been declining. They request larger gaps and wider spacing in certain suitable units.

Specifically a comment stated, *"Of particular importance to a number of Partners are providing forage and/or winter range habitat for elk and deer. We encourage adopting variable density thinning approaches to enhance forage and winter range habitat for deer and elk in Jazz Thin units…"*

There is a trend of declining forage across the landscape (s. 3.8.3.4). While there is some potential to enhance forage with thinning, the primary purpose of this project is not to meet the total forage needs for deer or elk. That would take a much larger landscape scale planning effort that is outside the scope of this assessment. However, enhancing diversity is part of the purpose and need for this project and creating gaps for stand scale diversity is part of the proposed action. The proposed action has been adjusted in several units to incorporate some forage creation by heavy thinning where appropriate species are present (s. 1.4.5). This adjustment would still allow for full achievement of the project's purpose and need.

1.6.1.6 Skips: Comments suggest more of each unit should be skips. They are concerned that thinning captures future mortality, and that those potential dead trees are important for wildlife and as sources of down wood.

Specifically a comment stated, *"Skips should be at least 15% of treated acres (or more if riparian reserves are counted as skips) – in order to ensure a reliable, continuous, and well-distributed recruitment of dead wood structures."*

The proposed action includes skips of various sizes and distribution to enhance diversity of the stands. Skips within units would be placed where there are special features such as clumps of minor species, large snags, wet areas, or locations of rare

or uncommon species (s. 1.4.1). Over time, the trees in skips would develop similarly to the discussion for no action: they would have an abundance of relatively small snags as overcrowded trees die (s. 3.1.3). Many units have streams with stream protection buffers that also provide a similar function. In some areas half of the plantation acreage is in protection buffers. Skips would be placed on 5 to 10 percent of the units depending on the land allocation and the presence of stream protection buffers. This range provides for diversity between units.

Skips and the future dead trees that result from not thinning are important for some elements of diversity. However, increasing the percentage of skips reduces the acreage available to achieve the other important objectives of the project including thinning to accelerate late-successional conditions. As discussed in section 1.6.1.2, the analysis shows that sufficient quantities of dead and down wood would occur with the proposed action. Sufficient levels of snags and down wood would occur across the landscape to provide for the viability of snag and down wood dependent species such as pileated woodpeckers (s. 3.8.2.4). This concern is not considered a key issue because there are no substantive unresolved resource impacts.

1.6.1.7 Gaps in riparian reserves: Comments suggest that gaps would retard development of riparian values.

Specifically a comment stated, *"Gaps should be located no closer than one site-potential-tree height from streams - in order to ensure that streams are not unnecessarily deprived of dead wood, and to allow natural disturbance processes to determine ecological function in riparian reserves."*

The proposed action for riparian reserves is variable density thinning with skips and gaps and appropriately sized stream protection buffers (s. 1.4.2, s. 1.4.9.4). Gaps in riparian reserves would be 1/4 acre or less in size.

Recent research has shown that 90% of wood recruited into streams originated close to streams; much closer than the 100-foot setback distance (s. 3.3.4.3). The National Marine Fisheries Service has concurred that a 100-foot setback for gaps results in greater diversity of the upland portion of riparian reserves and does not retard attainment of wood recruitment (s. 3.3.4.6). Most wood recruited into streams would come from the riparian protection buffers (s. 3.3.4.3). This concern is not considered a key issue because there are no substantive unresolved resource impacts.

1.6.1.8 Earthflows: Comments suggested no new skid trails should be constructed in high risk earthflow areas.

Specifically a comment stated, "*The sale should be modified so that NO new skid trails, landings or temporary roads are constructed in high Earthflow areas. With this alteration, ground-based yarding could occur only if it takes place on pre-existing alignments and results in no additional compaction."*

Earthflows are where ancient landslides were deposited. They are gently sloping and are much more stable now than in the past (s. 3.5.2). Approximately 1,068 acres of the project overlaps the earthflow land allocation (s. 1.2.2.1). There are no new roads or new landings proposed for earthflow units (Appendix A maps).

Earthflows are considered appropriate places for timber management including thinning (s. 1.2.2.1). Earthflows have high levels of forest vegetation and are considered recovered (s. 3.5.6.2). Project design criteria discuss the use of existing skid trails and landings where appropriate (s. 1.4.9.5 & s. 3.6.9). This concern is not considered a key issue because there are no substantive unresolved resource impacts.

1.6.1.9 Range of Alternatives: Comments suggested that there is an inadequate range of alternatives.

Specifically a comment stated, "*There may be unresolved trade-offs between thinning and recruitment of dead wood to meet aquatic and terrestrial habitat goals and other biophysical functions such as carbon storage. More action alternatives should be considered such as:*

- *a more balanced disposition of wood from the stand – less wood exported off-site and more wood retained for on-site recruitment; wider stream buffers; greater use of untreated skips embedded within thinning units;*
- *dropping thinning units that require road construction, etc.*
- *several LRMP standards & guidelines are not being followed (e.g., B8-36 & FW-020, B8-40 & FW-018) because it is too expensive to conduct helicopter logging. This trade-off between economics and resource conditions represents an unresolved resource conflict that may deserve a NEPA alternative."*

The first two bullets are already addressed above in sections 1.6.1.1 and 1.6.1.2. These alternatives were considered (s. 2.3). The Forest Plan describes the process for documenting exceptions to "Should" standards and guidelines (s. 1.2.2.2). The rationale for these exceptions is documented and the impacts to the applicable resources was found to be minimal (s. 3.6.9). This concern is not considered a key issue because there are no substantive unresolved resource impacts.

1.6.1.10 Restoration Alternative: Comments suggested that trees in the LSR could be felled and left on site to accomplish thinning objectives.

Specifically a comment stated, "*Another detrimental impact of logging in the LSR is the loss of existing snags and snag recruitment. A mature drop and leave (MDL) prescription, which includes thinning conducted in stands where trees are large enough to be of commercial value which are not sold, but are left on the site. This alternative would obviate the need to build any roads, landings or skid trails to and in the LSRs, and the money saved could balance out the lost income."*

The proposed action would fall a few trees per acre to provide some woody debris. But to achieve the restoration objective in LSRs, the proposed thinning would remove approximately 150 trees per acre. If this quantity of trees were felled and left on site there would be a dramatic increase in the population of Douglas-fir bark beetle (s. 3.7.5.4). This insect can build its population quickly in the presence of down trees and then spread to standing live trees causing mortality. They would spread and kill trees in the plantation as well as mature trees in adjacent stands. Because of the threat of resulting mortality caused by the bark beetles, leaving felled trees on site in LSRs would not achieve the purpose and need for an increase in health and growth of stands. The analysis shows that sufficient quantities of dead and down wood would occur with the proposed action (s. 1.6.1.2 & s. 3.8.2.3).

The comment raises concerns about the impacts of building roads, landings and skid trails in LSRs and proposes this alternative to avoid those impacts. There would be no new road construction in LSRs (s. 3.7.5.4). The project would reuse existing road alignments, existing landings and existing skid trails (s. 1.4.9).

The project was found to be consistent with LSR standards and guidelines (s. 3.7.6). The U.S. Fish and Wildlife Service concurred that the project would not likely adversely affect the northern spotted owl or its critical habitat. The Regional Ecosystem Office reviewed the project and found it to be consistent with the objectives for LSRs (REO 2012) (s. 3.7.5.4). The concern about LSRs is not considered a key issue because there are no substantive unresolved resource impacts.

2.0 ALTERNATIVES

This chapter describes and compares the alternatives considered for this project. It includes a description of each alternative considered. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. The Proposed Action is described in s. 1.3 and is sometimes referred to as Alternative B.

2.1 Alternative A - No Action

Under the no-action alternative, current management plans would continue to guide management of the area. No timber harvest or other associated actions would be implemented to accomplish project goals. Stands would continue to remain uniformly dense and the overstocked condition would result in stands with reduced vigor, small trees, increased mortality, and increased susceptibility to stressors such as insects, diseases and weather. Additionally, no wood products would be provided (s. 3.1.3).

2.2 Alternative B - Proposed Action

This alternative is described in s. 1.4.

2.3 Other Alternatives Considered

Section 1.6.1 discusses comments that were received from the public suggesting the consideration of other alternatives. Some alternatives derived from public comment were considered and are documented in section 1.6.1 above. The following has some further elaboration:

2.3.1 One suggestion was to not build new roads or reopen old road alignments to avoid impacts to streams and aquatic resources (s. 1.6.1.1). Approximately 840 acres of the proposed action would be affected.

With the proposed action, new temporary roads would be strategically located on gentle slopes and would not cross any streams. The existing road alignments proposed for reconstruction have some stream crossings; however, they have been designed to minimize impacts to aquatic resources (s. 1.4.6.3). Road work included in the proposed action includes only those road segments that do not pose an adverse impact on aquatic resources and are needed to efficiently achieve the vegetation health and diversity objectives discussed in section 1.3.

During the early planning phase, road alignments to each unit were examined (s. 3.12.7). Some are not proposed for reconstruction because the resource impacts and costs were considered too great. Each road proposed for reconstruction and use was strategically assessed for resource impact and economic viability. Fisheries specialists on the interdisciplinary team and with the National Marine Fisheries Service found that the proposed action and project design criteria are sufficient to protect aquatic resources (s. 3.3.4.2). The proposed road construction and reconstruction would be consistent with Forest Plan standards and guidelines and the Aquatic Conservation Strategy.

Dropping 840 acres, which is more than half of the project acreage, would not meet the purpose and need for this project. This option was considered but not fully developed.

2.3.2 One suggestion was to delete thinning in LSRs, riparian reserves and earthflows to avoid impacts to the associated resources (s. 1.6.1.3). This would eliminate approximately 3/4 of the project.

This option would not provide the benefits of improved health and growth or enhanced diversity described in the purpose and need (s. 1.3, s. 3.1.4 & s. 3.2.4) for the affected acres. The effects of thinning in these land allocations to listed fish and aquatic resources, northern spotted owls and earthflow stability were not found to be substantial (s. 3.3, s. 3.7 & s. 3.5). The proposed action meets Forest Plan standards and guidelines for these land allocations (s. 3.3.4.9, s. 3.7.6 & s. 3.5.6.5), and was determined to not likely adversely affect listed fish or spotted owls (s. 3.3.4.6 & s. 3.7.5.2).

Dropping ¾ of the project acreage, would not meet the purpose and need for this project. This option was considered but not fully developed.

2.3.3 One suggestion was to use the LSRs prescription in certain matrix units to enhance long-term connectivity between the Collawash watershed and adjacent watersheds (s. 1.6.1.4). Specifically the units requested are: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 142, 144, 146, 148, 150, 152, 154, 156, 158 and 160. The watershed analysis identified areas of concern for late-successional connectivity where these units occur. The prescriptions for Matrix plantations and LSRs are different because these land allocations have different management objectives. Generally, LSRs would have lighter thinning treatments with more skips. Matrix prescriptions are adjusted to provide for forage enhancement which is not appropriate in LSRs.

The recommendations of the Collawash/Hot Springs Watershed Analysis for late-successional connectivity are not applicable to this project. It makes recommendations for late-successional habitats and the proposed units are second growth. The project is consistent with the Collawash /Hot Springs Watershed Analysis recommendation on page 1-3 that suggests the retention of late-seral habitat in key connectivity areas, the promotion of late-seral structure in riparian reserves and LSRs, the creation of snags and down logs in plantations, and delayed degradation of larger connected matches of mature forest.

This option was considered but not fully developed.

2.4 Comparison of Alternatives

This section presents a comparative summary of principal activities and the environmental effects for the alternatives being considered in detail. The summary is limited to the effects on the project's purpose and need, Forest Plan standards and guidelines, and other resources measurably affected and considered important for an informed decision.

	Alternative A - No Action	**Alternative B - Proposed Action**
Purpose and Need Indicators		
Increase health and growth (s. 3.1)	Stands would begin to stagnate and become more susceptible to diseases and wind damage.	Trees in thinned stands would have the space they need to grow and increase diameter, expand their crowns and become more windfirm.
Tree diameter in 40 years	16.6 inches. Not meeting late-successional character.	22.6 inches. Achieves the minimum size where stands begin to function as late successional.
Tree growth rate in 40 years	0.9 cubic feet per tree per year	2.1 cubic feet per tree per year

	Alternative A - No Action	Alternative B - Proposed Action
Diversity of vertical and horizontal diversity (s. 3.2)	Plantations would remain relatively uniformly dense and overcrowded.	Variable density thinning with skips, gaps, heavy thinning and forage openings would create greater structural diversity compared to no action.
Change in tree species	Douglas-fir would remain the dominant species.	Retention of minor species and removal of some Douglas-fir – results in greater representation of western hemlock, noble fir, Pacific silver fir, western redcedar and alder. More representative of historic species mix.
Change in other plants	Ground vegetation would remain unchanged.	More sunlight to forest floor would increase abundance of plants such as forage species.
Change in vertical canopy layers	Would primarily remain single story stands with small gaps created by natural disturbances.	Gaps and heavy thins would naturally regenerate and begin to grow young trees resulting in a two storied stand. Up to 10% gaps and up to 10% heavy thins.
Change in horizontal structure	Trees would remain uniformly dense.	A mix of gaps, skips, heavy thins, and variable density thinning would result in diverse structure. Up to 10% gaps, up to 10% heavy thins, skips would be 5 to 10% plus riparian buffers.
Change to snags and down wood (s. 3.8.2)	High levels of small snags and down wood in next few decades.	Lower levels of small snags and down wood compared to no action. Levels for larger sized snags and down wood are slightly less compared to no action. Snags and down wood would be created.
Sustainably provide wood products (s. 3.16)	No wood products provided. Future productivity reduced as plantations stagnate.	Provides approximately 15 MMBF of wood products and creates healthy stands for future productivity.
Summary of Actions (s. 1.4)		
Acres of plantations treated to meet purpose and need.	0	2,053
Acres of Riparian Reserve Enhanced	0	734
Acres of LSR Enhanced	0	726
Miles of temporary roads constructed and then decommissioned	0	0.4
Miles of temporary roads reconstructed and then decommissioned	0	12
Miles of system roads maintained	0	67
Issues and Concerns		

	Alternative A - No Action	Alternative B - Proposed Action
Roads (s. 1.6.1.1) (s. 1.4.6.2)	No road construction or reconstruction. Approximately 5 miles of existing temporary roads were never actively decommissioned and would remain unrestored.	Reconstruct 12 miles of existing road alignments and decommission. Temporary stream crossings minimized. Approximately 5 miles that were never actively decommissioned before would be decommissioned.
Decadence (s. 1.6.1.2) (s. 3.8.2.3)	Results in an abundance of small snags – as many as 55 per acre in 20 years. In 100 years - 22 snags per acre > 20 inches diameter and 7 snags per acre greater than 30 inches diameter.	Fewer small snags because small suppressed trees would be removed during thinning –14 to 20 snags per acre in 20 years. In 100 years – 17 to 22 snags per acre > 20 inches diameter and 7 to 8 snags per acre greater than 30 inches diameter.
Earthflow (s. 1.6.1.3) (s. 3.5.6)	No treatment in earthflows.	1,068 acres of earthflow thinned. All would meet Forest Plan Standards and Guidelines (S&Gs).
Late-seral prescriptions in Matrix (s. 1.6.1.4)	No treatments to accelerate late-seral conditions in matrix.	The LSR prescription is not used in Matrix. However matrix thinning would result in larger trees compared to no action.
Early-seral prescriptions (s. 1.6.1.5) (s. 1.4.5)	No treatments to create forage.	Several treatments are designed to enhance forage.
15% Skips (s. 1.6.1.6)	Entire stands would have abundance of down wood and snags.	Skips would be placed on 5 to 10 percent of the units depending on the land allocation and the presence of stream protection buffers (s. 1.4).
Gaps in riparian reserves (s. 1.6.1.7)	No gaps would be created in riparian reserves.	Gaps are created to enhance diversity (s. 1.3) on up to 10% of the acreage outside protection buffers (s. 1.4.2).
Earthflow skid trails (s. 1.6.1.8)	No skid trails in earthflows.	Existing skid trails and landings would be reused where appropriate (s. 1.4.9.5).
Effects Summary		
Fisheries ESA Listed Fish Habitat (s. 3.3.4.6)	No Effect	May Affect, Not Likely to Adversely Affect
Fisheries MSA Essential Fish Habitat (s. 3.3.4.6)	No Adverse Affect	No Adverse Affect
Aquatic Sensitive and Survey&Manage (s. 3.3.4.6)	No Impact	May impact individuals or habitat, but would not likely contribute to a trend towards Federal listing or loss of viability to the population or species
Management Indicator Species – Fish (s. 3.3.4.8)	Would not contribute to a negative trend in viability on the Forest	Would not contribute to a negative trend in viability on the Forest
Aquatic Conservation Strategy (s. 3.3.4.7)	Would not enhance late-successional characteristics of riparian reserves.	Meets ACS Objectives. Would enhance late-successional characteristics of riparian reserves.

	Alternative A - No Action	Alternative B - Proposed Action
Hydrologic Recovery (s. 3.4.1)	No change	Little change, meets S&Gs
Water Temperature (s. 3.3.4.1)	No change	Not measurable. Uses stream protection buffers.
Sediment (s. 3.3.4.2)	No change	Project design criteria (PDCs) minimize erosion and sedimentation.
Geologic Stability (s. 3.5)	No change	Landslide prone areas are avoided. Earthflows are hydrologically recovered. Meets S&Gs.
Soil Erosion (s. 3.6.6)	No change	Very small risk with PDCs
Soil Disturbance (s. 3.6.7)	No change, gradual recovery. Many plantations currently exceed S&Gs.	Uses existing skid trails & landings. Temporary roads and landings would be restored. Exceptions to S&Gs
Organic Matter (s. 3.6.8)	No change, gradual recovery.	PDCs minimize alteration of duff and down wood. Slash would be retained and would quickly decay.
Northern Spotted Owl (s. 3.7.5)	No noise, no reduction in dispersal habitat. No Effect	Retention of dispersal habitat in LSR, reduction of dispersal habitat in matrix. Seasonal restriction minimizes noise effect. May affect, but is not likely to adversely affect. Would not cause jeopardy.
Sensitive Species (s. 3.8.1.1)	No Impact	For Johnsons's Hairstreak butterfly - May Impact Individuals, but not likely to Cause a Trend to Federal Listing or Loss of Viability to the Species. No Impact for others.
Survey and Manage (s. 3.8.1)	No Effect	Does not apply to stands less than 80 years of age.
Snags (s. 3.8.2.3)	Results in an abundance of small snags – as many as 55 per acre in 20 years. In 100 years - 22 snags per acre > 20 inches diameter and 7 snags per acre greater than 30 inches diameter.	Fewer small snags because small suppressed trees would be removed during thinning –14 to 20 snags per acre in 20 years. In 100 years – 17 to 22 snags per acre > 20 inches diameter and 7 to 8 snags per acre greater than 30 inches diameter.
Deer and Elk (s. 3.8.3.4)	Forage is declining across the landscape. Projected decline in population.	Project would enhance forage. Population may still decline.
American Marten (s. 3.8.3.5)	No habitat	No habitat
Pileated Woodpecker (s. 3.8.3.6)	Abundant snag habitat	Would not contribute to a negative trend in viability on the Forest for pileated woodpecker.
Scenery (s. 3.9)	No change	Little change. Would diversify uniform patterns.
Scenic and Recreational Rivers (s. 3.11)	No change	Outstandingly remarkable values (fish and geology) would be protected.

	Alternative A - No Action	Alternative B - Proposed Action
Transportation (s. 3.12)	No road maintenance	Would maintain and repair 67 miles of system roads that are needed for public access including wilderness trail heads. Approximately $300,000 would be generated to maintain and repair roads.
Botany (s. 3.13)	No change	For many species that may be present - May Impact Individuals or habitat but not likely to lead to a trend toward federal listing.
Competing and Unwanted Vegetation (s. 3.14)	No change. Six invasive plants are present	PDCs would minimize spread of existing invasives and would minimize the introduction of new species.
Summary of Other Resources		
Wilderness	No change. Roads to wilderness trail heads would not be repaired.	Roads to wilderness trail heads would be repaired. Several units touch the wilderness boundary. (70, 74, 76, 78, 82, 120 & 122)
Inventoried Roadless Areas (IRAs)	There are no units in IRAs. The Bull of the Woods IRAs have been added to the wilderness system.	
Private Land	There are no private lands in the project area.	
Macro Scale Disturbance Regime (s. 1.2.1.1)	Fire has been dominant landscape pattern-forming disturbance agent in the Collawash Watershed. The units are in Fire Group 8; the "warm moist western hemlock, Pacific silver fir" group has a stand replacement fire regime where most or all trees would be killed with a fire frequency of 50 – 300+ years. While fire frequency tends to be low because of moist habitats, when fires do occur they tend to be large and stand-replacing (killing all or most trees). Recent wild fires in the Collawash were not in this fire group but in higher elevation groups where lightning is common and fires are more frequent.	
Fire Hazard (s. 1.2.1.1) (s. 1.4.10)	Fire suppression in the past 100 years has not dramatically altered the structure of stands or increased fire hazard in this group. No fuels treatments are proposed other than landing slash disposal. Slash would be left in the units. It would be crushed under equipment where mechanical harvesters are used.	
Micro Scale Disturbance Regime (s. 1.2.1.1)	Disturbance agents in the project area affect individual trees, small groups of trees or large areas of susceptible species. Disease, insects and wind have been the secondary disturbance agents in the proposed treatment area. Small (1/4 acre) to large (1-3 acre) isolated pockets of laminated root rot and armillaria root disease are present throughout these stands.	
Mature/Late-Successional/Old-Growth Forest	The project occurs in young even-aged plantations 30 to 60 years of age. Some units are bounded by stands with older forest. There would be little or no effect to these adjacent stands.	
Recreation	There are no developed recreation areas near the project. Some roads that lead to recreation areas would be repaired and maintained.	

3.0 ENVIRONMENTAL CONSEQUENCES

This section summarizes the physical, biological, social and economic environments of the affected area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in the chart above.

Cumulative Effects

3.0.1 A discussion of cumulative effects is included for each resource where appropriate. Cumulative effects are impacts on the environment that result from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions. If the proposed action would have little or no effect on a given resource, a more detailed cumulative effects analysis is not necessary to make an informed decision.

The land area and the time scale used for cumulative effects analysis varies by resource. The analysis considers the impact of activities on other ownerships where appropriate. In the Collawash watershed, the only other non-National Forest lands are 850 acres managed by the Bureau of Land Management (BLM). The BLM acreage is all Late-successional Reserves and the plantations there are quite young.

In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects.

The cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for not taking this approach:

- A catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions over the last century (and beyond), as well as by natural processes of growth and recovery since. Trying to isolate the individual actions that continue to have residual impacts would be nearly impossible.
- Providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the proposed action or alternatives. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because there is limited information on the environmental impacts of individual past actions, and one cannot reasonably identify each and every action over the last century that has contributed to current conditions.
- Focusing on the impacts of past human actions risks ignoring the important residual effects of past natural events, which may contribute to cumulative effects just as much as human actions. By looking at current conditions, we are sure to

capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed to those 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 would 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)"

Each resource includes a discussion of how information on past projects was considered. For the reasons discussed above, the analysis of past actions is primarily based on current environmental conditions. Some resources utilize the current GIS vegetation layer which includes information on current condition of forest stands as they have been affected by events such as forest fires, past regeneration harvest and road construction as well as the growth that has occurred since.

3.0.2 Other Projects

The proposed Cascade Crossing power line project does not cross the project area. However the proponent of the power line, as part of their planning process, is considering an alternative that would cross into the Collawash watershed near the Forest boundary. The closest alternate route would be approximately 5 miles from the nearest Jazz unit. There is not sufficient certainty or site-specificity for the effects of this power line to be reasonably quantified in this EA. The appropriate time to conduct a cumulative effects analysis would be in an Environmental Impact

Statement for the new power line once proposed routes and alternatives are firmly developed.

The Forest has been planning and implementing the decommissioning of roads. In the Collawash watershed, approximately 74 miles of roads have been decommissioned recently and approximately 123 more miles will be decommissioned in the near future. The effects and benefits of decommissioning would be included in resource analyses where appropriate.

Other types of projects or activities are also considered where appropriate including road maintenance, danger tree removal, gathering of special forest products, and recreational uses.

3.1 STAND GROWTH AND PRODUCTIVITY

(This section elaborates on Purpose and Need section 1.3 and s. 1.2.1.3)

Growth and productivity are primarily concerns in the matrix land allocation but the stand dynamics of plantations are also relevant to achieving objectives for other land allocations. Section 1.2.6 contains a discussion about stand dynamics and growth. Soil productivity is discussed in section 3.6. This section summarizes the silvicultural specialist report and the stand data in the analysis file.

When the plantations were created, trees were planted at relatively close spacing with the understanding that density management practices would occur over time to sufficiently space the trees to maximize their growth. When trees are too closely spaced they experience a slowing of growth due to competition for sunlight, moisture and nutrients.

Denser stands are more susceptible to stem breakage or tipping in winds. Trees that grow at wide spacing and in windy areas can develop resistance to wind by growing strong stems and strong, spreading root systems. Trees that grow at tight spacing in the interior of stands are protected from the wind and often would not develop resistant stems or roots.

The Jazz project area lies within the Western Hemlock Zone (WHZ). The WHZ is an area where specific complexes of plant communities or associations occur. Plant associations describe the assemblages or complexes of vegetation and plant communities found in the forest. They reflect differences in temperature, moisture, and plant debris inputs and tend to correlate well with timber productivity and provide a useful tool for making inferences about growth and yield. The Western Hemlock Zone encompasses forests where western hemlock would dominate the overstory (assuming no disturbance) but Douglas-fir is currently the dominant overstory species. All plant associations in the proposed Jazz project area are within the western hemlock series. Most of the area is located on productive, well-drained soils, typical of the plant associations they occupy.

The stands in the Jazz project area display moderate species diversity with common overstory species consisting predominantly of Douglas-fir (*Pseudotsuga menziesii*), with minor inclusions of western hemlock (*Tsuga heterophylla*), noble fir (*Abies procera*), grand fir (*Abies grandis*), Pacific silver fir (*Abies amabilis*), and western redcedar (*Thuja plicata*). Ground cover includes, dwarf Oregon grape *(Mahonia nervosa*), vine maple (*Acer circinatum*), salal (*Gaultheria shallon*), snowberry (*Symphoricarpos albus*), swordfern (*Polystichum munitum*), and bracken fern (*Pteridium aquilinum*). There are inclusions of red alder (*Alnus rubra*), primarily in wet areas.

The western hemlock zone supplies most of the timber produced on the Forest, however there is great variability in timber productivity. In the western hemlock zone, on average, the most productive conditions occur where effective rooting depth is greatest, the input of plant residues is high and the organic matter is decomposed and leached into the soil quickly. The plant associations with the highest amounts of large fallen trees are those with a warm, moist environment and relatively high productivity.

3.1.1 For this proposal, the following actions have the potential to affect stand growth, productivity and health, both positively and negatively and are included in the analysis of effects. Thinning would generally have a positive effect on growth and productivity. Potential negative effects may include soil compaction from the use of heavy equipment, damaging leave trees, and attracting insects by leaving slash and down logs on the ground. With the proposed action certain elements designed to enhance diversity such as skips and gaps have the potential to reduce the acreage where thinning benefits for tree growth and productivity would occur. The effects of thinning are generally felt only inside the thinned stands; therefore the analysis area for direct, indirect and cumulative effects for stand growth and productivity would be the unit boundaries.

3.1.2 Existing Condition

Plantations in the Jazz project are capable of rapid growth but growing space has become limited due to overcrowding and stands are experiencing growth suppression and some mortality. The major causes of growth suppression are competition from surrounding trees, concentrations of ground and understory vegetation, and limited resources such as light, water, and nutrients.

The species mix is similar in each of the stands but most exhibit various concentrations and distributions. Douglas-fir generally dominates the overstory in the plantations with lesser quantities of western hemlock, noble fir, grand fir, and areas scattered with western redcedar. Relative densities (RDs) range from 55 to 85 with an average diameter of approximately 12 inches. The net growth rate (which includes growth and mortality) is 0.7 cubic feet per tree per year. Heights in the project area

range from approximately 85-110 feet. Productivity is relatively high when compared to Region 6 averages; site indices range from site I to III.

Both laminated root rot and armillaria root disease have caused moderate to severe infection and mortality throughout the project area. Openings ranging in size from ½ to 3 acres have been created by laminated root while smaller patches of armillaria are more common.

Direct and Indirect Effects

Random plots were measured within the proposed thinning units and the data was incorporated into the Forest Vegetation Simulator (FVS) (Crookston 1999) to project future growth. Stand exam data and FVS outputs were interpreted by a certified silviculturist.

In the following analysis, projections are sumarized for 40 years from now. This allows sufficient time for trees that have been thinned to improve root development and to fully realize the site's potential. In terms of tree size, 20 inches in diameter is displayed because it is thought to be the minimum size at which stands begin to exhibit late-successional conditions.

3.1.3 Alternative A - No Action - Trees that have been uniformly spaced during planting have less of a chance to express dominance when they have been planted from genetically similar seed sources and maintained at relatively even spacing. Therefore, when these stands reach density levels in which individual trees are competing with each other for growing space it may take longer for individuals to express dominance. As tree competition increases, stems would continue to grow in height, but diameter growth would drastically slow. These trees would become more dependent on neighboring trees for support. When trees develop in this manner they are more likely to blow down in large groups or if drought conditions persist, be more susceptible to insects and disease.

With no action, the average stand diameter in 40 years would be approximately 16.6 inches and the net growth rate (which includes growth and mortality) would be 0.9 cubic feet per tree per year. Stocking would be at levels where growth suppression and mortality continues to occur (RD would exceed 95). The understory vegetation would also continue to be suppressed.

Failure to maintain tree spacing while they are young can have consequences lasting the life of the stand (Oliver 1996). If no action is taken, the overstocked condition of current stands would result in stands with reduced vigor, small trees, increased mortality, and increased susceptibility to stressors such as insects, diseases and weather.

In terms of wind stability, with no action stands would remain crowded and would gradually decrease in vigor. Stands would reach density levels in which individual

trees are competing with each other for growing space. As tree competition increases, stems would continue to grow in height, but diameter growth would drastically slow. These trees would become more dependent on neighboring trees for support. When trees develop in this manner they are more likely to blow down in large groups or if drought conditions persist, be more susceptible to insects and disease. Overcrowded stands cannot defend themselves very well against damaging agents such as insects because their sap production is limited. Trees have less of a chance to express dominance when they have been planted from genetically similar seed sources and maintained at relatively even spacing.

3.1.4 Proposed Action – In general, thinning tends to improve the overall vigor, growth, health and architecture of trees. Thinning can directly affect productivity and forest health by maintaining growth rates of young stands. Thinning would redistribute growth potential to fewer trees, while maximizing the site's potential, leaving a stand with a desired structure and composition (Oliver 1996).

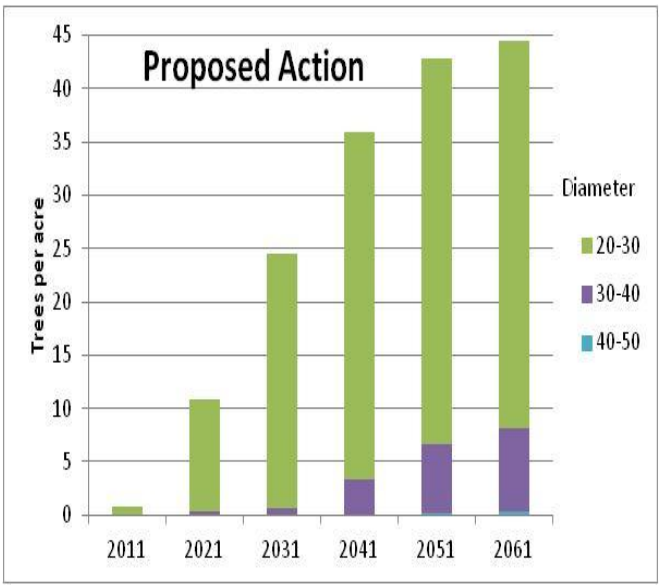
Thinning provides growing space, which gives the trees with the best competitive advantage the opportunity to take advantage of this growing space for the longest practical time, fully utilizing the ability of the trees to expand their crowns into the growing room provided by the removal of neighboring trees (Oliver and Larsen, 1996). Trees with larger crowns have greater stem taper, that is, the base of the tree is relatively large compared with trees that have small short crowns. Thinning increases a tree's resistance to the wind (windfirmness) by maintaining a larger crown and increasing stem taper. Trees with more taper are less likely to suffer stem breakage or windthrow. In general, thinning increases both stem and root strength. Thinning can also improve the resistance of some trees to some pathogens by manipulating the structure and species composition of a stand.

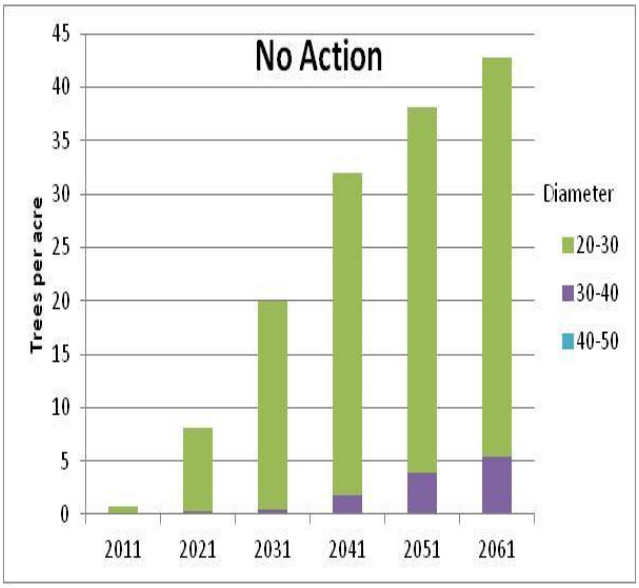
Stands in the matrix would be thinned to improve stand growth, individual tree growth and to provide variability. The thinning prescription would employ a range of relative densities from 20 to 25. (This range corresponds to approximately 80 and 120 square feet of basal area.) These prescriptions would achieve the matrix objectives of stand growth, productivity and health goals while providing forest products. These objectives would be met with the proposed action but would not be achieved with no action.

Average stand diameter in 40 years would be approximately 22.6 inches and the net growth rate (which includes growth and mortality) would be 2.1 cubic feet per tree per year. Thinning would achieve one of the purposes of this project which is to provide forest products consistent with the Northwest Forest Plan goal of maintaining the stability of local and regional economies. It would supply approximately 15 million board feet of wood products now but it would also keep forests healthy and productive to sustainably provide forest products in the matrix in the future. Not only are forest products needed by society, but also the employment created is important to local and regional economies (Northwest Forest Plan ROD p. 26, Mt. Hood Forest Plan p. Four-3&26).

Comparison of Alternatives

The following charts show a side-by-side comparison for live trees greater than 20 inches in diameter. The smaller trees have been subtracted to focus on the size of trees that are thought to be most important. The proposed action creates larger trees sooner compared to no action.





3.1.5 Cumulative Effects – Health and Growth

Because the effects of thinning on growth and productivity are generally felt only inside the thinned stands, the analysis area for cumulative effects is the unit boundary. The existing condition and the changes projected above include past actions as they have affected growth including previous logging, site preparation, planting (including the selection of genetically appropriate seed), and precommercial thinning. There are no other owners or entities performing actions inside the units to consider. There are also no foreseeable future projects occurring inside the units to consider. While there may be future logging or other management within the units, there are no current proposals with sufficient site specificity to conduct an analysis. Because the impact of the proposed action on growth and productivity is a beneficial one, and there are no other additive impacts to consider, therefore there would be no cumulative effects.

3.1.6 Forest Plan standards and guidelines

Forest Plan References
Forestwide Timber Management Standards and Guidelines - FW-306 to FW-385, page Four-86

Mt. Hood FEIS pages IV-50 to IV-76
Northwest Forest Plan - Matrix Standards - page C-39

FW-372 Thinning has been designed to maintain the desired stocking level to achieve a vigorously growing stand throughout the rotation, while considering wildlife cover needs.

The proposed action is consistent with this standard and guideline and the no-action alternative is not.

3.1.7 Other Findings

The proposed action is consistent with the National Forest Management Act regulations for vegetative management. There would be no regulated timber harvest on lands classified as unsuitable for timber production (36 CFR 219.14) and vegetation manipulation is in compliance with 36 CFR 219.27(b).

3.2 DIVERSITY

(This section elaborates on Purpose and Need section 1.3 and s. 1.2.1.4)

3.2.1 Introduction - This section focuses on diversity at the stand scale. Other sections of this document contain discussions of stand and landscape scale effects to wildlife (s. 3.8) and botany (s. 3.13). This section summarizes the silvicultural specialist report and the stand data in the analysis file.

Diversity is the distribution and abundance of different native plant and animal communities and species within an area. There are many types of diversity including but not limited to genetic, structural, horizontal, and vertical. At the landscape scale, a mix of forest types and ages can provide habitat for a wide range of plants and animals. At the stand scale other elements become more relevant such as species composition, snag abundance or the number of canopy layers.

The proposed action has the potential to affect diversity, both positively and negatively. Thinning would feature variable density with skips and gaps. Leave trees would include minor species, trees with the elements of wood decay and non-hazardous snags while some snags and down logs would be created. Some hazardous snags may be lost. The effects of thinning on the elements of stand diversity are generally felt only inside the thinned stands; therefore the analysis area for direct, indirect and cumulative effects for stand diversity would be the unit boundaries. Other elements of diversity at the larger landscape scale are discussed in section 3.8.

One of the purposes of the project is to create greater variability in the stands (s. 1.3). To evaluate the accomplishment of this objective, the alternatives are compared in terms of the following measures: acres treated, the change in tree species composition, the change in the abundance of other desired plants, the change in vertical canopy layers, the change in horizontal structure with skips and gaps, and the changes to snags

and down logs. Additional discussions of snags and down logs at the stand and landscape scale are in section 3.8.2.

3.2.2 Existing Condition

All of the stands are relatively dense with one canopy layer (see s. 3.1). The plantations were planted primarily with Douglas-fir in the lower elevations; in some areas other species such as noble fir were planted. Some other tree species such as western hemlock, grand fir, Pacific silver fir or western redcedar are present either because they survived the clearcutting and burning or because they seeded in from stand edges. Snags present in the stands are the result of planted trees that have died from inter-tree competition or disease over time. There is a fair amount of variability in the quantities of down wood based on the treatments that were done at the time of the original clear cutting. Root rots are one of the disturbance factors that are creating some small gaps in certain affected stands.

Direct and Indirect Effects

3.2.3 No Action

The uniformity of plantations would remain unchanged in terms of species composition, vertical or horizontal structure. Recent studies have indicated that dense, closed-canopy second-growth stands without legacy trees can result in a period of low structural diversity that can last more than 100 years and can have profound effects on the capacity of the forest to develop biocomplexity in the future (Courtney 2004, appendix 5, p. 3-24). The plantations contain some small and medium size snags (planted trees that died) and these would remain with this alternative. Over time as trees become suppressed, more small and medium size trees would die. At the landscape scale, there is not a shortage of this size of snag. Where root rots occur, there would be a continued slow expansion of gaps as trees die and fall. Species that rely on diverse mature forests would have to wait many years for appropriate habitat conditions to develop without intervention.

3.2.4 Proposed Action

The proposed thinning as described in s. 1.4.1 would introduce some elements of diversity that are lacking in plantations. The concepts of variable-density thinning are elaborated in research by Carey, Chan and Tappeiner (Carey 2003) (Chan 2006) (Tappeiner 1999). Thinning would be conducted to introduce structural diversity through variable-spaced thinning. Minor species, non hazardous snags and down wood and would be retained and skips and gaps would be created. The quantity and sizes of skips and gaps are varied based on land allocation and site-specific situations.

These changes would result in improvements in diversity that would benefit plants and animals in the project area and across the landscape. Plantations would have a more complex mix of tree species and spatial arrangement. There would be greater

variability of vertical and horizontal stand structure and more sunlight would reach the forest floor to create greater diversity of ground vegetation. There would be a greater diversity of live trees and sufficient quantities of dead trees, down wood, and live trees with the elements of wood decay to meet the needs of dependent species.

Because there are several elements of diversity considered here with both short and long-term implications, it is possible to affect one element positively while affecting others negatively. Variable density thinning to achieve vertical and horizontal structure would result in a reduction in levels of small snags and down logs compared to no action. The proposed action would create some snags and down logs now and would result in large snags in the future that would be similar to the levels of large snags and down logs in the no action alternative. The proposed action would not affect the viability of species that depend on snags and down logs because sufficient levels would be provided at the local and landscape scales (s. 3.8).

3.2.5 Comparison of Alternatives

Measure	No Action	Proposed Action
Acres Affected	0	2,053 would be altered to enhance diversity.
Change in tree species	Tree species mix would not change. Stands are currently predominantly Douglas-fir (approximately 5 % minor species in most stands).	Retention of minor species and removal of some Douglas-fir – results in greater representation of western hemlock, noble fir, Pacific silver fir, western redcedar and alder (as much as 20% minor species in some stands). Minor species are likely to seed into stands more readily than Douglas-fir. More representative of historic species mix.
Change in other plants	Plants on the forest floor would remain unchanged.	More sunlight to forest floor would increase abundance of plants such as forage species.
Change in vertical canopy layers	Stands would primarily remain single story stands with small gaps created by natural disturbances.	Gaps and heavy thins would naturally regenerate and begin to grow young trees resulting in a two storied stand. (Up to 10% gaps and up to 10% heavy thins). Some seeding in would also occur in the rest of unit except in skips and riparian buffers.
Change in horizontal structure	Trees would remain uniformly dense. Root rot pockets would create small gaps in stands where it is present.	A mix of gaps, skips, heavy thins, and variable density thinning would result in diverse structure. (Up to 10% gaps, up to 10% heavy thins, skips would be 5 to 10% plus riparian buffers). The quantities of these features would vary between units.
Change to snags and down wood (s. 3.8.2)	High levels of small snags and down wood in next few decades.	The project would create some small snags and down logs now (s. 1.4.9). In terms of natural mortality, there would be lower levels of small snags and down wood in the next few decades compared to no action. In the long term, levels for larger sized snags and down wood are slightly less compared to no action.

3.2.6 Cumulative Effects

Because the effects of thinning on stand diversity are generally felt only inside the thinned stands, the analysis area for cumulative effects is the unit boundary. The existing condition and the changes projected above include past actions as they have

affected stand diversity including previous logging, site preparation, planting (including the selection of tree species), and precommercial thinning. There are no other owners or entities performing actions inside the units to consider. There are also no foreseeable future projects occurring inside the units to consider. While there may be future logging or other management within the units, there are no current proposals with sufficient site specificity to conduct an analysis. For these reasons, and because the direct effects would be primarily beneficial, cumulative effects would not be substantial.

3.2.7 Forest Plan standards and guidelines - Landscape and Stand Diversity

Forest Plan References
Forest Management Goals - #11 and 12, page Four-2
Forestwide Forest Diversity Standards and Guidelines – FW-148 to 169, page Four-67
Northwest Forest Plan - Aquatic Conservation Strategy Objectives - page B-11

The proposed action is consistent with these standards and guidelines. The no-action alternative would not enhance diversity.

FW-148 to 150	The thinning prescriptions retain a diversity of species.
FW-152 to 153	Not applicable
FW-154 &155	The thinning prescriptions retain a diversity of tree species based on site potential and encourage the continued presence of minor forest tree species.
FW-156	No native species would be lost.
FW-157	Some areas contain an abundance of alder. It would be retained where feasible.
FW-158 to 160	Not applicable
FW-163 to 169	See Wildlife section

3.3 FISHERIES

This section summarizes the Fisheries Biological Assessment and Biological Evaluation.

The project "Action Area" consists of the Collawash River 5th field watershed containing both the Collawash River, and the Hot Springs Fork of the Collawash River. The action area is defined for ESA purposes as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 402). There are five sixth field subwatersheds in the project area. The project area is defined as the proposed thinning units, or the area of

ground disturbance while the action area is a larger watershed and includes the haul routes.

These rivers originate from rainwater and snowmelt on the crest of the Cascades. Annual precipitation can be up to 100 inches in the form of rain and snow.

The Collawash River is classified as Tier I, Key Watershed in the Northwest Forest Plan. Tier I watersheds have been identified as crucial refugia for at-risk fish species.

The lower reaches of the watersheds support populations of at-risk anadromous fish, including spring Chinook salmon, winter steelhead and coho salmon. Streams with these fish are referred to as listed-fish habitat (LFH). The upper reaches of the two watersheds do not have anadromous fish due to small stream sizes and barriers that block their access. Despite this, the upper reaches support native resident cutthroat and rainbow trout.

The Project Area is filled with steep, boulder strewn tributary streams of high gradient and flashy character. Peakflows (also called channel forming flows) are important to the watershed health. Fairly frequent high flows are responsible for shaping the channel, and moving large woody debris from tributary to mainstem and adjacent riparian areas.

Past actions that have shaped the watershed and its fisheries include timber harvest, road building, hatchery introductions, and downstream hydroelectric development. Timber harvest has created a fragmented pattern that has contributed to a loss of riparian habitat, increased stream temperatures and increased sedimentation. Regeneration and clearcut harvest occurred on approximately 25% of the forested lands within the watershed, converting mature forest habitat to plantations. The riparian reserves of the watershed have been altered by road building.

Past clear cut timber harvest often occurred within riparian areas and to the edges of adjacent streams. The harvest impacted stream shade, and water temperatures, but shading has recovered to near historic conditions with deciduous and early-seral vegetation, and large second-growth trees.

3.3.1 Management Indicator Species

Because of their relative sensitivity to change, the family of fishes, known as salmonids, was selected as "an indicator species group" for aquatic habitats. This group of species is especially important for their commercial and game values and because they occupy the spectrum of aquatic habitats on the Forest. It is assumed that if the needs of salmonids are met, the needs of other fish and aquatic species would also be met. Management Indicator Species for the Forest include Chinook salmon, coho salmon, steelhead, coastal cutthroat trout and rainbow trout. A Forest-level analysis of the status of these species and their habitat was conducted in 2011. The state of Oregon, in concert with the regulatory agencies, manages fish populations

while the Forest manages the habitat. For a population to be viable, attributes such as species abundance, productivity, spatial structure, and genetic diversity are needed for the species to maintain its capacity to adapt to various environmental conditions and allow it to sustain itself in the natural environment. All of these attributes are affected by habitat and other environmental conditions that influence species behavior and survival. The Forest-wide analysis was conducted at a coarse scale using available GIS data. The project level interdisciplinary team took the Forest-wide data and refined it based on field examinations and local knowledge of habitat conditions. For example, some of the maps of resident fish presence show fish in portions of streams that are known to be intermittent with no fish.

3.3.2 Federally Listed Species

Columbia River Bull Trout (Salvelinus confluentus) Threatened
Bull trout were historically present in the Clackamas River system and the lower mainstem Collawash River. They were believed to be extirpated in the entire Clackamas watershed. Repeated recent fish sampling conducted in the Clackamas River drainages failed to uncover any bull trout presence. Bull trout were evaluated for reintroduction through a feasibility analysis and were reintroduced into the upper Clackamas River in 2011 as a nonessential experimental population. All of the proposed harvest units would be one mile or further from any bull trout habitat.

Lower Columbia River Steelhead (Oncorhynchus mykiss) Threatened
Lower Columbia River (LCR) steelhead occur in the Clackamas River, Sandy River, and Hood River basins. They also occur in the West Columbia Gorge tributaries. Adult winter steelhead enter rivers and streams on the Forest primarily during April through June with peak migration occurring in May. Steelhead use the majority of the mainstem rivers and tributaries as spawning and rearing habitat. LCR steelhead occur within the action area.

Upper Willamette River Chinook (Oncorhynchus mykiss) Threatened
Upper Willamette River (UWR) spring Chinook salmon that occur in the Clackamas River consists of both naturally spawning and hatchery produced fish. Only wild naturally produced Chinook are allowed to pass PGE's North Fork Dam and fish ladder onto National Forest lands in the Clackamas watershed. These fish primarily spawn and rear in the mainstem Clackamas River and larger tributaries.

Spawning in the upper Clackamas drainage has been observed in the mainstem Clackamas from the head of North Fork Reservoir upstream to Big Bottom, Oak Grove Fork, Pinhead Creek, the Collawash River and Hot Springs Fork of the Collawash River, lower Fish Creek, South Fork Clackamas River and Roaring River. Upper Willamette River Chinook salmon occur within the action area.

Lower Columbia River Coho Salmon (Oncorhynchus kisutch) Threatened
The Clackamas River contains the last remaining viable run of wild late-run winter coho in the Columbia Basin. There is also an early returning run that has naturalized

from hatchery stocks within the Clackamas Basin. Coho salmon occur within the mainstem Clackamas River, and the lower reaches of streams in the Clackamas watershed including the Oak Grove Fork to river mile 3.8 and the lower North Fork Clackamas River below the barrier falls. Lower Columbia River coho occur within the action area.

3.3.3 Sensitive Species and Survey and Manage Species

Because this project involves thinning stands less than 80 years of age, the standards and guidelines outlined in the 2001 Record of Decision for the Amendments to the **Survey and Manage**, Protection Buffer, and other Mitigation Measures are not applicable, as the Pechman exemption applies to these stands.

Sensitive species on the Regional Forester's list in the Action Area:

Scott's Apatanian Caddisfly (Allomvia scotti)
Habitat for the Scott's apatanian caddisfly larvae is low to high elevation; cold, pure, well-oxygenated water in springs, and small streams. The project site is not likely to impact any springs or spring outflows.

3.3.4 Direct and Indirect Effects Summary

For this proposed project, the following actions have the potential to affect water quality and aquatic species or their habitats: tree felling, road maintenance, log yarding, log haul, and road decommissioning. These actions are of concern because they could affect stream temperature, levels of sediment in streams, peak flows, and future in-channel large wood recruitment.

To determine potential effects to aquatic species, each of the relevant habitat indicators was evaluated by proximity to the action, probability that an effect would occur, and magnitude of the action.

No Action

Plantations are overstocked with relatively uniform tree size and distribution, have low species diversity, and have low habitat value. These plantations do not meet the needs of riparian dependent aquatic and terrestrial species. The plantations provide some shade to streams but they do not produce the size and quantity of coarse woody debris sufficient to sustain physical complexity and stability of the riparian reserves and associated streams. They do not have mature and late-successional stand conditions.

With no action there would be no change to water quality, fisheries resources, or peak flows. Since there would be no ground disturbance or loss of forest canopy there would be no potential for any increase in surface erosion, sedimentation, peak flows

or temperature. Riparian reserves would retain their current level of shade and water temperatures within and downstream of the project area would gradually improve as riparian reserves across the watershed grow denser.

If no action were taken in riparian reserves, riparian stands would maintain their mid-seral structure for many decades and not reach the desired late-successional characteristics as quickly as thinned stands. There could potentially be negative effects because stands would become or remain overcrowded, stream bank stability, and overall health of the riparian reserves. Stands under this condition would be denser, less diverse (structurally), have smaller diameter trees, and less understory development compared to the proposed action. Riparian tree size would be smaller with no action. Over time, there would be an abundance of trees dying and falling into streams.

Proposed Action

Related subjects are discussed in the hydrology section including Hydrologic Recovery in s. 3.4.1, Water Temperature in s. 3.3.4.1, and Sediment in s. 3.3.4.2.

Variable density thinning would accelerate the development of mature stand conditions in riparian areas and protection buffers would provide sufficient shade and supply of down wood to improve stream channel complexity for aquatic species. Complexity, in this case, is both physical and biological complexity. Physical complexity is created when large wood falls into streams and creates new habitat that supports multiple species and ages of fish and other organisms. Biological complexity is the result of diverse physical habitat and produces rich food resources that are available to other aquatic organisms. Mature stand conditions would also protect stream temperatures by providing canopy coverage and shade from direct sunlight on streams. Mature stands would help keep water temperatures within the tolerance of aquatic species living in the action area.

3.3.4.1 Water Temperature

Summer stream temperatures are often higher than the Oregon State DEQ Water Quality Standards in the Collawash River and Hot Springs Fork of the Collawash River watersheds.

According to the Oregon State water temperature standards, the seven-day-average maximum temperature of a stream identified as having core cold water habitat use on subbasin maps and tables set out in OAR 340-041-101 to 340-041-340 may not exceed 16.0 degrees Celsius (60.8 degrees Fahrenheit). The seven-day-average maximum temperature of a stream identified as having salmon and steelhead spawning use on subbasin maps and tables set out in OAR 340-041-0101 to 340-041-0340 may not exceed 13.0 degrees Celsius (55.4 degrees Fahrenheit) at the times indicated on the maps and tables. If the seven-day-average maximum temperature is greater than the standard, no further increase in water temperature is permitted.

When streams consistently exceed state standards, they may become listed as a Category 5 stream in the 303(d) standards of the Clean Water Act. Category 5 streams are considered impaired and in need of a water quality improvement plan. These are the highest priority streams for reducing the impacts of management activities on water quality, namely stream temperature. After a TMDL (Total Maximum Daily Load) is approved in a watershed, the Category for water quality limited streams is changed to Category 4A, water quality limited, TMDL approved. This is the case for the water quality limited streams (see discussion below) in the Collawash Watershed, where a TMDL (Total Maximum Daily Load) for water temperature in the Willamette Basin has been approved by the EPA.

The project's potential effect on stream temperature has been assessed by discussing the efficacy of project design criteria, based guidance in the Northwest Forest Plan Temperature TMDL Implementation Strategy (USDA 2010).

Portions of the Collawash River and Nohorn Creek have been identified as water quality limited for temperatures in excess Oregon State standards. In the Collawash River from river mile 0 to 7.7 standards are not met for spawning and from river mile 0 to 12.2 standards are not met for core coldwater habitat. In Nohorn Creek from river mile 0 to 1.8 the standard for spawning is not met. These streams are listed as Category 4a which is assigned to streams that were quality limited, but have been delisted since a TMDL has been approved. The TMDL for the Willamette Basin was approved by the US EPA on September 29, 2006.

Higher than average water temperatures are probably endemic to portions of this watershed, particularly in the Lower Hot Springs Fork and mainstem Collawash (USDA 1995) because of the east-west orientation of the Hot Springs Fork, the wide channels (~100 feet bankfull), as well as geothermal inputs of warm water from natural springs.

Aerial photos from the 1940s show little evidence of natural disturbance and extensive old growth riparian vegetation (USDA 1995). Before 1950, riparian areas throughout most of the watershed were well vegetated with mature Douglas-fir, true firs, cedar and hardwoods.

In the 1950s, road construction and timber removal began in the Collawash watershed, and continued through the 1980s. During the 50-70s, removal of streamside vegetation was the norm throughout the watershed. During this period, riparian vegetation that provided stream shading and the resulting water temperature moderation was sometimes removed during logging operations. The removal of shade likely contributed to stream temperature increases, and appears to be partly represented in current water temperature data. Summer daily maximum water temperatures values for the mainstem Collawash generally shows the highest temperatures (19 degrees Celsius).

After 1980, the retention of streamside vegetation became more common in what are known as riparian reserves. Regrowth of riparian vegetation is expected to result in a gradual reduction in stream temperatures in the watershed. The stands proposed for thinning are relatively dense and provide shade for adjacent streams.

With no action, shade would remain unchanged. Water temperature would gradually improve over time as vegetation in impacted riparian areas grows back.

For the proposed action, shade can be affected by the width of the protection buffer, by the intensity of thinning in the upland portion of the riparian reserve and the cutting of trees for skyline yarding corridors over streams. Approximately 48 skyline corridors for timber yarding are proposed over perennial streams in the project area. Of the streams that have skyline corridors crossings, none would have listed-fish habitat or critical habitat (LFH). Of the streams that have surface connection to LFH; the closest is 620 feet from LFH.

Project Design Criteria were developed to reduce potential impacts to stream temperatures as a result of yarding over streams, as well as meet the guidelines of the Northwest Forest Plan. For example, operators would be required to fully suspend logs when yarding over streams. Corridors would be no more than 15 feet wide, and at least 100 feet apart. There could be a small negative effect to water temperature at the site-specific scale. Trees removed for yarding corridors would eliminate very little actual effective shade and result in little, if any direct solar radiation on the stream channel. Because of this, water temperatures are unlikely to increase. Any effect that does occur would be of short duration as the young stands would be expected to re-close openings in a few years. The magnitude (intensity) of effect on stream temperature is expected to be insubstantial due to the small area of effect. As crowns expand and the corridors close, the effect of yarding would be immeasurable.

Timber thinning has the potential to affect stream temperature through modification of canopy in the riparian reserve. Riparian reserve thinning would occur on approximately 588 acres with the proposed action, outside of the stream protection buffers.

The effect of this project on stream temperatures was analyzed using the Northwest Forest Plan Temperature TMDL Implementation Strategy (USDA USDI 2005, 2011). The strategy describes how to calculate the width of perennial stream buffers needed to maintain shade and corresponding stream temperature in the period of greatest solar radiation. The primary shade zone, is calculated by using site-specific tree heights and hillslope information. The extent of the secondary shade zone, defined as vegetation that intercepts solar radiation during the morning and afternoon hours is considered to be well contained within one site potential tree height (180 feet). If enough shade is provided in the primary shade zone by dense canopy cover, then little benefit is realized from shade provided in the secondary zone. The project plantations have dense canopy cover condition within the primary shade zone (206-327 trees per acre, 87-100 feet tall, mean tree diameter of 12 inches, tree spacing of

11-15 feet). The primary shade zone ranges from 50 to 55 feet, depending on ground slope. Most streams adjacent to harvest units are very small and contribute only a small portion of summer flow to downstream LFH and therefore have minimal ability to change LFH temperatures.

Project design would result in buffers for perennial streams that range from 50 to 100 feet depending on stream orientation and distance to LFH. Outside of protection buffers, thinning would retain a 50% or greater canopy closure.

Within the primary shade zone, the variable width stream protection buffers and the post harvest canopy cover outside of the buffer are adequate to maintain shade and stream temperatures.

The proposed action would protect stream temperature and ensure that sufficient shade would remain for the streams in the project area.

Stream protection buffers applied to the intermittent non-fish bearing streams in the project area would retain direct overhead shading. Intermittent streams only carry water during wet times of the year (winter and spring) when temperatures are cooler. Since these channels have little or no surface flow during the summer time when elevated stream temperatures are of concern no increase in stream temperature is expected downstream. No water quality effects are foreseen in the long term, and the low probability of effects would decrease, as the canopy and ground cover are re-established to pre-harvest conditions.

3.3.4.2 Sediment

Forest soils generally have very high infiltration capacities, far in excess of usual rainfall intensities (Brown 1980). When the soil infiltration rate is much greater than any expected rainfall intensity, surface erosion would rarely occur. In the absence of adequate design criteria and mitigation measures, the removal of soil surface cover and the mechanical compaction of soil could create favorable conditions for surface erosion. Mechanical compaction of surface soil by machines also may reduce infiltration and produce surface runoff (Brown 1980). The project's potential effect on stream sedimentation has been assessed by discussing the efficacy of project design criteria, based on monitoring and an examination of relevant research.

This watershed has large earthflows that resemble slowly moving earth glaciers that cross certain portions of the watershed and contain debris torrent zones. The stability section has more detail on earthflows (s. 3.5). During high flows (typically winter) these earthflows contribute visible amounts of fine, intermediate, and larger sediment to the Collawash and lower subbasin watersheds, raising turbidity levels during high runoff flow events.

According to the Collawash/Hot Springs Watershed Analysis (USFS, 1995), existing management-related sediment production and delivery comes primarily from the road system. The dominant processes contributing to sediment production from roads are cut bank and fill slope related erosion, and erosion related to concentrated flows. On-going road decommissioning work is reducing the road mileage in the watershed, and moving drainage patterns back to more natural conditions.

Streambank condition can have an effect on sediment production during peak flow events. After the floods of 1996, down cutting and bank scour was evident in some areas. Tributary streams that flow through earthflow areas show evidence of active streambank erosion, such as the Farm Creek subwatershed.

The lack of large woody debris in the 5th field watershed contributes to the instability. In this watershed, the current streambank condition is within a normal range, eroding in sediment rich portions, and stable in hardened channel portions.

In the 1950s road construction and timber removal began in the Collawash watershed, and continued through the 1980s. Road construction that crossed streams and ground-based logging near streams has resulted in increases in sediment over baseline conditions.

With no action, road maintenance would continue to occur which would result in some potential sediment input to streams. However, due to insufficient funding, roads may not be adequately maintained and may pose a risk of failure and may contribute sediment to streams.

Proposed Action Direct and Indirect Effects

Road and Landing Construction and Road Maintenance

Road construction and road maintenance activities have the potential to indirectly introduce fine sediment into stream channels. Road maintenance prior to log haul would help maintain the design drainage of the road surface which reduces the potential for larger sediment inputs to runoff that may enter stream courses. The proposed action would re-open approximately 12 miles of old temporary roads and construct approximately 0.4 mile of new temporary road. Temporary road reconstruction would re-establish several stream crossings, using log fords with pit run rock, french drains with pit run, or temporary culverts. These roads would be obliterated after project completion.

Maintenance of the existing system roads prior to hauling would include measures to upgrade the quality of the road bed and to improve road drainage. This includes the placement of new aggregate surfacing where necessary, blading, removing debris from landslides, brushing out encroaching vegetation, removing berms, ditch and culvert inlet cleanout where needed, and repairing several sections of asphalt road surface. Aggregate road surfacing greatly minimizes the amount of fine sediment

from road surfaces entering streams following log haul, especially during and following rainfall events. Additionally, deep patch repairs to the roadbed are proposed along some segments of the haul route.

Road-related ground-disturbing activities have been designed to minimize the risk of sediment being transported to streams from erosion or surface run-off. Road work would be restricted to the dry season between May 31 and November 1. This restriction would reduce the risk of surface erosion due to ground disturbance. The 0.4 mile of new temporary road construction would not cross streams, so they would not cause an increase in the stream drainage network.

All new temporary roads and re-opened temporary roads would be obliterated and revegetated directly following completion of harvest operations to help reduce compaction, increase infiltration rates, minimize surface erosion, and re-establish natural drainage patterns.

Road maintenance prior to log hauling also increases the risk of road related sediment entering streams near road crossing during rainfall events. This increase is associated primarily with aggregate and native surface roads although ditch cleaning associated with paved roads is a potential sediment source. Any fine sediment created by road maintenance activities would most likely be washed from the road surface in the first few precipitation events of the fall that are sufficient to cause runoff from the road surface. Although there is a possibility of increased sediment entering streams due to these activities, most road-related sediment would be trapped and stored in the ditches or on the forest floor below cross drains.

Decompacting the road surface during decommissioning or obliteration activities loosens the soil, thus making it more likely to be mobilized during the first significant run-off period unless the road is on relatively flat terrain, not near streams, or sufficient ground cover (mulch, woody debris, etc.) is provided. Since there is culvert removal associated with the proposed decommissioning activities there is the potential to deliver sediment into stream channels during project implementation. Road obliterations near streams would have short-term, construction-related effects. Stream bank condition and habitat substrate may also be adversely affected during implementation. Turbid conditions would dissipate soon after the in-stream work phase is completed, generally in a few hours. However with careful project design and mitigation measures such as erosion control, these effects are expected to be of a limited extent and duration.

Project design criteria and associated BMPs for road decommissioning would reduce the risk of sediment entering any stream course. The impacts to water quality caused by sedimentation due to road construction, reconstruction, maintenance, or road decommissioning, if any, would be short-term and undetectable at the watershed scale.

It is unlikely that sediment would reach any habitat where ESA listed fish species are found. Any impacts from the minimal amount of sediment generated during these activities would be for a short-term duration, and undetectable at a subwatershed (6th field) or watershed (5th field) scale.

Harvest Activities (felling and yarding)

Thinning, particularly within riparian reserves, has the potential to cause a temporary reduction in water quality by allowing sediment to enter stream channels from surface erosion or run-off. Tree falling, ground-based yarding methods, and to some extent cable yarding methods (when full suspension isn't achieved) disturb soils that may result in minor erosion or displacement at the site level. Ground-based harvesting equipment and cable yarding does cause some direct soil displacement which would be mitigated through project design criteria. Most of the soil movement/erosion resulting from timber harvesting would travel short distances before being trapped by duff, woody materials, and other obstructions. The probability of overland surface runoff on uncompacted soil surfaces is also low for the soils in the project planning area.

Project design criteria would incorporate riparian protection buffers and other techniques such as using existing skid trails, operating harvesters on slash, and seasonal restrictions would further reduce the risk of surface erosion entering streams as fine sediment. Erosion control work following yarding activities would reduce the amount of soil that moves off site in the event surface runoff does occur. The fully vegetated riparian protection buffers would intercept most soil movement and greatly reduce the amount of sediment delivery to any stream. Implementation of these best management practices would result in a non-measureable amount of sediment being delivered to streams.

Sediment that is transported to stream channels is expected to be minor and a negligible amount should be transported to LFH. Distance of timber harvest activity to LFH, and the vegetation coverage between LFH and mechanical equipment reduces risk of fine sediment transport. There may be negative effects to the suspended sediment and substrate indicators at the site-scale in the short term, but the probability of sediment reaching and affecting LFH is low.

Log and Rock Haul

Hauling along aggregate surface or native surfaced roads has the potential to introduce sediment in small quantities to streams. Traffic breaks down surfacing material resulting in finer surface gradation and increased sediment transport from the road surface. Any fine sediment created by hauling traffic would more than likely be washed from the road surface in the first precipitation event that is sufficient to cause runoff from the road surface. Any input of sediment is expected to be minimal as the roads where there is a potential for surface run-off are asphalt or durable crushed rock. All native surfaced roads along the haul route are along ridge tops or gentle terrain, and have no hydrological connection to any streams. Road use however

would be restricted to periods when road related runoff is not present and as such, little sediment is expected to leave the road bed while haul is occurring.

During the wet season, log haul would only be permitted on asphalt and rocked roads when conditions would prevent sediment delivery to streams. In periods of high rainfall, the contract administrator would restrict log hauling when necessary to minimize water quality impacts. Haul would be stopped if there is rutting of the road surface or a noticeable increase in the turbidity of water draining to the road ditches or at stream crossings.

Log hauling would not measurably increase the amount of fine sediment in streams. The roads along the haul route are rocked or paved at stream crossings, and road ditches are well vegetated. Road maintenance prior to log haul would help maintain the design drainage of the road surface which reduces the potential for sediment to runoff into stream courses. Road maintenance and repair would have a beneficial effect on slope stability would reduce the risk of water quality and resource damage from the use of these roads. The potential for sediment input into streams along the haul routes would further be minimized by permitting haul only when conditions would prevent sediment delivery to streams.

There is a high probability that timber and rock haul would introduce some sediment into ditch lines and some streams tributary to LFH during operations. Five aggregate surface roads either adjoin a paved stream crossing, or parallel LFH within a distance of 1,000 feet or less. Road 6300 is adjacent to the Collawash River for 2,500 feet and is within 500 feet of LFH. Road 6310 is less than 500 feet from LFH. Three other roads (road 6330, 6340, and 6380) are less than 1,000 feet from LFH.

To reduce the impacts of sedimentation, two of the closest roads to LFH on the haul route would be closed during the wet season (6300 and 6380). Project design criteria restrict the construction of new temporary roads and landings within 500 feet of LFH or within 200 feet of any other stream. Stream protection buffers, and other PDCs would ensure that sediment delivery to streams would be minor, but cause little impact to LFH.

3.3.4.3 **Wood Recruitment**

Public comments suggested that recent research points toward a conclusion that thinning reduces the quantity of woody debris available to streams. The suggested papers include Beechie et.al (2000), Pollock et.al (draft 2010), Roni et.al. (2002) and others as well as a summary of analysis included in other Environmental Assessments. A suggestion was made that the Forest Vegetation Simulator (FVS) model would show similar results. These papers and other research were examined and the FVS model was used to assess tree mortality. Detail on the FVS output is in section 3.8.2.3.

Large woody debris (LWD) is important in streams because it creates pools, enhances deposition of spawning gravels, boosts trophic processes, and adds structural complexity. In the 1950s through 1970s, the Forest routinely removed large woody debris from streams and salvaged logged in the Collawash watershed. Removal of LWD reduced fish habitat quality and resulted in stream incision that is still evident today. Large Woody Debris is delivered to stream channels naturally by landslides, falling from adjacent riparian areas, and transport from upstream. Road construction has created a barrier to the movement of wood from upstream locations to LFH; if pieces of wood are moved down stream they are caught in a culvert and removed during road maintenance.

Surveys have found wood quantities in most streams to be below current standards. Because many riparian areas were logged in the past, there is not much potential for large woody debris recruitment into associated streams. Small woody debris currently plays an important role in the streams in the action area.

With no action, there would be an abundance of small wood recruited into streams as trees in plantations die and fall (s. 3.1.3 & s. 3.8.2.3).

With the proposed action, stream protection buffers would provide high levels of small wood recruitment (s. 3.8.2.3).

Thinning in the upland portion of the riparian reserves would result in fewer trees dying, and live trees would grow larger compared to no action. The stream protection buffers would continue to supply nearly the same level of small wood recruitment to streams. Recent research (Johnston 2011) has shown that 90% of LWD in western Oregon and Washington streams originated at ground distances between 33 and 66 feet from streams. Streams with 100-foot buffers would have greater than 90% of the predicted level of recruitment and streams with 50 or 60-foot buffers would have approximately 85% of the predicted level of recruitment. The plantations proposed for thinning are not the only sources of wood recruitment along stream reaches. There are mature forest stands along the affected stream reaches that also contribute wood to streams and the wood from these stands would be much larger than what is contributed from plantations. As trees respond to thinning there would be large sized trees that would become available for recruitment to tributary channels and riparian reserves.

Project area tree diameters range in size from 11 to 16 inches. A twenty inch or larger diameter tree is considered functional in LFH because of the complex habitat it creates compared to smaller trees (USDA 2011).

The FVS model predicts that tree size would average 16.6 inches diameter with no action and 22.6 inches diameter in approximately 40 years after thinning (s. 3.1.3&4). The FVS summaries in section 3.8.2.3 show that in 40 years, the levels of dead trees over 20 inches diameter associated with the 120 basal area thinning prescription for

riparian reserves would be approximately 8 per acre compared to 11 per acre with no action.

In the interim, smaller wood would be provided from the stream protection buffer. The thinned portion of the riparian reserve would have larger trees but they tend to be healthy and not as likely to die and fall toward the stream. There is the potential to manually fall trees toward the stream if necessary to meet objectives for instream wood instead of waiting for trees to die and relying on chance that the dead tree would fall toward the stream.

The probability of affecting instream wood abundance in LFH is low because of the protections provided by stream protection buffers and because riparian reserve acres treated amount to only 2% of the total riparian reserve acres contained within Collawash fifth-field watershed.

3.3.4.4 Changes to Riparian Reserve Vegetation

One of the aspects of the purpose and need is to accelerate the development of mature and late-successional stand conditions in riparian reserves. The current vegetation in plantations does not meet the needs of associated aquatic and riparian resources. Timber production is not the objective in riparian reserves; this section focuses on tree growth and when desired riparian conditions might develop.

The riparian reserve plantations are overstocked and have relatively uniform tree size and distribution, have low to moderate amounts of small diameter coarse woody debris, lack understory development and have low levels of snags. These plantations are not late-successional and do not meet the needs of riparian dependent species. The plantations provide some shade to streams but they do not produce the size and quantity of coarse woody debris sufficient to sustain physical complexity and stability of the riparian reserves and associated streams. They do not have mature and late-successional stand conditions.

No Action

With no intervention, these stands would remain at maximum density for many decades until natural mortality opens the canopy enough to allow expansion of crowns and understory response from increased light. Development of desired late-successional characteristics would proceed very slowly under these conditions.

Proposed Action

Silvicultural prescriptions would incorporate variable-density thinning, retention of minor species, and the creation of skips and gaps to move the stands toward the eventual acquisition of late-successional characteristics. Many of these same practices

are also proposed on the matrix portion, but the riparian reserve portion would have protection buffers and an emphasis on stream shading.

As trees respond to thinning they would be larger, and there would be greater diversity compared to no treatment. With the proposed action, plantations would acquire late-successional characteristics sooner compared to no action (s. 3.1).

Riparian thinning with the prescribed stream protection buffers would maintain and restore the species composition 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 distributions of large-diameter coarse woody debris sufficient to sustain physical complexity and stability.

3.3.4.5 Cumulative Effects

Cumulative effects associated with the proposed action and past, present and reasonably foreseeable future actions focus on stream temperature, sediment input to streams and flow changes, wood recruitment and riparian vegetation. Additional cumulative effects discussions that relate to fisheries can be found in sections 3.4.1.5&6 (hydrologic recovery), section 3.3.4.1 (temperature) and section 3.3.4.2 (sediment).

The analysis area for cumulative effects is the entire Collawash watershed because the effects of thinning and associated road work on streams and fish can be felt downstream. Because alterations to streams and riparian vegetation are long lasting, the time frame for cumulative effects analysis goes back to the beginning of active management in 1950. There is no private land in the analysis area. The BLM manages less than 1/10 of 1 percent of the watershed and has no ongoing or foreseeable actions. There are also no foreseeable future projects on the Forest to consider other than the ongoing projects listed below. While there may be future logging or other management within the watershed, there are no current proposals with sufficient site specificity to conduct an analysis.

Past disturbances within the action area are the most substantial contribution to cumulative effects, and include fires, timber harvest and road construction. There are five ongoing thinning projects within the Collawash watershed that may create cumulative effects in relation to the Jazz Thinning Project. The projects are Day (61 ac), Hot (284), Fan (209 ac), Pin (401 ac), and Pink (188 ac) for a total of 1,143 acres. The Forest has been planning and implementing the decommissioning of roads. The Jazz project combined with these ongoing thinning projects affect less than 3% of the watershed. In the Collawash watershed, approximately 74 miles of roads have been decommissioned in the past 15 years and approximately 123 more miles will be decommissioned in the near future. Several wildfires have occurred within the watershed within the last few years including View Lake (2,760 ac), Lenore (298 ac) Mother Load (2,740) and Blister Fire (303 ac) for a total of 6,101 acres. These fires

have burned approximately 6% of the watershed with no post fire salvage. Most of the acreage burned was in high elevation ridgetops a few miles from LFH.

Fires and past management actions including logging and road construction are incorporated in the discussion of existing condition (s. 3.3.4.1-4). Since the creation of the Northwest Forest Plan, many factors have contributed to a trend of stable or improving stream habitat conditions on the Forest (s. 3.3.4.8). Harvest levels since the Northwest Forest Plan have been well below the level projected. Recent project have been designed using the standards and guidelines of the Northwest Forest Plan and its emphasis on restoration in key watersheds. As a result, ongoing thinning projects, road decommissioning, hazard tree felling, road maintenance, firewood cutting, and dispersed recreation are not creating measureable impacts to streams or aquatic resources at the subwatershed scale. In recent years, road decommissioning has occurred and more is planned. Decommissioning a stream crossing can create a short-term pulse of sediment during in-stream work but there would be a long-term restoration with reduced overall sedimentation. The proposed action and other thinning projects would improve stream and riparian conditions by moving the stands toward late-successional conditions. Other ongoing thinning use a similar set of PDCs to protect fish habitat. The Jazz project when added to all the management actions in the past 10 years and all of the projects under contract but not yet completed affect between 0.2% and 6.5% of the riparian reserves of the various 6th field watersheds.

The Biological Assessment found that the proposed action along with other past and ongoing actions would not have a measurable or substantive effect on aquatic resources, including stream temperature, sedimentation, wood recruitment and riparian vegetation because of protections provided by project design criteria including stream protection buffers and seasonal restrictions. While there are likely some short-term cumulative effects related to stream temperature, sedimentation and wood recruitment, there would also be some cumulative benefits as riparian reserves are restored to late-successional conditions and as roads are decommissioned. The ongoing projects meet Forest Plan aquatic standards and guidelines and are consistent with the Aquatic Conservation Strategy. Even with all of the past and ongoing projects, the individual drainages and the Collawash watershed as a whole are recovered hydrologically (s. 3.4.1.6). This project and all of the other ongoing projects were found to not likely to adversely affect listed fish or their habitat (s. 3.3.4.6). For these reasons cumulative effects would not be substantial.

3.3.4.6 Consistency Determination

Determination of Effect to Federally Listed Species & Designated Critical Habitat
Critical habitat exists downstream of the proposed project in the Collawash and Hot Springs Fork of the Collawash rivers. Siltation of LFH is the most likely disturbance that could result from this project. Due to small scale of the impacts and the distance of the project to water sources, disturbance would be localized and of short duration. This project warrants a **"May Affect, Not Likely to Adversely Affect"** for LCR

steelhead, Upper Willamette River Chinook, and LCR coho salmon, their proposed or designated critical habitat, or LFH. The National Marine Fisheries Service has concurred with this determination in their Letter of Concurrence (USDC 2012).

Determination of Effect to Federally Listed Species & Designated Critical Habitat
Suitable habitat exists for Columbia basin bull trout in the Clackamas River and lower four miles of Collawash River. The species was believed extinct for 48 years. The U.S. Fish and Wildlife Service has established a nonessential experimental population in the Clackamas River and its tributaries. All of the proposed timber harvest units would be one mile or further from any potential bull trout habitat. The small scale and short duration of operations in the action area make the extent of impacts minimal. For this reason the proposed project would have **No-Effect (NE)** on bull trout or its habitat.

Determination of Effect to Essential Fish Habitat
Essential Fish Habitats (EFH) are those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (Magnuson-Stevens Act or MSA). The Pacific Fisheries Management Council (PFMC) has recommended an EFH designation for the Pacific salmon fishery that would include those waters and substrate necessary to ensure the production needed to support a sustainable fishery (i.e. properly functioning habitat conditions necessary for the long-term survival of the species through the full range of environmental variation).

Salmon fishery EFH includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to coho and Chinook salmon in Washington, Oregon, Idaho, and California. Salmon EFH excludes areas upstream of longstanding naturally impassable barriers (i.e. natural waterfalls in existence for several hundred years). Three salmonid species are identified under the MSA, Chinook salmon, coho salmon and Puget Sound pink salmon.

The Proposed Action would have No Adverse Affect on Essential Fish Habitat for Chinook and coho salmon. The National Marine Fisheries Service has concurred with this determination in their Letter of Concurrence (USDC 2012).

Determination of Effect to Regional Forester's Special Status Species
The only aquatic invertebrate species on the Forest Service Regional Forester's Special Status Species list is Scott's Apatanian Caddisfly *(Allomvia scotti)*. The project design criteria including stream protection buffers are sufficient to provide for the habitat needs of this species. Anticipated effects of implementing the proposed action would not significantly affect habitat or species persistence.

The potential impacts to Special Status species include log haul and landing construction. Due to the short duration of log haul impacts or the proximity of landing construction to habitat, and the low probability that sediment would reach these species or their habitat, the project warrants a **"May impact individuals or**

habitat, but would not likely contribute to a trend towards Federal listing or loss of viability to the population or species."

The effects determinations for Federally Listed species and Special Status species are appropriate because the project with design criteria would not have a measurable effect on baseline conditions including stream flow, sediment erosion, or water quality. The primary potential impacts to listed-species and their critical habitat would be sedimentation from log haul and landing construction. However, the impact would be of short duration, the likelihood is low that sediment would be transported out of the action area, and there would be low probability that sediment would reach LFH or aquatic species.

3.3.4.7 Aquatic Conservation Strategy

The Aquatic Conservation Strategy (ACS) of the Northwest Forest Plan (USDA and USDI 1994) was developed to restore and maintain the health of watersheds and aquatic ecosystems. The ACS objectives are detailed on page B-11 of the Northwest Forest Plan.

The no-action alternative would maintain the current conditions and would result in plantations that are overstocked with relatively uniform trees with low levels of diversity. They do not have mature and late-successional stand conditions (s. 3.3.4).

The proposed action was evaluated at various temporal and spatial scales. The following table designates the relevant indicators for each objective with a check mark. The suite of indicators for each objective was evaluated to determine if the action achieves the specific ACS objective.

Aquatic Conservation Strategy Objectives and Related Indicators.

	Aquatic Conservation Strategy Objectives								
Indicators	**#1**	**#2**	**#3**	**#4**	**#5**	**#6**	**#7**	**#8**	**#9**
Temperature		X		X				X	X
Sediment				X	X	X		X	X
Chemical Contamination				X				X	X
Physical Barriers	X	X						X	X
Substrate			X		X	X			X
Large Woody Debris			X					X	X
Pool Frequency			X						X
Pool Quality			X						X
Off-Channel Habitat	X	X	X						X
Refugia	X	X						X	X
Width/Depth Ratio			X					X	X
Streambank Condition			X			X		X	X
Floodplain Connectivity	X	X	X				X	X	X
Peak/base Flows					X	X	X		
Drainage Network Increase					X	X	X		
Riparian Reserves	X	X	X	X	X	X		X	X

Following is a summary of the nine ACS objectives and how the proposed project would influence them:

ACS Objective 1. **Distribution, Diversity and Complexity of Watershed and Landscape-Scale Features:** The vegetation in the watershed including riparian reserves has been changed from one predominated by mature forest to one fragmented by clear cuts and plantations. The project would meet this objective because of the protections provided in riparian reserves. The project would accelerate the restoration of late-successional conditions and reduce fragmentation. Riparian prescriptions would restore plantations by creating diversity and complexity. Stream protection buffers would be used on perennial and intermittent streams to provide for shade and wood recruitment. New roads would not cross streams. Road repairs would result in a road system that minimizes impacts to aquatic resources.

ACS Objective 2. **Spatial and Temporal Connectivity Within and Between Watersheds:** The spatial and temporal connectivity in the project area has been affected by the construction of roads and riparian logging. Some roads follow river bottoms and have narrowed the flood plain and accelerated flow causing bank erosion and increased stream temperature. Connectivity has also been disrupted by roads that cross streams with culverts. The project would meet this objective because new roads would not cross streams and stream temperature and wood recruitment would be maintained by the protection buffers adjacent to streams. Erosion prevention measures would minimize transport of sediment and downstream turbidity. Riparian prescriptions would restore plantations by creating diversity and complexity. As these and other riparian reserve plantations are enhanced across the watershed, late-successional connectivity would be restored. Road repairs and decommissioning actions across the watershed would result in a road system that minimizes impacts to aquatic resources.

ACS Objective 3. **Physical Integrity:** The project would meet this objective through design criteria and the protection provided by riparian reserves. Stream protection buffers and road use restrictions during the winter months and other PDCs would minimize erosion. The restrictions would limit sedimentation of streams and habitat changes. Variable density thinning in riparian reserves with protection buffers would restore a diverse, healthy riparian area and would accelerate the growth of trees and would provide a sufficient quantity of shade and large woody debris. New roads would not cross streams. The project would not alter shorelines, banks or bottom configurations.

ACS Objective 4. **Water Quality:** Temperature and sediment in the project area have been affected by the construction of roads and riparian logging. Both are gradually improving as roads are decommissioned and as riparian vegetation grows and provides shade. The project would meet this objective through design criteria and the protection provided by riparian reserves. The quality of water would be maintained by following PDCs that include restrictions on wet season logging and haul, equipment slope restrictions and erosion control methods. Stream protection buffers would maintain stream temperatures and filter out sediment.

ACS Objective 5. **Sediment Regimes:** Even though this watershed has a history of natural erosion process through landslides and debris flows, human activities such as road construction has changed the frequency and timing of erosion processes. Road decommissioning efforts have already restored the highest risk road segments. The project would meet this objective by implementing the PDCs that include restrictions on wet season logging and haul, equipment slope restrictions and erosion control methods. Stream protection buffers would trap material away from streams. New roads would not cross streams. Road repairs would result in a road system that minimizes sedimentation.

ACS Objective 6. **In-Stream Flows:** The project area is prone to rain on snow events. Road construction and regeneration timber harvest caused some drainages to

exceed recovery standards. The trend in recent years has been toward full recovery as plantations grow. Compared to regeneration harvest, thinning has much less affect on hydrologic recovery. The project would meet this objective because hydrologic recovery would continue to improve, and the instream flow regime, including the magnitude of peak flows would be maintained. The watershed would continue hydrologic recovery beyond the minimum levels identified in the Forest Plan.

ACS Objective 7. **Timing, Variability and Duration of Floodplain Inundation:** The timing, variability and duration of floodplain inundation and water table elevation in meadows and wetlands has been altered by timber harvest and the removal of large wood in streams over the past half century. The project would meet this objective because of the protection provided by riparian reserves. Protection buffers adjacent to streams would provide a source of woody debris recruitment. The watershed would continue hydrologic recovery beyond the minimum levels identified in the Forest Plan. There would be no measurable change in peak flow. This project would protect flood plains, wet areas and meadows.

ACS Objective 8. **Species Composition and Structural Diversity of Plant Communities:** Past regeneration harvest has changed both the species and structure in riparian reserves. Stands are dominated by dense mid-seral Douglas-fir plantations. The project would meet this objective because of the protection provided by riparian reserves. Minor tree species would be retained. By protecting stream buffers, wetlands, and thinning in riparian reserves, this project would promote the recruitment of structurally diverse plant communities. Riparian reserve prescriptions include protection buffers and upland variable density thinning with skip and gaps to enhance structural diversity. Gaps would allow light to penetrate beneath the canopy and provide space for natural recruitment of diverse plant communities. Thinned riparian reserves would promote the growth of trees and provide sufficient large woody debris for stream communities.

ACS Objective 9. **Well-Distributed Populations of Native Species:** Past regeneration harvest changed the mix of native species in riparian reserves. Gradually, as plantations grew from early seral to mid seral the species present also changed. In some cases non-native species were inadvertently introduced. The project would meet this objective because of the protection provided by riparian reserves. Minor tree species would be retained. Thinned riparian areas would promote diverse overstory and understory vegetative growth. Design criteria address measures to minimize the spread of invasive plants and to use native species for erosion control.

3.3.4.8 Management Indicator Species (MIS)

Management Indicator Species (MIS) for the Forest include the threatened anadromous species (Chinook salmon, coho salmon and steelhead), and resident trout.

A Forest-level analysis of the status of these species and their habitat was conducted in March of 2011 (project file). The state of Oregon, in concert with the regulatory agencies, manages fish populations while the Forest manages the habitat. For a population to be viable, attributes such as species abundance, productivity, spatial structure, and genetic diversity are needed for the species to maintain its capacity to adapt to various environmental conditions and allow it to sustain itself in the natural environment. All of these attributes are affected by habitat and other environmental conditions that influence species behavior and survival. Maps of the distribution of fish species for the Forest are located in the analysis file. The Forest-wide analysis was conducted at a coarse scale using available GIS data. The project level interdisciplinary team took the Forest-wide data and refined it based on field examinations and local knowledge of habitat conditions.

Resident trout, including coastal cutthroat trout and rainbow trout, are found in most west-side streams on the Forest and are among the most widely distributed salmonids encountered. Information on fish populations came from Level II stream surveys in the past decade from most of the larger fish bearing streams in the watershed (Fan Creek-1999, Pink Creek-2010, Dickey Creek-2003, Blister Creek-2000, East Fork Collawash-1996). Additional information was also gathered by specialists during project planning on-the-ground inspections. Many tributary streams within the action area contain populations of resident trout. The proposed action is designed to avoid impacts to these species and other MIS downstream by creating stream protection buffers. Resident trout are confirmed to be present in 109 miles of streams in the action area.

Several MIS fish species were listed as threatened under the Endangered Species Act due to concerns for their population levels and the condition of habitat and other factors such as commercial fishing and hydroelectric dams. Since the creation of the Northwest Forest Plan, the following factors have contributed to a trend of stable or improving stream habitat on the Forest:

- In-stream restoration projects including the reconnection of side channels, and the addition of wood and boulders.
- Replacing undersized culverts with larger ones or bridges that allow improved fish passage and the ability to withstand larger flood events.
- Decommissioning several hundred miles of roads.
- Managing riparian reserves for shade, large wood recruitment, and the development of late-successional conditions.
- Managing Off-Highway Vehicle use to avoid erosion near sensitive streams.
- Managing stream diversions for irrigation to minimize effects to fish.
- Treating hazardous fuels to minimize the impact of wildfire on riparian areas and fish.
- Removal of a dam that blocked fish passage.

Viability

In summary, the PDCs would minimize negative effects of sediment or turbidity. Winter haul could potentially generate the greatest impact to streams occupied by MIS fish. By adhering to the PDCs, and prohibiting wet season haul on Roads 6300, 6330 and 6380, the effects would be slightly negative, but not substantial to MIS fish. All other haul routes would be maintained and closely monitored by the sale administrator, district hydrologist and fish biologist. Monitoring of compliance with wet season haul restrictions would be conducted to minimize turbidity inputs.

For MIS fish, the direct, indirect and cumulative effects to water quality and the physical habitat for these species are low to immeasurable due to protections provided by PDCs, and the low potential for any sediment to reach streams where these species reside. As such, this project would not contribute to a negative trend in viability on the Forest for MIS fish.

3.3.4.9 Forest Plan Standards and Guidelines

The Forest Plan has guidelines for water (FW 54-79), riparian (FW 80-136), fisheries (FW 137-147), and other areas (B7-28 to B7-39). And the Northwest Forest Plan has riparian reserve Standards and Guidelines (pages C-31 to 38). The proposed project meets all of these standards and guidelines. In the long term, the proposed action would enhance riparian areas, water quality, and aquatic species and habitat at both the project and watershed scale.

3.4 HYDROLOGY

This section covers the topic of hydrologic recovery. It summarizes the hydrologist's specialist report and the stand data in the analysis file. Stream temperature and sediment are related topes covered in section 3.3.4.1 and 3.3.4.2. There is additional discussion on other related topics in the Fisheries (s. 3.3) and Soils sections (s. 3.6).

The project is within the Collawash River 5th field watershed (Hydrologic Unit Code (HUC) 1709001101) of the Clackamas River watershed. The Collawash River 5th field watershed is 97,486 acres (all Federally managed) in size and includes the mainstem Collawash River and tributaries including the Hot Springs Fork of the Collawash and its tributaries. Elevation in the proposed action area ranges from 2000-4000 feet.

The watershed contains 38 miles of anadromous streams, 130.1 miles of resident fish bearing streams, and approximately 491 miles of non-fish bearing streams.

Resource management activities in the Collawash Watershed that have had effects on aquatic resources are timber harvest, road building, and downstream hydroelectric development. Regeneration and clearcut harvest have occurred on approximately 25% of the forested lands within the watershed. The riparian reserves of the

watershed have been altered by the past timber harvest and road building. Past timber harvest in the riparian areas impacted stream shade, but shading has recovered as plantations grow. Most riparian reserve plantations in this watershed now support second-growth trees.

Best Management Practices (USDA 1988) are used to ensure the impacts of current management activities on Forest Service lands do not adversely affect streams and the biota that depend on these aquatic resources and to ensure compliance with the Forest Plan, as amended, the Clean Water Act, as amended, the Oregon Administrative Rules (OAR Chapter 340-41-0004,0028, and 0036), Department of Environmental Quality (DEQ), and the Memorandum of Understanding between the Oregon DEQ and the USDA, Forest Service. General BMPs are described in the document General Best Management Practices, USDA Forest Service, Pacific Northwest Region (11/88). The BMPs are flexible in that they are tailored to account for diverse combinations of physical and biological environmental circumstances. The Forest has documented typical BMPs and assessed their effectiveness (USDA 2004). Project level BMPs are elaborated in s. 1.4.9.

Field Reconnaissance Visits

A watershed specialist along with other interdisciplinary team members including a geologist, soils scientist and fisheries biologist were involved with the creation of the proposed action and design criteria. The team visited proposed harvest units with streams, suspected slope stability problems, or extensive disturbance during past timber harvesting to look for potential water quality and other concerns with proposed harvest units.

Watershed Condition Framework

The Watershed Condition Framework (WCF) is a comprehensive approach for proactively implementing integrated restoration on priority watersheds on national forests and grasslands.

The WCF will improve the way the Forest approaches watershed restoration by targeting the implementation of restoration activities in those watersheds that have been identified as priorities for restoration. The WCF also establishes a nationally consistent reconnaissance-level approach for classifying watershed condition, using a comprehensive set of 12 indicators that are surrogate variables representing the underlying ecological, hydrological, and geomorphic functions and processes that affect watershed condition. Primary emphasis is on aquatic and terrestrial processes and conditions that Forest management activities can influence. The WCF provides an outcome-based performance measure for documenting improvement to watershed condition at forest, regional, and national scales. The process is described at http://www.fs.fed.us/publications/watershed/Watershed_Condition_Framework.pdf.

Watershed condition classification is the process of describing watershed condition in terms of discrete categories (or classes) that reflect the level of watershed health or integrity.

Class 1 watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. These are considered to be functioning properly.

Class 2 watersheds exhibit moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. These are considered to be functioning at risk.

Class 3 watersheds exhibit low geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. These are considered to have impaired function.

The watershed condition classification uses the 12 core national indicators, shown in the following table.

Aquatic Physical (Weight = 30%)	**Aquatic Biological** (Weight = 30%)	**Terrestrial Physical** (Weight = 30%)	**Terrestrial Biological** (Weight = 10%)
Water Quality Water Quantity Aquatic Habitat	Aquatic Biota Riparian/Wetland Vegetation	Roads & Trails Soils	Fire Regime or Wildfire Forest Cover Rangeland Vegetation Terrestrial Invasive Species Forest Health

The overall watershed condition ratings for each of the 6th field watersheds affected by the proposed action is less than 2, which is considered to be functioning properly. Watershed condition classification maps and other information can be downloaded at http://www.fs.fed.us/publications/watershed/

Summary of Watershed Condition Ratings for 6th Field Watersheds in Jazz Thinning Project

USGS HYDROLOGIC UNIT CODE (HUC 6) NAME	Aquatic Physical Score	Aquatic Biological Score	Terrestrial Physical Score	Terrestrial Biological Score	Composite Score
Nohorn Creek	1.6	1.0	2.1	1.0	1.5
Lower Hot Springs Fork Collawash River	1.2	1.0	1.9	1.0	1.3
East Fork Collawash River	1.4	1.0	1.8	1.0	1.4
Happy Creek-Collawash River	1.6	1.0	1.9	1.0	1.4
Farm Creek-Collawash River	1.7	1.0	2.1	1.0	1.5

3.4.1 Hydrologic Recovery

3.4.1.1 Aggregate Recovery Percentage (ARP) Methodology

The elements of the proposed action that would affect hydrologic recovery include thinning, cutting trees for down logs, creating snags and the removal of trees for road, landing, skyline corridor and skid trail construction.

A model-generated index called the Aggregate Recovery Percentage (ARP) has been used to represent the proportion of a watershed in a hydrologically mature condition, and to estimate the potential for adverse cumulative effects related to past, present and foreseeable future actions. It is also a tool to determine compliance with Forest Plan standards and guidelines pertaining to cumulative watershed effects. The model was originally developed to model hydrologic recovery for timber harvest operations where most of the forest canopy was removed, but has been adapted for partial forest canopy removal that occurs during forest thinning projects. By measuring the percent of an area in a hydrologically recovered condition, the ARP model evaluates the risk of increased peak flows from rain-on-snow events. In stands with little or no forest canopy within the transient snow zone, more snow accumulates than beneath a partially or fully hydrologically recovered forest.

The ARP model ranks recovery from 0 to 100, with 100 being fully recovered. Stands that have trees greater than 8 inches in diameter and over 70% canopy closure are considered hydrologically recovered. In the ARP model, stand age is used to determine whether stands meet these criteria. Recovery curves have been developed to model forest stand growth after either complete or partial removal of forest canopy, to determine when a forest stand has hydrologically recovered. A regeneration harvest would result in a stand that would be modeled at 0 % recovery, while a thinned stand would be modeled as having partial hydrologic recovery depending on the amount of forest canopy removed. As time goes by the plantations would grow and recovery would gradually occur. Depending on the quality of site conditions, full hydrologic recovery may take approximately 30-35 years after regeneration harvest.

The 4,200-foot elevation line is generally considered the threshold for the transient snow zone in this area. The transient snow zone is an area in the basin where precipitation frequently falls as snow but then may melt a few days or weeks later, a cycle that may be repeated several times each winter. This transient snow zone can cause flooding if heavy rain and warm temperatures occur simultaneously when snow has accumulated (rain on snow events).

Stand alterations above this elevation would not likely affect peak flows while actions below this elevation could result in more runoff from non-hydrologically recovered stands when there is rapid melting during rain-on-snow events (Christner 1982). The proposed project is below the 4,200-foot level. The Forest Plan often refers to watershed impact area or threshold of concern which are the inverse of ARP, with 0 being fully recovered.

As timber harvest occurs either by complete or partial canopy removal, a portion of the watershed is no longer considered hydrologically mature if enough forest canopy is removed, thus the ARP for that drainage is reduced from 100% depending on the extent and intensity of timber harvest. Studies have shown that in forest openings, or areas that have had forest cover removed, snow accumulation is increased due to the loss of canopy interception. With higher levels of snow accumulation and increased rates of snowmelt in stands where sufficient canopy has been removed, there is the potential to generate more water during rain-on-snow events, which can contribute to increased peak stream flows. As an increasing portion of a watershed is put into an open or partially hydrologically immature condition, the potential for peak flows to be increased becomes greater. Over time, vegetation grows back and in 30 to 35 years would return to a hydrologic mature condition, thereby recovering.

The ARP analysis includes the elements of the proposed action that would affect hydrologic recovery including tree cutting and road construction. Because of the variable nature of the proposed treatments, canopy closure estimates were used that averaged thinning, skips, gaps, riparian protection buffers, forage openings, skid trails, skyline corridors and landings. Where applicable, the ARP analysis also addresses many other factors including:

- All past timber harvest, road construction, rock quarries, and other openings such as the power line;
- Projects that are under contract but not yet completed;
- Recent wildfires;
- Roads that have been recently been decommissioned and others that are planned for the near future; (As these road beds begin to grow trees and close in they would become hydrologically recovered but this process would take approximately 35 years for full recovery.)
- Other ownership; (In the Collawash watershed, the only other non-National Forest lands are 850 acres managed by the Bureau of Land Management (BLM). The BLM acres are all in late-successional reserves and the plantations there are not yet ready for thinning. There are no foreseeable future projects on the BLM portion of this watershed.
- Other foreseeable actions. (While it is likely that there would be thinning or other stand management in the future, there are no other current proposed actions to include in the ARP calculation at this time. Future actions cannot be known site specifically at this time. The appropriate consideration of cumulative effects for unspecified future project would be at the time an environmental analysis is conducted for those future projects.)

To calculate an estimated ARP, the acres of all of the forest stands by stand origination date were tallied in the drainages. Drainages are small watersheds also called 7th field drainages that are roughly 1,000 to 7,000 acres in size. Some small streams are combined where necessary to make logical analysis areas. A spreadsheet was used to estimate hydrologic recovery for these stands assuming a 35 year period

for a stand to reach full hydrologic recovery, when a stand has reached an average diameter of 8 inches and 70 % canopy closure. All past harvests are included but recent timber sales (since 2000) and those not yet completed are tracked by project name.

3.4.1.2 Existing Condition

The stands proposed for thinning are currently hydrologically recovered according to Forest Plan standards and guidelines because they are greater than 8 inches diameter and greater than 70% canopy closure. Because there has been relatively little regeneration harvest in the past two decades, the ARP levels in all the drainages are continuing to increase by approximately 1 to 2% per year in these drainages as young plantations grow. Many of the drainages contain inclusions of Wilderness. The following table shows the current condition for each drainage excluding Wildernesses. An analysis including wilderness is found in the cumulative effects section.

Current level of hydrologic recovery in Jazz Project 7th field drainages

Drainage Name	Current Condition (ARP)
Panzy	94.1%
Blister	86.4%
Dutch	80.1%
Hot Springs Tribs (Cat, Sand, Pink, Pin, Rock and Ferry Creeks)	88.9%
Skin	83.6%
Lower Nohorn	81.8%
Lower Lower Collawash (Cap, Sluice and Slide Creeks)	91.5%
Upper Lower Collawash (Paste and Peat Creeks)	92.0%
Farm	81.9%
Buckeye	93.5%
Happy	94.7%
Upper Collawash (Blitzen, Russ, Ochre, Jazz, Dunno)	87.2%
East Fork Collawash (Ogre, Round, Gyp and Cachebox)	87.2%

Approximately 74 miles of road have already been decommissioned. Additional roads will be decommissioned in the future. As these roads are decommissioned, natural drainage patterns would be re-established, reducing amount of the road drainage network increase in the watersheds where the road decommissioning occurs.

3.4.1.3 Direct, Indirect, and Cumulative Effects

No Action

It is likely that past forest management activities (timber harvest and road building) in the Jazz Project area have affected peak and base flows. The current ARP values

indicate that all 7th field drainages in the Jazz Project area are 80 to 95 percent hydrologically recovered. Under the no action alternative, hydrologically recovery would gradually continue as young plantations grow.

Under the no action alternative there would be no timber harvest, no road reconstruction, or new temporary road construction, so there would be no risk of peak flow increases due to these activities.

Proposed Action

The thinning and road construction of the proposed action is dispersed over a wide landscape overlapping parts of 13 drainages. The following table shows the reduction in ARP value with project implementation.

3.4.1.4 Reduction in ARP value by 7th field drainage due to proposed action

Drainage Name	Acres Thinned	Percent Change
Panzy	77	0.2%
Blister	86	0.3%
Dutch	2	<0.1%
Hot Springs Tribs	291	0.6%
Skin	4	<0.1%
Lower Nohorn	82	0.6%
Lower Lower Collawash	124	0.4%
Upper Lower Collawash	455	1.1%
Farm	140	0.5%
Buckeye	138	0.7%
Happy	118	1.1%
Upper Collawash	240	0.8%
East Fork Collawash	39	<0.1%

With the relatively high existing levels of hydrologic recovery for these drainages, the slight changes in ARP associated with the project would not likely cause stream channel instability or increases in peak flows during rain-on-snow events.

Since no temporary roads with road ditches are being constructed, there would be no stream channel network extension as a result of implementing this project.

3.4.1.5 Cumulative Effects

The Collawash Watershed is used here as the analysis area for cumulative effects. The time frame used to include or exclude actions varies by the type of action. Some impacts are considered permanent with no modeled recovery including permanent

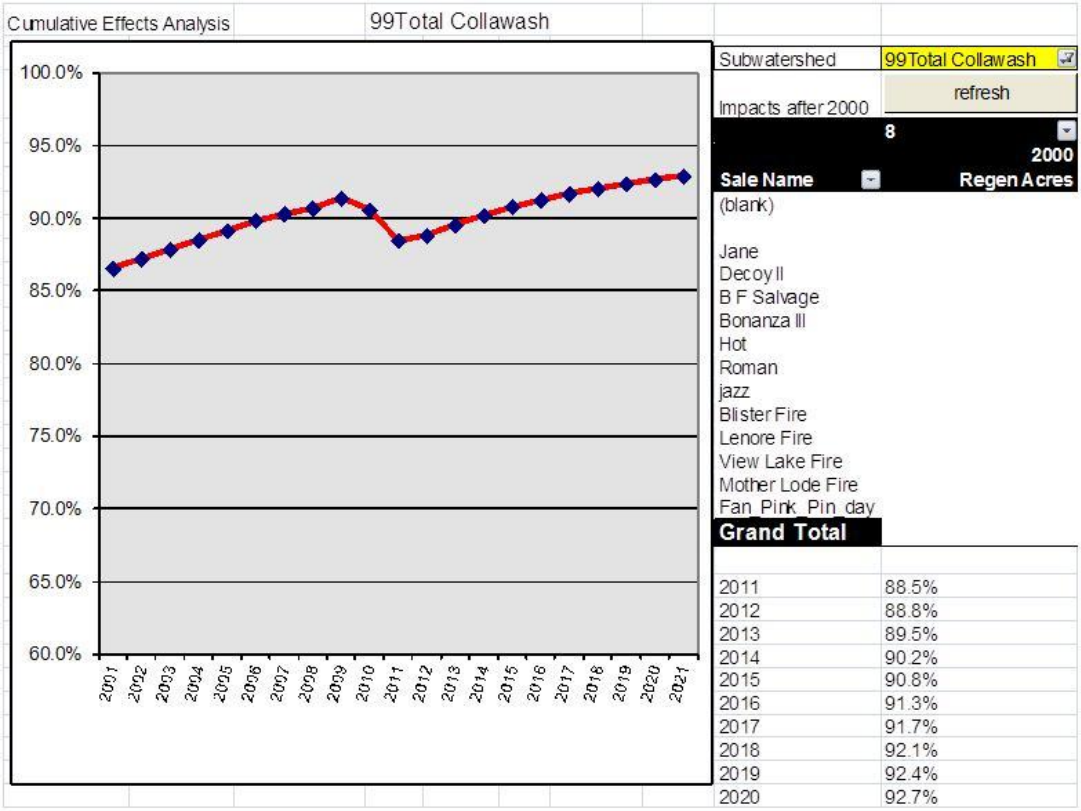
roads, quarries and the power line right-of way. Some impacts such as regeneration harvest would recover gradually over approximately 35 years.

The BLM harvest is included. There are also no foreseeable future projects on the Forest to consider other than the ongoing projects listed below. While there may be future logging or other management within the watershed, there are no current proposals with sufficient site specificity to conduct an analysis.

Past disturbances within the action area are the most substantial contribution to cumulative effects, and include fires, timber harvest and road construction. There are five ongoing thinning projects within the Collawash watershed that are included in the analysis of cumulative effects. The projects are Day (61 ac), Hot (284), Fan (209 ac), Pin (401 ac), and Pink (188 ac) for a total of 1,143 acres. The analysis also tracks projects by name that were implemented between 2000 and the present including Jane, Decoy 2, BF salvage, Bonanza 3, and Roman. The analysis includes harvest before 2000 even though it is not tracked by name. Several wildfires are included in the analysis including View Lake (2,760 ac), Lenore (298 ac) Mother Load (2,740) and Blister Fire (303 ac) for a total of 6,101 acres. These fires have burned approximately 6% of the watershed with no post fire salvage.

The following chart shows the cumulative recovery of all stands in the watershed combined with the cumulative impact of all actions that have affected hydrologic recovery. It is a weighted average of the modeled recovery status of thousands of stands. The dip in the line in 2010 and 2011 represents the effect of the View Lake Fire Complex and the Mother Lode Fire. While the thinning of the Jazz project and the other ongoing thins would likely be spread out over several years, it is modeled here as occurring in 2012 which is the earliest potential harvest date. The graph does not show a downward dip in the line in 2012 because all of the many plantations in the watershed are growing at a rate faster than the impact caused by Jazz.

3.4.1.6 ARP in Collawash Watershed, 2001 to 2021



Cumulative effects pertaining to peak flow increases are not expected because changes to hydrologic recovery as projected by the ARP model are very small in a watershed that is steadily moving toward full recovery. Since no new permanent or temporary roads are being constructed that have a hydrological connection to any water source, there is little potential for peak flow increases due to the more rapid routing of water by road drainage ditches.

3.4.2 Forest Plan goals, standards and guidelines

Forest Plan References
Forestwide Water Standards and Guidelines - FW-54 to FW-79, page Four-53
Mt. Hood FEIS pages IV-22, IV-47, IV-155 to IV-167

There are several Forest Plan standards and guidelines that address hydrologic recovery. The project is fully consistent with all of the standards and guidelines addressed below. The ARP model ranks recovery from 0 to 100 with 100 being fully recovered. The Forest Plan refers to a maximum watershed impact area or threshold of concern which are the inverse of ARP with 0 being fully recovered. The ARP numbers are subtracted from 100 to get watershed impact area or threshold of concern.

FW-63

This standard and guideline indicates a maximum watershed impact area of 35% at the 5th field watershed scale for lands available for vegetative manipulation. For the Collawash 5th field watershed the level projected for the watershed after project implementation would be approximately 11%.

FW-64

This standard and guideline indicates a maximum watershed impact area of 35% at the drainage scale for lands available for vegetative manipulation.

Drainage Name	Proposed Action 2012 - Watershed Impact Area
Panzy	5.4%
Blister	13.5%
Dutch	17.4%
Hot Springs Tribs	11.3%
Skin	15.1%
Lower Nohorn	17.4%
Lower Lower Collawash	8.4%
Upper Lower Collawash	8.5%
Farm	16.8%
Buckeye	6.6%
Happy	5.8%
Upper Collawash	15.4%
East Fork Collawash	11.4%

FW-65
This standard and guideline indicates a maximum threshold of concern of 18% for certain special emphasis watersheds.

Name	Proposed Action 2012 - Watershed Impact Area
Panzy	5.4%
Blister	13.5%
Hot Springs Tribs *	12.4%
Upper Collawash Tribs**	11.6%

*This includes Cat, Sand, Pink, Dutch, Thunder, Pin, Rock and Ferry Creeks.
**This includes Paste, Peat, Happy, Buckeye, Farm, Dickey, Blitzen, Russ, Ochre, Jazz, Dunno, Ogre, Round, Gyp, Cachebox, East Fork, Elk Lake, Battle and Mother Lode Creeks.

The project would meet State of Oregon water quality standards and the Clean Water Act by incorporation of Water Quality Best Management Practices (BMPs) (see project design criteria). These BMPs reduce or eliminate potential degradation from increased water temperature or sedimentation.

3.4.3 At this time it is uncertain whether this project will require a National Pollution Discharge Elimination System (NPDES) permit, due to several factors.

In Northwest Environmental Defense Center v. Brown, 640 F.3d 1063 (9th Cir. 2011) ("NEDC"), the Ninth Circuit Court of Appeals held that stormwater runoff associated with two logging roads that flows into systems of ditches, culverts, and channels before being discharged into forest streams and rivers is a point source discharge for which a National Pollutant Discharge Elimination System (NPDES) permit is required. The Court of Appeals then remanded to the district court for further proceedings consistent with its opinion. The State of Oregon and other parties filed petitions for certiorari with the U.S. Supreme Court to review the Ninth Circuit's decision and on June 25, 2012, the U.S. Supreme Court granted certiorari. The United States was not a party to litigation.

NEDC v. Brown involved a citizen suit; thus any available relief on remand would be limited to addressing the violation in question and is only binding on the involved parties. Because the USDA Forest Service was not a party, the Ninth Circuit's decision did not impose any affirmative duties on it. However the case has implications for federal land management agencies.

In response to NEDC v. Brown, EPA issued a formal notice on March 23, 2012 in the Federal Register (77 FR 30473) indicating its intent to expeditiously propose revisions to its Phase I stormwater regulations (40 C.F.R. §122.26) to specify that stormwater discharges from logging roads are not stormwater discharges "associated with industrial activity." The notice also states that EPA intends to further study and seek public comment on alternative approaches for addressing stormwater discharges from forest roads.

Additionally, following the Ninth Circuit's decision, Congress took legislative action suspending any potential permitting requirement imposed by the decision:

> From the date of enactment of this Act until September 30, 2012, the Administrator of the Environmental Protection Agency shall not require a permit under section 402 of the Federal Water Pollution Control Act (33 U.S.C. 1342), nor shall the Administrator directly or indirectly require any State to require a permit, for discharges of stormwater runoff from roads, the construction, use, or maintenance of which are associated with silvicultural activities.

Consolidated Appropriations Act, 2012, § 429, Pub. L. No. 112-74, 125 Stat. 786, 1046-1047 (Dec. 23, 2011). Thus, until September 30, 2012, no NPDES permits are required for stormwater discharges from roads associated with silvicultural activities.

Permanent legislation is also pending in both the U.S. Senate and the House of Representatives that would amend Section 402 of Clean Water Act to exempt stormwater discharges resulting from silvicultural activities from NPDES permit requirements.

Due to these factors, it is uncertain at this time whether any NPDES permitting requirements apply, or will apply in the future to stormwater discharges from logging roads.

3.5 GEOLOGIC STABILITY

This section summarizes the stability specialist report. The elements of the proposed action that would affect the initiation or acceleration of landslides include road construction, thinning, cutting trees for down logs, creating snags, and the removal of trees for road, landing, skyline corridor, and skid trail construction.

3.5.1 Methodology

The likelihood of thinning-induced landslides occurring within an area is determined by inspection of the slope by a slope-stability specialist. All proposed thinning units are located in previous regeneration harvest units (clearcuts). Trees have a beneficial effect on slope stability by lowering the groundwater table through evapo-transpiration. Tree roots stabilize the upper several feet of soils. Previous regeneration harvest units that show no signs of shallow or deep-seated post-harvest slope instability are assumed to remain stable after thinning. Areas that have post-harvest signs of instability are dropped from consideration for thinning.

The determination of landslide incidence after the original regeneration harvest is accomplished by using historical aerial photos, existing landslide mapping (GIS layer), field reports of landslide incidence by other resource specialists, and field visits to selected units by a slope stability specialist.

3.5.2 Existing Condition

The Collawash area contains some of the most geologically unstable terrain on the Forest. This unstable terrain is largely a result of the type of parent rock present, the age of the rock and the weathering history. Most of the rock in this area is of volcanic origin and can be divided into two groups: lava rock and pyroclastic rock. The lava rock is typically andesite that is resistant to weathering and forms steep hillslopes. The original minerals present in the pyroclastic rock have typically been altered into clay minerals, resulting in a very weak material that is unable to support even moderately steep hillslopes. Extensive glaciation in the distant past oversteepened the valley walls. Once the glaciers melted and removed lateral support from the valley walls, large portions of those valley walls collapsed as massive landslides composed mostly of the highly altered, clay-rich, pyroclastic material.

The ancient landslide deposits developed during a much wetter climate than our present climate. The wetter climate occurred thousands of years ago. During that time unstable hillslopes collapsed and formed earthflows and large debris slides that became large coalescing deposits of landslide material. These landslide deposits can be several square miles in area and may be several hundred feet deep. Slope angles are usually gentle. These landslide deposits are more stable now than they were in the past but there are still portions of them that are adjusting to their new slope position. These adjustments are typically expressed as small landslides (slumps or debris slides) that occur at locally steep areas of the ancient landslide deposits, for example, along stream banks. These adjustments usually occur during or immediately after major storm events, when the ground water table is high. Most of the ancient landslide deposits are dormant and would require a major change in their hydrology or slope geometry to become active again. These dormant landslide deposits have been mapped as landform type Ancient Landslides – Dormant (ALD).

Other ancient landslide deposits have been recognized as being recently active. Evidence for recent movement includes fresh scarps, cracks, very tilted trees, and similar clues. These recently active landslide deposits have been mapped as landform type Ancient Landslides – Active (ALA). Landform type ALA can have a variety of types of landslides, but they are usually earthflows, debris slides, or slumps.

The large, ancient, mostly-dormant, landslide deposits in this area have been classified as high risk earthflows, moderate risk earthflows, and low risk earthflows. The high-moderate-low adjectives describe the relative susceptibility of the terrain to reactivation of ground movement from any cause.

Landslides can also occur on landform types other than ancient landslide deposits. Usually these are debris slides and debris flows that originate on steep slopes. Debris slides typically occur on slopes that are greater than 60%. Debris flows typically originate in channels that have a gradient that is steeper than about 35%. In this area many of the larger streams originate on the upper valley walls where the stream gradients are steep, and the channels are incised enough that debris flows are common. These streams are referred to here as debris-flow-prone streams.

Poorly located, poorly constructed, or poorly maintained roads can result in slope stability problems and can result in resource damage. Well located, well constructed, and well maintained roads would have a minimal effect on slope stability.

Most of this area was heavily roaded beginning in the late 1950s and continuing through the 1980s. Road construction practices gradually improved though the decades but there remain many roads that were poorly located and/or poorly constructed in the past. Without proper maintenance these roads can be a threat to water quality and fish habitat.

Beginning in the mid-1970s and continuing to the present, many unstable portions of existing roads have been rebuilt or modified to stabilize the road and the hillslope.

More recently, road decommissioning projects have removed many problem areas and reduced the potential for road-related landslides and the resulting adverse effects on water quality and fish habitat.

Debris flows are a natural process in this area and have the beneficial effect of delivering boulders and large woody debris to lower elevation stream segments which enhances fish habitat. Debris flows can have detrimental effects also, such as delivering excess fine sediments to fish habitat, or blocking road crossings and diverting drainages. Poorly designed or poorly located road/stream crossings can impede this natural process and have an adverse effect on fish habitat. When debris flows reach a road, they can pass through the crossing unimpeded, they can be stopped completely, or they can block the culvert, divert the water flow, and cause extensive erosion of the road fill. In a worst case scenario, a debris flow can be temporarily stopped at the crossing and allow more water and sediment to accumulate behind the crossing, until the entire crossing structure fails catastrophically. The debris flow then continues down channel, much larger and more destructive then it would have been without the interference from the road crossing.

Many of the proposed thinning units within this planning area occur on the large, ancient, mostly-dormant, landslide deposits that contain small areas of mapped active landslides.

3.5.3 Landslide Analysis

All the proposed thinning units are plantations where regeneration harvest occurred followed by planting. The removal of all the trees in an area has a much greater potential to impact slope stability than a thinning would. The level of stability of the slopes of all the proposed thinning units was therefore tested in the past by that original harvest. A conservative approach to evaluating the effects of thinning on slope stability is to identify the areas of the original harvest units that show evidence of landslide activity and exclude those areas from any future harvest. It is presumed that areas that remained stable after the original regeneration harvest would continue to be stable after thinning.

The determination of landslide incidence after the original harvest was accomplished by using historical aerial photos, existing landslide mapping, field reports of landslide incidence by other resource specialists, and field visits to selected units by a slope stability specialist.

The slope stability specialist visited the following categories of proposed thinning units:

1. all units that contained mapped active landslides
2. all other units reported to have a landslide by other resource specialists

The following table displays the units that fell into one of the above two categories and were examined in the field by the slope stability specialist.

Category	Thinning unit number
1	2, 4, 12, 14, 20, 28, 30, 32, 38, 40, 44, 46, 48, 50, 52, 54, 56, 58, 60, 66, 68, 70, 78, 80, 84, 88, 104, 108, 120, 122, 124, 128, 130, 132, 138, 144, 146, 154, 156
2	16, 64, 74, 86, 118

There are some mapping inaccuracies present in the GIS coverage of the mapped active landslides. This resulted in some map overlap between the proposed thinning units and the mapped active landslides that did not actually exist on the ground. Usually these false overlaps were small sliver polygons.

The boundaries of twenty-four proposed thinning units were modified to exclude from thinning those areas that were judged to be unstable or potentially unstable: 12, 30, 32, 40, 44, 46, 52, 54, 56, 60, 64, 68, 78, 80, 84, 86, 104, 118, 120, 122, 130, 132, 138 and 146.

Additional unstable or potentially unstable areas may be discovered during unit layout. If so, a slope stability specialist would be consulted to advise on potential adjustments.

3.5.4 Direct and Indirect Effects for Landslides

Alternative A (No Action)

No thinning would occur. The overcrowded trees would continue to grow slowly. Existing shallow landslide scars within the project area would slowly heal as vegetation becomes denser. The level of instability of deeper-seated active landslide areas would likely remain about the same.

Road access would remain as it presently exists. No temporary road construction would occur so there would be no increased landslide risk from road construction. No maintenance or repair of existing roads would be scheduled so there would be an increasing risk of resource damage from the existing road system.

Alternative B (Proposed Action)

Thinning would occur in areas that are considered to be stable by a slope stability specialist. Known unstable or potentially unstable areas have already been deleted from the proposed thinning units. Additional unstable areas identified during unit layout would also be deleted or designated as skips. The thinning would enhance tree growth and tree root growth over the long term, restoring hill slope stability to original levels. The thinning would likely reduce hill-slope stability slightly for a few

years after thinning when dying tree roots have not yet been replaced by new root growth. Existing shallow landslide scars within the project area would be protected and would continue to slowly heal as vegetation on the scars became denser. The level of instability of deeper-seated active landslide areas would be unaffected by the thinning.

The construction of temporary roads on stable ground would have no perceptible effect on slope stability. These roads would be obliterated after use. Existing system roads that would be used for timber haul would be maintained and repaired. These actions would greatly reduce the risk of resource damage from these roads.

3.5.5 Cumulative Effects for Landslides

All thinning projects in this area have been previously examined by a slope stability specialist and the unstable portions of the thinning units if any, have been dropped from the project. The thinning projects would result in a temporary reduction in the tree canopy, which would very slightly increase peak stream flows in the project area. Stream channels would be protected with buffers that would mitigate against increases in channel bank instability. The longer-term effect would be an increase in slope stability and water quality.

The road decommissioning projects would have a beneficial effect on slope stability and water quality. These projects would remove a large number of stream crossings and some road segments on potentially unstable ground and allow more road maintenance to occur on the roads that remain.

The road repair projects would also have a beneficial effect on slope stability and water quality. Better maintained roads have less environmental impact than poorly maintained roads.

These projects combined would have a net beneficial effect on slope stability and water quality regardless of the impacts of other nearby past, present, or reasonably foreseeable future actions.

3.5.6 Analysis of Direct Indirect and Cumulative Effects for Earthflows

The elements of the proposed action that would affect hydrologic recovery of earthflows include thinning, cutting trees for down logs, creating snags and the removal of trees for road, landing, skyline corridor and skid trail construction. The analysis areas are the individual earthflows (s. 3.5.6.2).

3.5.6.1 Methodology

The Aggregate Recovery Percentage (ARP) index is used to estimate the potential for adverse cumulative effects related to past, present and foreseeable future actions. It is

also a tool to determine compliance with Forest Plan standards and guidelines pertaining to cumulative earthflow effects (Forest Plan, B8-031 and B8-032). By measuring the percent of an area in a hydrologically recovered condition, the ARP model evaluates the risk accelerating the movement of earthflows. In stands with little or no forest canopy cover within the transient snow zone, more snow accumulates than beneath a partially or fully hydrologically recovered forest.

The ARP model ranks recovery from 0 to 100 with 100 being fully recovered. Stands that have trees greater than 8 inches in diameter and over 70% canopy closure are considered fully recovered in terms of hydrology (Forest Plan, FW-064, B8-031 and B8-032). In the ARP model, stand age is used to determine whether stands meet these criteria. Forest hydrologists have developed recovery curves to model the changes to hydrology as young stands grow as well as the effects to hydrology for projects such as thinning that remove only a portion of the trees in a stand. A regeneration harvest would result in a stand that would be modeled at zero% recovery. As time goes by the plantations would grow and recovery would gradually occur. Depending on site conditions, full recovery may take approximately 30 years.

The ARP analysis includes the elements of the proposed action that would affect hydrologic recovery. Where applicable, the ARP analysis also addresses many other factors including:

- All past timber harvest, road construction, rock quarries, and other openings such as the power line;
- Projects that are under contract but not yet completed;
- Recent wildfires;
- Roads that have been recently been decommissioned and others that are planned for the near future; (As these road beds begin to grow trees and close in they would become hydrologically recovered but this process would take approximately 30 years for full recovery.)
- Other ownership; (In the Collawash watershed, the only other non-National Forest lands are 850 acres managed by the Bureau of Land Management (BLM). None of the BLM acreage is in earthflow.)
- Other foreseeable actions. (While it is likely that there would be thinning or other stand management in the future, there are no other current proposed actions to include in the ARP calculation at this time. Future actions cannot be known site specifically at this time. The appropriate consideration of cumulative effects for unspecified future project would be at the time an environmental analysis is conducted for those future projects.)

There are five ongoing thinning projects within the Collawash watershed that are included in the analysis of cumulative effects because portions of them touch earthflows. The projects are Day, Hot, Fan, Pin, and Pink. The analysis also tracks projects by name that were implemented between 2000 and the present including Decoy 2, BF salvage, Bonanza 3. The analysis includes harvest before 2000 even though it is not tracked by name. The recent wildfires did not overlap the earthflow analysis areas.

Since it is not practical to visit thousands of stands, the condition of current vegetation was derived from a GIS vegetation layer. This file contains the sizes, shapes, locations and vegetation characteristics for all stands as they have been modified and affected by factors such as past timber harvest, tree growth and fires. A computer model in the analysis file contains the spatial data and ages of the stands derived by intersecting the GIS vegetation layer with the drainage layer. Recent timber sales (since 2000) and those not yet completed are tracked by project name.

3.5.6.2 Existing Condition

The stands proposed for thinning are currently hydrologically recovered. Because there has been relatively little regeneration harvest in the past two decades, all of the earthflows are steadily moving toward full recovery. The ARP values are increasing by approximately 1 to 2% per year in these areas as young plantations grow. The following table shows the current condition for each earthfow.

Earthflow Name	Current Condition
Blitzen	94.0%
Cat	96.6%
Farm	96.3%
Happy High	94.4%
Happy Moderate	96.1%
Ochre	93.2%
Panzy	94.7%
Paste	96.3%
Peat	95.8%
Pink High	95.0%
Pink Moderate	84.2%
Sluice	97.0%

3.5.6.3 Direct and Indirect Effects

The thinning of the proposed action is dispersed over a wide landscape overlapping parts of 12 Earthflows. The following table shows the reduction in ARP value with project implementation.

Earthflow Name	Acres Thinned	Percent Change
Blitzen	13	1.1%
Cat	13	0.2%
Farm	24	0.4%

Happy High	41	2.5%
Happy Moderate	62	0.9%
Ochre	108	1.5%
Panzy	109	1.8%
Paste	29	4.3%
Peat	177	2.4%
Pink High	13	1.1%
Pink Moderate	57	0.6%
Sluice	135	0.8%

Individual plantations that are thinned below 70% canopy closure would be considered unrecovered in terms of the ARP model. These impacts would last a few years until canopy closes in again as trees grow in response to the thinning. Road construction acreage is included but recovery would take approximately 30 years. With the relatively high levels of hydrologic recovery for these earthflows, the slight changes associated with the project would not likely cause the acceleration of movement of earthflows.

With no action these impacts would not occur and the stands would remain fully recovered hydrologically.

3.5.6.4 Cumulative Effects

The analysis above includes all past and foreseeable timber harvest, fires, roads, quarries and the power line right-of way. Since there are no other ownerships in the earthflows and no other foreseeable future actions to include in the analysis, there would be no additional cumulative effects other than the ones already analyzed.

Cumulative effects pertaining to earthflow stability are not expected because changes to hydrologic recovery as projected by the ARP model are very small in a landscape that is steadily moving toward full recovery.

3.5.6.5 Forest Plan Consistency

The project is fully consistent with B8-031 and B8-032.

Earthflow Name	Risk Level	Forest Plan Goal	Proposed Action 2012
Blitzen	High	90%	92.9%
Cat	High	90%	96.4%
Farm	Moderate	75%	95.9%
Happy	High	90%	91.9%
Happy	Moderate	75%	95.2%
Ochre	Moderate	75%	91.7%
Panzy	Moderate	75%	92.9%

Paste	Moderate	75%	92.0%
Peat	High	90%	93.4%
Pink	High	90%	93.9%
Pink	Moderate	75%	83.6%
Sluice	High	90%	96.2%

All of the thinning units are consistent with the B8 – Earthflow standards and guidelines and the Forestwide Geology standards and guidelines. All unstable and potentially unstable areas have been examined and dropped from this project. This project would maintain the existing slope stability in this area and would improve it as thinning enhanced tree growth and tree root growth restore the hill slope stability to pre-development levels.

3.6 SOIL PRODUCTIVITY

This section summarizes the soil specialist report and data in the analysis file.

3.6.1 **Methodology**

This section details potential effects to the soil resource for the proposed treatment units. Other sections cover related topics including the geology (s. 3.5), hydrology (s. 3.4) and fisheries (s. 3.3).

The productivity and health of entire plant communities depend on the maintenance of healthy soils. Soil distribution is complex across the watersheds where this analysis area is located. Each soil map unit (number) has been assessed for many risks and hazards called management ratings (e.g. erosion risk, compaction hazard, etc.), which are located in the Mount Hood National Forest Soil Resource Inventory (SRI, Howes, 1979). The SRI is most useful as an initial broad-scale planning tool to identify and display maps of possible soil concerns or sensitive areas. Interpretations are based on observations of soil characteristics at sites thought to best represent the entire soil mapping unit.

A three-step field methodology was used for this effects analysis; revised soil mapping, assessment of existing condition, and identifying areas of concern to focus the analysis. In addition, previous field experience, personal observation and knowledge of how soils respond to the proposed types of management actions were used to predict impacts.

Revised soil mapping - Because of the scale of the SRI (1 inch per mile), soil properties can vary significantly within a mapping unit and on-site investigations are often required to refine or modify interpretations. Qualified soil scientists adjust management interpretations to reflect on the ground conditions and provide resolution

to the soil map units at a site-specific scale.

Priority stands were chosen for field evaluation and validation of SRI soil mapping. Appropriate map changes were made to reflect field observations. With updated and validated soil mapping, pertinent management interpretations should be more accurate and therefore provide high confidence when determining levels of risk.

Assessment of existing soil disturbance condition – Soil disturbance, such as soil compaction, soil displacement and puddling, severe burning, accelerated erosion, excess removal of organic material, and aggravated mass wasting equate to an irretrievable loss of soil productivity (for definitions of listed impacts, see Forest Service Manual [FSM] 2521.1, Region 6 supplement 2500-96-2, effective 6/4/96). See Chapter 4, Soil Physical Properties: Importance to Long-Term Forest Productivity (Perry, 1989) for a review of impacts and effects of compaction, surface soil disturbance, soil loss, and fire effects, and their relation to long term soil productivity.

The extent of detrimental soil condition was determined from field observations of a sample of proposed treatment units visited during the fall and summer of 2010 and summer of 2011. Representative stands included each of the two primary soil types in the planning area –those derived from pyroclastic parent materials, including earthflow terrain and those derived from glaciation. In addition, stands were chosen based on logging method, with emphasis on ground-based systems. Skyline and helicopter stands were not visited as intensively because of the relatively small soil impacts resulting from those logging methods as compared to ground-based logging.

The condition of soils was evaluated for the amount of detrimental disturbance from past activities using a combination of qualitative measures and professional judgment. Qualitative data was acquired by classifying soil disturbance using Howes Disturbance Classes, developed on the Wallowa-Whitman National Forest (Howes, 2000). This is a process that breaks soil disturbance into six classes based on visual evidence. The visual evidence is correlated to infiltration rates, percolation, channeling of surface water, productivity, potential restoration work, and Regional and Forest Plan standards and guidelines. Soil disturbance features observed in the field were compared to past treatment activities observed on old aerial photos (from the earliest flight flown after the stand was originally clearcut). The level of disturbance was rated as a percentage of each unit area.

Areas of concern - Field notation of specific logging concerns such as proximity to springs, riparian areas or high water tables, and/or unstable areas.

3.6.2 Measures

For this analysis three measures are used to assess impacts; erosion, soil disturbance and organic matter.

Erosion

Soil erosion can directly affect soil productivity by reducing soil depth and volume, resulting in a loss of nutrients and water holding capacity. An indirect affect from soil erosion is runoff from bare areas carrying soil particles to water bodies where it becomes sediment. Sedimentation is addressed in the Fish (s. 3.3.4.2) section. This hazard rating is based on bare surface soil properties that affect detachability, such as soil texture, slope, etc. Management ratings for erosion risk, as an example, follow the variability of the soils across the landscape, with some soils mapped with a severe erosion risk, others with slight, and many in between. Although ratings are a good preliminary analysis tool, in actuality almost any soil regardless of rating can become more erosive than rated depending on site-specific circumstances. Soils with a slight erosion risk rating that are compacted and bare can become erosive even on gentle slopes. Conversely, erosive soils occurring on very steep slopes in this analysis area may be stable for decades because of sufficient protective groundcover (tree needles, leaves, wood, rocks, etc.). Erosion is measured by acres of exposed soil.

Soil Disturbance

Soil productivity and soil water storage capacity can be affected by compaction, puddling, displacement, erosion and severe burning. These conditions, if severe enough can result in soils that have low levels of porosity, reduced root penetration, increased runoff, reduced infiltration, reduced soil water storage capacity, reduced soil water availability, reduced nutrient availability, and reduced levels of mycorrhizae and other soil organisms. Soil disturbance is measured by percent of units in detrimental soil condition.

Organic Matter

Soil fertility and soil biological systems will properly function if certain components are present, such as appropriate levels of organic matter and coarse woody debris. Poor or non-functioning soil biological systems may lead to difficulties in revegetation efforts, or decline in existing desirable vegetation. Soil biology involves complex interactions occurring between organisms and their soil habitats, including physical and chemical characteristics. Organic matter is measured by acres of soil organic layer removed.

3.6.3 Analysis Area

The analysis areas for soil resources for direct, indirect and cumulative effects are the boundaries of the plantations proposed for thinning, decommissioned road locations, and adjacent slide paths that affect the proposed units. These are appropriate boundaries because actions outside the plantation boundaries would have little or no affect to soil productivity within the plantations, and the actions within and adjacent

to the plantation boundaries would have little or no affect to soil productivity elsewhere.

Elements of proposal that could affect soil productivity

For this project, the following actions have the potential to affect soil productivity: actions that disturb soil such as skidding and yarding of logs, the use of harvesters (mechanical tree fellers), temporary road construction and reconstruction, actions that harvest or kill trees, burning and landing creation. Other aspects of the proposed action such as road reconstruction or repair, road closures, log haul, and the creation of snags would not have a meaningful or measurable effect on soil productivity because they do not alter soil conditions. Some actions are specifically designed to benefit soil productivity including the creation of down logs, road decommissioning, and decompacting temporary roads and landings.

The analysis also considers restorative actions and the design criteria and best management practices that minimize impact. For example: existing roads, landings and skid trails would be reused where feasible, equipment would be restricted to appropriate slopes, erosion control methods such as water bars, seed and mulch would be used.

3.6.4 Existing Condition

Soil Types and Geographic Locations in the Planning Area

Revised mapping – Soil mapping in the upper Collawash drainage was revised where SRI mapping did not reflect field observations - soils derived from pyroclastic parent material were observed in large areas that had been mapped as glacial soils. Soil mapping units (MU) and characteristics described in the SRI were used to develop the new mapping unit boundaries and designations.

Soils in this analysis can be divided into three main categories (Earthflow, Pyroclastic and Glacial) and further subdivided into a total of six general types based on slope steepness.

Earthflow terrain – the thinning units which overlay this landtype are generally located on the east slope of the Collawash River (units 2, 4, 6, 8, 16, 18, 20,2 2, 28, 30, 32, 34, 36, 38, 40, 44, 46, 50, 60, 62, 64, 66, 68, 69, 70, 72, 74, 76, 78 ,80, 83, 86, 88, 90, 92, 94, 96, 98, 104, 106), and the north and south slopes of the Hot Springs Fork of the Collawash River – south: (units 110, 112, 114, 116, 118, 122, 124, 126, 128, 130) and north: (units 136, 137, 138, 140). They are the most productive of all the soils mapped in this analysis area. These soils are generally less than 30% slope.

Pyroclastic parent material – the units which overlay this landtype are located throughout the project area (units 10, 12, 14, 24, 26, 28p, 30p, 38p, 42, 44p, 46p, 48,

50p, 52, 54, 56, 58, 70p, 74p, 82, 90p, 101, 102, 104p, 106p, 108, 120, 122p, 130p, 132, 134, 142, 144, 146, 148, 150, 152, 154, 156, 158). Slope shape ranges from slightly uneven to dissected. Soils tend to become coarser textured as slope increases.

Glacially derived soils – units which overlay this landtype are on an upper slope of the Collawash River (unit 100), and in the upper slopes of the Hot Springs Fork of the Collawash River (unit 156).

3.6.4.1 Summary of the major soil types in the analysis area and associated management interpretations from the SRI.

	Soil Map Unit	Natural Soil Mantle Stability	Erosion Potential		Compaction Hazard	Susceptibility to Soil Displacement
			Surface	Subsoil		
Earthflow terrain < 30% slope						
	2	Unstable – Very unstable	Moderately Severe - Severe	High	High	High
	3-4	Stable	Very Slight	Low	High	Moderate
	100	Stable – Moderately Stable	Moderate – Severe	High	High	Moderate
	104	Stable-Moderately Stable	Slight - Moderate	Mod - High	Moderate-High	Low-Moderate
Earthflow terrain >30% slope						
	101	Moderately stable-Unstable	Severe	High	High	Moderate-High
	102	Moderately stable-Unstable	Severe	High	High	Moderate-High
	105	Unstable	Moderate-Severe	High	Moderate	High
	106	Unstable	Moderate-Severe	High	Moderate	High
Pyroclastic parent materials > 60% slope						
	108	Unstable	Severe	High	Moderate	High
	109	Unstable	Severe	High	Moderate	High
	113	Unstable	Severe	High	Low-Moderate	High
Steep Uplands > 30% slope						
	15	Very Unstable	Very severe	High	Low	High
Glacial deposits < 30% slope						
	320	Very Stable	Slight	Moderate	Moderate	Low
	327	Stable	Slight-Moderate	Moderate	Moderate	Low
Glacial deposits > 30% slope						

			Erosion Potential			Susceptibility
	329	Moderately Stable	Moderate	Moderate-High	Moderate	High

3.6.5 **Direct, Indirect and Cumulative Effects**

The current condition described in the analysis below incorporates all past actions that have occurred within the analysis areas which correspond to the proposed thinning unit boundaries. There are no other ownerships to consider within the analysis areas. There are also no foreseeable future actions to include. While there may be future thinning or other actions, there is no proposal now for future actions that have sufficient site specificity to conduct an analysis. The appropriate time to conduct a cumulative effects analysis for future projects would be in a future EA after a firm proposal is developed.

3.6.6 **Erosion**

Existing Condition
In the Jazz project area surface soil erosion potential varies from moderate to very severe for soils derived from weathered pyroclastics and from slight to moderate for soils derived from glacial till. Ground cover can be used as an indication of erosion risk. All of the units have well above 90% groundcover. Existing surface erosion is mainly confined to exposed soil on active landslides, unpaved road surfaces, road cutbanks and ditches.

Direct and Indirect Effects
Soil erosion can directly affect soil productivity by reducing soil depth and volume, resulting in a loss of nutrients and water holding capacity. An indirect effect from soil erosion is runoff from bare areas carrying soil particles to water bodies where it becomes sediment (see s. 3.3 and 3.4).

Alternative A – No Action
Erosion rates within the analysis area would remain as they are. Over time, as bare areas become revegetated, erosion levels would decrease. If an existing slide were to become more active, or if new landslides were to occur, an increased level of soil erosion would be expected in the exposed soil areas.

Alternative B – Proposed Action
Soil erosion risk would increase with the proposed action because bare soil would be exposed during implementation. Erosion would not occur where duff and other effective ground cover is retained. Therefore, practices which limit the amount of soil exposure, or which re-establish ground cover after soil is exposed, would result in less erosion occurring. Of the proposed yarding systems, ground-based systems result in a greater amount of ground exposure than skyline and helicopter systems. Units that are prescribed for ground-based yarding systems generally have gentle to

moderate slopes, so even if the potential for erosion may be high, eroding materials would not move far before redeposition occurs. On units prescribed for ground-based mechanical felling systems where slopes approach 40%, the potential for erosion increases. Best Management Practices result in a low potential for sediment to be delivered to streams. The use of stream protection buffers, designated skid trails, and establishing effective ground cover by applying seed, fertilizer, and straw mulch on the disturbed soils would further reduce erosion features and disturbance. In conclusion, by maintaining proper amounts of protective groundcover along with BMP design criteria, the risk of erosion and subsequent sediment delivery caused by the proposed action is extremely small.

Bare soil would be exposed as logs are dragged on and machines travel over the ground surface. Approximately 61 acres of roads, skid trails and landings would be constructed or reconstructed. Approximately 50 acres of bare skyline yarding corridors would occur. A total of 111 acres would have potential increased erosion as a result of thinning activities. Disturbed areas, particularly where slopes are greater than 25%, would be potential chronic sources of sediment until they are revegetated successfully.

There are a few units on which erosion risk is higher. Skyline units with downhill yarding are proposed on steep, highly erosive soils (units 30, 34, 44, 80, 82). Logs dragging downhill may create depressions in the yarding corridors from which it might be difficult to remove water. Because yarding corridors in a downhill system come together at the landing, any water and sediment travelling down the corridors, would be concentrated at the landing. This would be minimized by establishment of waterbars and other techniques to divert water to the side and the establishment of ground cover.

Downhill skyline yarding units and erosion risk ratings.

Thinning Unit #	Soil MU	Erosion Hazard	
		Surface	Subsoil
30	102	Severe	High
34	102	Severe	High
44	104 108 109	104 =slight to mod 108 = Severe 109 = Severe	104 = Mod to High 108 = High 109 = High
80	106	Mod to Severe	High
82	106	Mod to Severe	High

Cumulative Effects

Best Management Practices and the design criteria would result in little effect to erosion from the proposed action combined with past actions because sufficient ground cover would be applied or retained.

3.6.7 **Soil Disturbance**

Existing Condition

The majority of readily observable ground disturbances in the field were heavily compacted old skid trails, landings, and temporary roads. Also observed were areas where displacement or excess removal of organic material had occurred from historic logging activity. It was observed that all ground-based units visited still show signs of skid trail compaction. There does not seem to have been substantial recovery on skid trails where the old harvest units are located on gentle slopes. Soil Mapping Unit 100 appears to have been especially impacted, probably due to the ease of access for tractor use and finer texture soil properties. Historic disturbance on these soil types mainly attributed to skid trails and landings, still rated as detrimental in nearly all cases.

The percentage of area in a detrimental soil condition varies from stand to stand due to the occurrence, manner, and extent of past timber harvest and fuel treatment activities. All units were clear cut harvested from 1953 to 1975 and subsequent site preparation included broadcast burning, machine piling, or windrowing. Management practices at that time did not restrict machine movement, skid trail density, removal of woody debris or intense burning; therefore existing detrimental impacts to soil are generally higher than allowed under the current Forest Plan standards and guidelines. The estimated percent area of detrimental soil condition in each of the treatment units can be found in the analysis file.

Glacial soils - For glacial soils, detrimental condition ranged from 16% to 18%. It is estimated that all of the areas that had been previously logged with ground-based equipment exceed 15% detrimental soil condition. None of the areas in units previously logged with skyline or other cable methods exceed 15%.

Earthflow soils - On earthflow soils, detrimental condition ranged from 9% to 30%. It is estimated that all units previously harvested with ground-based equipment and skyline or other cable systems exceed 8 % detrimental soil condition.

Alternative A – No Action
Percent disturbed soil condition would slowly decline as compacted areas move toward recovery due to physical and biological processes.

Alternative B – Proposed Action
Changes to disturbed soil condition were estimated. It was assumed that existing landings, temporary roads, and skid trails would be reused, and where previous entries created higher percent detrimental conditions, a progressively greater number of existing skid trails would be available to be reused. It was assumed that in some cases, new landings may need to be constructed where logging system changes from the original entry require alternate locations (i.e. originally tractor, now skyline), or existing landings are located too close to streams. New skid trail locations may be required in places where current management practices regarding stream and drainage

crossing protection differ from the previous entry. Existing temporary roads or landings not used during the project would remain in a compacted condition. The rehabilitation of skid trails is not included in the proposed action. Since the roots of trees have penetrated into the skid trails, deep soil tillage on skid trails would cause adverse impacts to roots, leading to reduced growth, and increased root disease and tree mortality. Roots and burrowing animals would to continue to break up the compaction over time. The opportunity to mechanically rehabilitate skid trails may come in the future if and when regeneration harvest occurs.

Approximate acreage by yarding system is at s. 1.4.8. Most units thinned with ground-based equipment would be felled mechanically, as well as some skyline and helicopter units less than 40% slope. Approximate length of temporary roads is at s. 1.4.6.3. After logging is complete, these temporary roads would be decompacted and revegetated.

A net increase in disturbed soil condition is predicted where more skid trails, yarding corridors, landings and roads would be constructed than already exist. In units with greater than 15% disturbed conditions (>8% in earthflow units), restoration of temporary roads and landings would be accomplished by subsoiling to a depth of at least 18 inches or they would be scarified with a loader or excavator. Revegetation would initiate sufficient recovery of productivity and increase soil water storage.

Cumulative Effects

Estimated Detrimentally Disturbed Soil Conditions summarized by past methods and proposed logging system.

Past Harvest		Proposed Action			
Logging System	Estimated Existing Condition	Logging System	Estimated Change with Proposed Action	Cumulative Effects	Alt. B Acres
Ground	14% - 30%	Ground	2% – 6%	16% – 36%	389
		Skyline	2% - 3%	16% – 33%	240
		Helicopter	1%	15% – 31%	125
Cable	9% – 14%	Ground	2% – 6%	11% – 20%	38
		Skyline	2% - 3%	11% – 17%	751
		Helicopter	1%	10% – 15%	83

3.6.8 Organic Matter

Existing Condition

Duff layers are relatively thin due to past harvest and fuel treatment history, and range from 0.5 to 3 inches with an average of 1 inch. Some units have low levels of course woody debris (CWD) on the forest floor. In these areas the level is below historic ranges of CWD that naturally occurred prior to harvest and fuel treatment. CWD plays an important role in nutrient cycling; where there are low levels there is diminished long-term site productivity. CWD levels vary between units primarily due to differences in past fuel treatments and the degree of decay in the mature trees and whether cull logs were removed or left in place during the original harvest.

Direct and Indirect Effects

Alternative A – No Action
Forest organic litter input, organic decomposition rates, duff layer development and soil fauna and microbe activity would be unchanged. Organic matter decomposition and nutrient cycling is influenced substantially by temperature and moisture which would remain unchanged. Organic materials would be subject to disturbances such as windthrow, fire and climatic change. As unthinned stands age, trees would die and fall (see snag and down wood analysis in s. 3.8.2). These stands would eventually produce large trees which would be a source of future large decaying logs on the ground.

Alternative B – Proposed Action
Logs existing on the forest floor would be retained. The harvesting operations would add small woody debris of the size class of the cut trees. This would include the retention of cull logs, tree tops, branches, broken logs and any snags that would be felled for safety reasons. Snags or green trees that fall down after the harvest operation would contribute to the down wood component of the future stand. If funding becomes available, two to seven trees per acre would be felled or girdled to create coarse woody debris.

Duff disturbance would be minimized where full suspension yarding occurs in skyline and helicopter operations, and where designated and existing skid trails are used in ground-based yarding operations. Soil microbial populations would likely be reduced initially in areas of exposed soils. Leaving branches and needles throughout the units where trees are felled should help maintain carbon and nutrient levels. Organic material would be displaced on approximately 111 acres of soil exposed during mechanical felling, yarding and road construction and reconstruction operations.

Cumulative Effects

Fuel treatments from initial clearcut harvests have reduced duff levels and organic soil materials on all units. Field visits and aerial photo interpretation indicate that fuel treatments included windrow and burn on two units, pile and burn on two units, and broadcast burning on the remaining units. Additional displacement of organic material would occur on soils exposed during the proposed action.

3.6.9 Forest Plan Standards and Guidelines

Mt. Hood Forest Plan References

Forestwide Soil Productivity Standards and Guidelines - FW-22 to FW-38, page Four-49
Forestwide Geology Standards and Guidelines - FW-1 to FW-21, page Four-46
Earthflow Standards and Guidelines - B8-28 to B8-41, page Four-264
See Mt. Hood FEIS pages IV-11, and IV-155 to IV-167
Northwest Forest Plan - Coarse Woody Debris Standards and Guidelines - page C-40
Soil Disturbance Standards and Guidelines - page C-44
Modify Fire and Pesticide Use, Minimize Soil Disturbance Standards and Guidelines - page C44

FW-1 to 16	Slope stability concern areas have been identified by the Forest Geologist, and have been deleted from the proposed units.
FW-017 to 019	Most units that were logged with ground-based equipment in the original harvest are not consistent with these standards. See discussion below for exception for FW-018.
FW-020	Most units that were logged with ground-based equipment in the original harvest would be logged similarly this time reusing existing landings and skid trails. See discussion below for exception.
FW-021	Natural drainage features would be maintained or improved.
FW-22 to 23	Most units that were logged with ground-based equipment in the original harvest are not consistent with these standards. See discussion below for exception.
FW-24	Minimization of rutting would be achieved through the BT6.6 and CT6.6 provisions in the contract.
FW-25	Ground cover would be maintained at the prescribed levels.
FW-28 to 30	Rehabilitation would be accomplished only on roads and landings used by the operator. Rehabilitative techniques would not restore the soil resource to a level of less than 15% impaired. See discussion below for exception.
FW-31 to 34	Sufficient woody debris would be left on site including existing down logs, tops and branches and trees felled to create coarse woody debris.
FW-037	Many aspects of the project include design features that limit disturbance to the soil's organic horizon: broadcast burning and mechanical fuel treatments would not occur, skyline and helicopter systems are used where appropriate, existing temporary roads, landings and skid trails would be reused where appropriate and mechanical fellers would operate on top of branches and tops.
B8-31 to 32	These are addressed in section 3.5.6.5.
B8-36	Most units that were logged with ground-based equipment in the original harvest would be logged similarly this time reusing existing landings and

	existing skid trails. See discussion below for exception.
B8-40	Most units that were logged with ground-based equipment in the original harvest are not consistent with this standard and guideline. See discussion below for exception.
B8-48 to 49	Road locations have been reviewed by the Forest Geologist.

Exceptions

Exceptions to Forest Plan standards and guidelines FW-018, FW-020, FW-022, FW-028, FW-030, B8-036 and B8-040 are proposed.

FW-022

This standard and guideline suggests that cumulative detrimental soil condition should not exceed 15%. Many units already exceed this level. Even though there was no standard for long-term soil productivity when the original clearcuts were logged, the stands continue to grow well and are projected to continue to grow well after the proposed thinning. Stand exams show that plantations that have detrimental soils above 15% have similar growth rates compared to nearby similar plantations that are below 15%. The proposed action has been designed to minimize additional soil impact and to restore soils where appropriate. In areas not disturbed again, natural recovery would continue to occur as roots and burrowing animals penetrate and break up compacted soils, and as organic matter accumulates. The objective of maintaining long-term site productivity would still be met.

FW-028 & FW-030

This standard and guideline suggests rehabilitation of impacted soils where the cumulative detrimental condition is greater than 15%. While this is proposed for temporary roads and landings that are used by the contractor, it is not proposed for skid trails in plantations. Most units that were logged with ground-based equipment in the original clearcut harvest would remain above 15% detrimental soil condition. Mechanical treatment of skid trails in these units would cause excessive root damage that would lead to reduced growth, and increased root disease and tree mortality. The proposed action would reuse existing skid trails where appropriate but not all areas that were disturbed in the original logging would be disturbed again because of the requirements of the design criteria and best management practices. The opportunity to mechanically rehabilitate skid trails may come in the future if and when regeneration harvest occurs. In areas not disturbed again, natural recovery would continue to occur as roots and burrowing animals penetrate and break up compacted soils, and as organic matter accumulates.

B8-36 & FW-020

These standards and guidelines suggest that ground-based yarding of logs should not occur. For the proposed action, ground-based yarding would be used on earthflow

plantations where ground-based systems were used in the original logging. An exception is proposed because examination of the units has found that the use of existing roads, skid trails and landings with restoration would result in minimal impact. The objective of providing for earthflow stability would still be met. One option would be to switch to a skyline system, which would overlay the impact of skyline corridors over an existing network of skid trails and in many cases would result in the need to build new roads and landings to facilitate skyline logging. Another option would be to switch to helicopter logging with its associated increase in cost. These options were adopted in some situations where appropriate but in most earthflow units, the objective of earthflow stability would still be met by thinning to create healthy, productive stands using ground-based methods.

B8-40 & FW-018

These standards and guidelines suggest that cumulative detrimental soil condition should not exceed 8% on earthflows. Many units already exceed this level. Even though there was no standard for long-term soil productivity or earthflow stability when the original clearcuts were logged, the stands continue to grow well and are projected to continue to grow well after the proposed thinning. The proposed action has been designed to minimize additional soil impact and to restore soils where appropriate. In areas not disturbed again, natural recovery would continue to occur as roots and burrowing animals penetrate and break up compacted soils, and as organic matter accumulates. The objective of maintaining long-term site productivity and earthflow stability would still be met.

3.7 NORTHERN SPOTTED OWL

In the project area, the Late-Successional Reserve (LSR) has the same boundaries as the 2008 Spotted Owl Critical Habitat. LSR habitat is the primary habitat for spotted owls as designated under the Northwest Forest Plan in 1994. The objective of the LSR is to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for the late-successional and old-growth related species including the northern spotted owl (USDA, USDI 1994a).

The project area is covered by the North Willamette LSR Assessment (USDA, USDI 1998). The purpose of the assessment is to document current conditions and functions of the LSR(s) and present sideboards for management activities in the LSR to meet the objectives in the Standards and Guidelines of the Northwest Forest Plan.

3.7.1 Endangered Species Act Compliance

The northern spotted owl is the only federally listed species (threatened) under Section 4 of the Endangered Species Act that occurs within or near the proposed project area. A programmatic Biological Assessment (USDA 2010) has been

prepared for thinning projects. Consultation with U.S. Fish & Wildlife Service (USFWS) has been completed for this project.

The project is covered by multiple consultation efforts. One Letter of Concurrence, written by U.S. Fish & Wildlife Service and dated February 02, 2010 (*reference* 13420-2010-F-0157) (USDI 2010) and another Letter of Concurrence dated May 17, 2011(*reference* 13420-2011-I-0135) (USDI 2011).

In the first programmatic consultation document, the Jazz name was not assigned to this project yet and it is referred to as "Collawash Thin." Refer to the Biological Assessment Appendix C and Letter of Concurrence page 49. Subsequent reinitiation of consultation occurred with a supplemental Biological Assessment dated March, 2011 and Letter of Concurrence dated May 17, 2011. This updated consultation refers to Jazz by name and covers heavy thinning and creation of forage areas in the Matrix which was requested during public scoping but not included in the original consultation. Refer to the Letter of Concurrence page 35. These documents are incorporated by reference and summarized below.

The USFWS concurs with the Forest Service that the proposed action warrants an effects determination of "***may affect, but is not likely to adversely affect***" for spotted owls (USFWS 2011). The following documents the rationale for this determination.

3.7.2 **Habitat Methodology & Existing Condition**

Spotted owl habitat is divided into suitable, dispersal and capable. "Suitable" describes habitat used by owls for nesting, roosting and foraging (NRF). In general, suitable habitat is 80 years of age or older, canopy cover exceeds 60 percent, stands are multi-storied, and there are sufficient snags and down wood to provide opportunities for nesting, roosting and foraging. Dispersal habitat is typically over 40 years of age with a canopy cover of 40 percent or greater and an average stand tree diameter of 11 inches or greater. Spotted owls use dispersal habitat to move between blocks of suitable habitat and juveniles use it to disperse from natal territories. Dispersal habitat may have roosting and foraging components, enabling spotted owls to survive, but lack structure suitable for nesting. Owls can also disperse through suitable habitat. In this document, the term "dispersal habitat" is used to describe stands that provide for dispersal but are not suitable unless otherwise noted. Sometimes the term total dispersal habitat is used to include the sum of dispersal only habitat and suitable habitat. Capable habitat is other forested lands with the potential to eventually grow and become dispersal or suitable habitat. Young forest plantations fit this category.

Spotted owl locations are sometimes referred to as "activity centers" because in some situations, no nest was actually found at the time of the survey. The site on the map was the closest location that could be determined based on the owls' center of activity. These activity centers are treated as nest locations. More recently the USFWS did an analysis to determine potential locations of owls in suitable habitat where surveys have not been adequately completed to determine presence. The

USFWS used the BioMapper habitat model to predict these sites (USDI, USDA 2008). In the Forest GIS system these owls are labeled CIS (computer implied sites) and this document refers to them as predicted sites.

For the project area, spotted owl home range is a 1.2 mile radius circle (2,895 acres) centered on the owls' activity center. Incidental take would be presumed to occur when suitable habitat is removed from a home range, and/or if the total suitable habitat is less than 40% of the home range. A core area is defined as the area within a home range that receives disproportionately high use (502 acres or a 0.5 mile radius circle). Incidental take would be presumed to occur when suitable habitat is removed from a core area and/or if suitable habitat is less than 50% of the core area. The nest stand is considered a 300-meter radius circle around the activity center.

Since there are few recent surveys for spotted owls that show the locations of active nest sites, historical spotted owl information is used. Use of historical activity centers is appropriate since studies show nest sites are used for many years. In addition, predicted owl sites (CIS) are used. The proposed action could potentially affect sixteen historical and two predicted owl pair's. Even though the project does not affect suitable habitat, the following table show an analysis of suitable habitat for each owl pair to show the relative fragmentation of existing habitats.

3.7.3 Data on the 16 historical and two predicted owl pairs

Owl Pair Number	**Acres of Suitable Habitat in Home Range**	**Percentage of Suitable Habitat in Home Range**	**Acres of Suitable Habitat in Core Area**	**Percentage of Suitable Habitat in Core Area**
320P94*	925	32.0	162	32.3
3538P94*	1198	41.4	223	44.4
3540P90*	639	22.1	215	42.8
3604P91*	839	29.0	138	62.0
3645P97	1555	53.7	320	63.7
3672T90	1742	60.2	300	59.8
5013P85	1422	49.1	263	52.4
5252T93*	1172	40.4	143	28.5
5316P89	1860	64.2	411	81.9
5372P89*	700	24.2	101	20.1
5373P90	1222	42.2	293	58.4
5374P87	669	23.1	253	50.4
5375P90	1921	66.4	447	89.0
5537P93	2231	77.1	418	83.3
5979T91	2120	73.2	351	69.9
5982T91	1689	58.3	361	71.9
CIS 25	2362	81.6	457	91.0
CIS 44	2270	78.4	406	80.9

* Shaded rows indicate that the amount of suitable habitat for a specific owl pair is below the threshold the USFWS has determined would support northern spotted owl pairs. The threshold for survival is above 40% suitable habitat in the home range and above 50% in the core area.

Six out of 16 historic owl territories have a lack of mapped suitable spotted owl habitat. The two predicted spotted owl sites have sufficient habitat. In total, there are 13 spotted owl habitat sites that can potentially support spotted owls at current levels within and adjacent to the Jazz Planning Area. However, the presence of barred owls would likely influence the actual number of pairs that can utilize this habitat.

Barred owls are known to be present on the Forest. Barred owls have been expanding into northern spotted owl territory from northeastern Canada since about 1900 and in some cases have been displacing spotted owls (Anthony 2004) (Courtney 2004) (USDI 2011). Barred owls may be expanding their range because of changes to forest structure from logging, wildfire or climate change. By casual observation and incidental surveying since 1994, barred owls do appear to be more common on the Forest than they were when surveying began in 1979. Since wide-scale surveys on the Forest have not been conducted for owls since approximately 1994, it is unknown how the presence of barred owls has affected the local population of spotted owls. Regionally barred owls are considered a serious threat to the continued existence of spotted owls. Barred owls are thought to be more aggressive than spotted owls and may be out competing them for food, killing young, and inter breeding. Spotted owl recovery efforts may include killing barred owls (USDI 2011).

3.7.4 **Methodology for Noise Disturbance Effects**

The USFWS has concluded (USDI 2011) that noise can result in a disruption of breeding, feeding, or sheltering behavior of the spotted owl such that it creates the potential for injury to individuals (i.e. incidental take in the form of harassment). For a substantial disruption of spotted owl behavior to occur, the disturbance and spotted owl(s) must be in close proximity.

A spotted owl that may be disturbed at a roost site is presumably capable of moving away from a disturbance without a substantial disruption of its behavior. Since spotted owls forage primarily at night, projects that occur during the day are not likely to disrupt its foraging behavior. The concern about noise is with breeding behavior at active nest sites. In the late breeding period, potential effect from disturbance declines because juvenile spotted owls are increasingly more capable of moving as the nesting season progresses. The critical breeding period is March 1st through July 15th. After July 15th, most fledgling spotted owls are capable of sustained flight and can move away from most disturbances (USDI 2011).

The USFWS developed disruption distances based on interpretation of best available information (USDI 2003). The actions proposed for this project that generate noise above the local ambient levels are heavy equipment and chainsaw use. Normally the

analysis area for noise around known nest sites would be 35 yards for heavy equipment use, and 65 yards for chainsaw use. Type I (large) helicopters have a disruption distance of 0.25 miles. However for historic activity centers that have not been verified recently, 300 meters is added to these distances.

If a Type I helicopter is used, the restriction would be for 768 yards from March 1-September 30th to protect nesting and juvenile owls. If smaller helicopters are used or Kmax helicopters, the restrictions are reduced as described in the biological assessment.

Log-hauling on open roads is not expected to have adverse affects during anytime of the year, since spotted owls rarely nest at or immediately adjacent to a road. The potential for noise related impacts is also dependent on the background or baseline levels in the environment. In areas that are continually exposed to higher ambient noise levels (e.g. areas near well-traveled roads, campgrounds), spotted owls are probably less susceptible to small increases in disturbances because they are accustomed to such activities.

3.7.5 **Direct and Indirect Effects by Alternative**

3.7.5.1 **No Action**

No short-term effects to the spotted owl would occur with this alternative. For the short term (0-10 years), the areas that are currently providing dispersal habitat would continue to function as dispersal habitat. Snag and down wood levels would gradually increase due to overstocked stands and insects and diseases in the area. However, because there is root rot in some of the stands additional trees may fall over and provide additional down wood, but snags may not stand as long as in stands not infected by root rot. No action in young stands in the stem-exclusion phase may keep high densities of flying squirrels.

In the long term, the stands would start to differentiate to varying degrees and show a substantial increase in the levels of snags, down wood and understory development. Where these conditions occur, they would improve the dispersal habitat characteristics being provided within some stands.

At 200 years of age these stands would function in a similar fashion to a treated stand but may have a larger amount of snags and down wood.

With no action there would be no noise related disturbance to owls.

3.7.5.2 **Proposed Action**

The stands proposed for thinning are not currently of a size or condition to be considered suitable habitat but they do function as dispersal habitat. Currently the

plantations are fragmenting a larger landscape of mature forest. The project would use variable density techniques to speed the creation of suitable spotted owl habitat in LSRs and improve stand growth in the matrix land allocation. The proposed stand treatment calls for opening the canopy to reduce suppression so the stand can grow larger trees and begin to develop a mid-level story preferred by spotted owls for roosting, nesting and foraging. The proposed action would result in a softening of the edge contrast between plantation and adjacent mature forest stands.

The thinning units are spotted owl dispersal habitat and they would be altered by this proposed action. The thinning in Matrix has a different emphasis than thinning in LSRs: the proposal for LSRs are designed to accelerate the growth of the trees in the stand to achieve late-successional functions more rapidly with both growth and snag production as part of the prescription. The northern flying squirrel is the principle prey of the northern spotted owl on the west side of the Cascades. There is a trade-off in several aspects of thinning to promote spotted owl habitat: the reduction in snags and down wood and the increased spacing of trees can reduce the productivity of the site for the northern flying squirrel for 20-40 years (Wilson 2009). Wilson also reported that the long-term benefits of variable-density thinning for squirrels are likely to be positive. The proposed action would help stimulate the development a lower canopy layer of trees which is thought to be important to accelerate late-seral conditions and promote prey for spotted owl. The stream buffers and skips would provide some habitat and habitat connectivity for northern flying squirrels during this time period so that long-term goals of promoting late-seral structure do not conflict with habitat requirements of this important species (Manning 2011). Complex structure favorable to flying squirrels may be achieved sooner in younger stands where there is a shorter vertical distance between the ground and the bottom of the canopy. The primary function of dispersal habitat however is for temporary movement and roosting as birds move between locations and is not required to provide optimal foraging opportunities.

The project would reduce dispersal habitat canopy levels below 40% in the matrix land allocation units. The USFWS has concurred that the thinning of dispersal habitat below 40% canopy cover would result in habitat removal, but there would remain sufficient dispersal habitat across the landscape to allow spotted owls to disperse.

Effect determination for Owls - The USFWS concurs with the Forest Service that the project ***may affect, but is not likely to adversely affect*** territorial or dispersing spotted owls due to habitat modification (USFWS 2011). This effect would be temporary because over time the residual trees would grow and canopy cover would again be over 40%. This effects determination is appropriate because no dispersal habitat would be removed in any of the Areas of Concern identified in the LSR Assessment, no habitat would be removed in nest stands, no thinning that would result in removal of dispersal habitat would occur in LSRs or critical habitat and thinning units are not concentrated in any spotted owl home range to an extent that would impact the ability of a northern spotted owl pair to forage for themselves and young.

Effect determination for Critical Habitat - There are 26 proposed units located in the 2008 delineation of critical habitat totaling 726 acres. The USFWS has identified dispersal habitat as a Primary Constituent Elements (PCE) necessary for spotted owl recovery. The USFWS has concurred with the Forest Service that the project ***may affect but is not likely to adversely affect spotted owl critical habitat*** (USDI 2010). This effects determination is appropriate because thinning to maintain 40% or more canopy cover in critical habitat would maintain dispersal habitat.

Effect determination for Noise Disturbance - The proposed action may have disturbance effects from the use of chain saws, heavy equipment and helicopters. In most cases these factors would be outside the threshold zone for disruption of nesting. For those actions that could adversely affect spotted owls a seasonal restriction that would lower the effect on the owls would be implemented. The effects of various activities and the associated seasons are listed in Table 9 of the USFWS Letter of Concurrence (USDI 2011). With these seasonal restrictions, the effect would be ***may affect but not likely to affect the northern spotted owl*** for disturbance.

Revised Recovery Plan for the Northern Spotted Owl 2011 - The Revised Recovery plan indicates that the most important range-wide threats to the spotted owl are competition with barred owls, ongoing loss of spotted owl habitat as a result of timber harvest, habitat loss or degradation from stand-replacing wildfire and other disturbances, and the reduction in quantity and alteration of distribution of spotted owl habitat as a result of past activities and disturbances. This project is consistent with the goals and criteria identified in the Revised Recovery Plan for the Northern Spotted Owl (USDI 2011).

3.7.5.3 CUMULATIVE EFFECTS

Past, Present and Foreseeable Future Actions: This analysis relies on current environmental conditions as a proxy for the impacts of past actions. This information comes from the current GIS vegetation, roads and activity layers which include data such as the current condition of forest stands and the age of plantations. These layers track forest vegetation and other features as they have been affected by events such as forest fires and past regeneration harvest as well as the growth that has occurred since. The analysis includes road construction, power lines and rock quarries. Recent and ongoing projects such as Day, Hot, Fan, Pin, and Pink are included as are recent fires. Future logging on the Forest is likely but details of location and timing are not known and are not sufficiently foreseeable to predict effects.

There are five ongoing thinning projects within the Collawash watershed that may create cumulative effects in relation to the Jazz Thinning Project. The projects are Day (61 ac), Hot (284), Fan (209 ac), Pin (401 ac), and Pink (188 ac) for a total of 1,143 acres. These are also thinning projects located in dispersal habitat for northern spotted owls. There are a series of road decommissioning projects occurring in the

watershed. Several wildfires have occurred within the action area. These recent fires (within the last five years) are View Lake (2,760 ac), Lenore (298 ac) Mother Load (2,740) and Blister Fire (303 ac) for a total of 6,101 acres.

The thinning projects would have a small impact on spotted owls. The thinning projects were all consulted on with the USFWS and they considered cumulative effects at the time they made their effects determination. The effects for thinning dispersal habitat in all of the ongoing projects is ***may affect but not likely to adversely affect the spotted owl***. While spotted owls utilize dispersal habitat for movements between locations they are not dependant on dispersal habitat for survival and would still utilize some thinning areas for dispersing. Even with all of the ongoing actions there would remain sufficient dispersal habitat across the landscape for owls to disperse. There would be some reduction in prey numbers where thinning has occurred for up to 20-40 years.

The road decommissioning would have very little impact on spotted owls because it does not remove any habitat. There could be some impact from disturbance from the use of heavy equipment but this would be minor since all equipment is used only during the daytime; and has no impact on spotted owl survival, reproduction or feeding.

The wildfires have likely impacted spotted owls by removing suitable habitat and burning over nest sites. Most of the burned acreage is quite far from the Jazz units. The fires do overlap 3 of the 18 home ranges: 5979T91, 5375P90 and 5373P90. The fires burned in a mosaic pattern with some canopy removal and some under burning. Since the proposed action would not remove suitable habitat there would be no additive cumulative effect of suitable habitat burned.

The cumulative effects of the proposed action is negligible and would not impact spotted owl survival, reproduction, feeding, or care of young. The USFWS has determined that the cumulative effects of the proposed Jazz Thinning would not cause the northern spotted owl to be in Jeopardy.

3.7.5.4 **LSR Assessment** – The proposed action includes 726 acres of plantation thinning in the LSR. Stands are less than 80 years of age and no new road construction would occur in the LSR. The LSR Assessment recommended retaining down wood cover at a rate of 10 to 15%. To achieve this in plantations, most of the trees that need to be cut to achieve thinning objectives would need to be left on the ground. The cost of creating down wood at these rates would not allow for an economically viable timber sale (There are no other funding sources available to do this work). There are also negative consequences associated with leaving large quantities of down wood that would attract Douglas-fir bark beetles which would spread to adjacent stands. Site-specific conditions and new science drove consideration of treatments that deviate from the down wood recommendations in the LSR Assessment triggering the need for a review by the Regional Ecosystem Office (REO 2012).

The proposed thinning in the LSR would meet the objectives for managing LSRs and is consistent with LSR standards and guidelines. This conclusion was reached in part for the following reasons:

- At the landscape scale, down wood levels are consistent with the objectives for managing LSRs.
- The LSR is currently at approximately 67% late-successional habitat, compared to the minimum level of 70 percent late-successional habitat in the Western Hemlock Zone (Note: Most of the potential harvest units within the LSR occur within this Zone). Mid-seral stands currently are lacking late-successional characteristics of large trees and multiple stories. This project would move plantations toward the desired future condition for this LSR.
- Thinning these young stands now would result in a size class distribution and canopy structure that more closely resembles the late-successional habitats that meet the Desired Future Conditions identified in the LSR Assessment in a much shorter length of time than if no treatment occurred.

3.7.6 Forest Plan Standards and Guidelines

Mt. Hood Forest Plan References
Forestwide Wildlife Standards and Guidelines – FW-170 to 186, page Four-69
Northwest Forest Plan - Standards and Guidelines - section C

The proposed action is consistent with the following standards and guidelines

NFP C-12	Thinning in LSRs is consistent with LSR standards and guidelines because stands are less than 80 years old and thinning is designed to accelerate the development of late-successional forest conditions. The proposal was reviewed by the Regional Ecosystem Office and found to be consistent.
FW 170 & 171	This standard and guideline is not applicable to individual projects.
FW-174	Habitat for threatened, endangered and sensitive species has been identified and managed in accordance with the ESA (1973), the Oregon ESA (1987), and FSM 2670.
FW-175	Habitat for threatened, endangered and sensitive species is managed at the landscape scale. This standard and guideline is not applicable to individual projects.
FW -176	A Biological Evaluation has been prepared.
FW 177 & 178	Consultation with USFWS has been completed.
FW-179	The creation of Species Management Guides is not applicable to individual projects.
FW-180	The maintenance of lists of threatened, endangered and sensitive species is done but this standard is not applicable to individual projects.
FW-181	This document does not include location information.

3.8 OTHER WILDLIFE

This section discusses wildlife species that are categorized as sensitive species, survey and manage species, management indicator species and migratory birds. It also includes a detailed discussion of snags and down wood which are important for many species.

3.8.1 SENSITIVE SPECIES AND SURVEY AND MANAGE SPECIES

Sensitive Species

A biological evaluation has been developed by a wildlife biologist to address the potential effect of activities on sensitive species. The objective is to avoid a trend toward Federal listing under the ESA. This section summarizes the biological evaluation which is incorporated by reference.

Methodology for Sensitive Species

A literature review of species habitat requirements was used to compare existing habitat conditions based on field visits and GIS analysis to suggest potential presence of species and the effect the project would have on that species. Professional knowledge and experience with the species was used to determine the effect the project would have on each species analyzed.

Background

Sensitive Species are plants and animals identified by the Regional Forester for which population viability is a concern, as evidenced by a current or predicted downward trends in population numbers or density and habitat capability that would reduce a species' existing distribution (FSM 2670.5). The species suspected or documented to be found on the Clackamas River Ranger District were analyzed to determine if habitat for them was present in the project area and if the project would have any impact on the population on the Forest.

Survey and Manage Species

Methodology for Survey and Manage Species

A literature review, conservation assessments, and survey protocols were used to assess species habitat requirements (http://www.blm.gov/or/plans/surveyandmanage/index.htm). Existing habitat conditions based on field visits and GIS analysis were used to determine potential presence of species and the effect the project would have on that species. Professional knowledge and experience with the species was used to determine the effect the project would have on each species analyzed.

Background

The Survey and Manage list of species used by this document for analysis is from Attachment 1 of the Settlement Agreement, Conservation Northwest v. Sherman Case No. 08-CV-1067-JCC (W.D. Wash.) filed 07/06/11. Existing exemptions ordered by the court in Northwest Ecosystem Alliance v. Rey, No. 04-844-MJP (W.D. Wash. Oct 10, 2006) and new exemptions specified by the above referenced settlement agreement filed 07/06/11 were applied to this proposed project. Because the stands are less than 80 years of age, the survey and manage standard and guideline does not apply. There are no known existing sites for survey and manage species in the proposed thinning units.

3.8.1.1 Summary of the effects to Sensitive Species and Survey and Manage Species from the Biological Evaluation.

Sensitive Species	**Suitable Habitat Presence**	**Impact of Proposed Action**
Johnson's Hairstreak	Yes	MII-NLFL
Mardon Skipper	No (no suitable meadows)	No Impact
Larch Mountain Salamander	No (Outside known range and lack of habitat)	No Impact
Cope's Giant Salamander	Yes	No Impact with riparian protection buffers
Oregon Spotted Frog	No (No suitable meadows)	No Impact
Lewis' Woodpecker	No (Outside Range)	No Impact
White-Headed Woodpecker	No (Outside Range)	No Impact
Bufflehead	No (No suitable ponds)	No Impact
Harlequin Duck	No (No suitable river habitat)	No Impact
Bald Eagle	No (No suitable lake or river)	No Impact
American Peregrine Falcon	Yes	No Impact with seasonal restriction
Townsend's Big-eared Bat	No (No cave habitat)	No Impact
Fringed Myotis	No (No cave habitat)	No Impact
California Wolverine	No (Below 7,000 feet)	No Impact
Cascades Axetail Slug	No (no mature habitat)	No Impact
Puget Oregonian	No (no mature habitat)	No Impact
Columbia Gorge Oregonian	No (no mature habitat)	No Impact
Evening Fieldslug	No habitat	No Impact
Dalles Sideband	No (eastside species)	No Impact
Crater Lake Tightcoil	No	No Impact
Crowned Tightcoil	No (no mature habitat, no records for Forest)	No Impact

Survey and Manage Species	Suitable Habitat Presence	Impact of Proposed Action
Larch Mountain Salamander	No (Outside known range and lack of habitat)	No Impact
Great Gray Owl	No (no 10 acre meadows)	No Impact
Red Tree Vole	No (no mature habitat)	No Impact
Oregon Megomphix	No (no mature habitat)	No Impact
Puget Oregonian	No (no mature habitat)	No Impact
Columbia Gorge Oregonian	No (no mature habitat)	No Impact
Evening Fieldslug	No habitat	No Impact
Dalles Sideband	No (eastside species)	No Impact
Crater Lake Tightcoil	No	No Impact

*MII-NLFL = May Impact Individuals, but not likely to Cause a Trend to Federal Listing or Loss of Viability to the Species.

3.8.1.2 **Species Discussion**

Johnson's Hairstreak
Johnson's Hairstreak butterflies use dwarf mistletoe for their primary habitat. There would be some removal of hemlock with dwarf mistletoe. While there may be an impact to individual butterflies it would not reduce the viability of the species in the watershed because the there is abundant dwarf mistletoe across the landscape to provide for viable populations.

Cope's Giant Salamander
Cope's Giant Salamanders utilize cold rocky streams for most of their life cycle. There is potential habitat for these salamanders in the proposed thinning units. However, required project design criteria for stream protections would minimize impacts to this species. There are no predicted impacts to Cope's giant salamander individuals or the viability of the species in the project area.

Peregrine Falcon
There is a peregrine falcon nest site approximately 2.3 miles from the nearest project unit. The Forest has adopted the strategy of avoiding ground disturbing activities up to 1.5 miles from the nest site and 3 miles with helicopter operations between January 1 and July 31. Because of the seasonal restriction within the 3 mile fly zone, there would be No Impact to peregrine falcons.

Great Gray Owl
No ten acre meadows are located within 600 feet of any units. Therefore, there would be no impact to this species.

Terrestrial Mollusks
Many of the terrestrial mollusks are listed as both sensitive and Survey and Manage species. None of the species would be impacted by the proposed project due to lack of suitable habitat. The species are either found in mature habitats or in the case of

the evening fieldslug are found in marshy/wetland conditions. The Dalles Sideband is an eastside Cascades species.

3.8.2 SNAGS AND DOWN WOOD

This section summarizes the wildlife report and the stand data in the analysis file.

3.8.2.1 **Methodology**

Snags and down wood analysis is based on several analysis tools. Standards and Guidelines for the Forest Plan, DecAID analysis tool, Gradient Nearest Neighbor (GNN) analysis, Forest Vegetation Simulator modeling, and species use information from DecAID. These tools are described below and additional elaboration is in the analysis file.

DecAID is a planning tool intended to advise and guide managers in their analysis to conserve and manage snags, partially dead trees and down wood for biodiversity (Mellen 2003). It also can help managers decide on snag and down wood sizes and levels needed to help meet wildlife management objectives. DecAID was developed to collect and synthesize the best available science on wildlife relationships with dead wood (Mellen 2009). DecAID is designed to be applied at scales of at least 6th field subwatersheds or larger watersheds, sub-basins, physiographic provinces, or landscape administrative units such as Ranger Districts or National Forests. DecAID is not intended to directly predict occurrence of wildlife at the scale of individual forest stands or specific locations. It is intended to be a broader 'descriptor' planning tool.

GNN uses satellite imagery to determine vegetation condition, and for this analysis it is used to determine the amount of snags and down wood from 2006 satellite imagery. A Forest-wide analysis was completed in 2010 to determine the current condition of snags and down wood in the watersheds using GNN data. This data is incorporated into this analysis to show the current condition in comparison to the reference condition described in DecAID.

The Forest Vegetation Simulator (FVS) is an individual-tree, distance-independent, growth and yield model (USDA 2009a). FVS can simulate a wide range of silvicultural treatments for most major forest tree species, forest types, and stand conditions. The Forest Vegetation Simulator is a system of highly integrated analytical tools that is based upon a body of scientific knowledge developed from decades of natural resources research and experience. FVS answers questions about how forest vegetation would change in response to natural succession, disturbances and proposed management actions (http://www.fs.fed.us/fmsc/fvs/).

The charts below show stacked bars with the largest size at the bottom and progressively smaller snags added as the bar goes up. Since DecAID divides snags into small (< 20 inches diameter) and large (> 20 inches diameter), these breaks are shown in the charts. The total quantity of large snags can be visualized by looking at

the purple and green portions of each bar. Three charts represent the range of thinning intensity with the proposed action; 80, 100 and 120 square feet of basal area retained after thinning (a lower number represents a wider leave tree spacing). The thinning level for LSRs and riparian reserves would be at approximately 120 square feet of basal area after thinning. These charts represent a weighted average that combines the projected snags for skips, gaps and thinning. Skips are areas not thinned and include riparian protection buffers as well as smaller skips scattered in harvest units. Snags in skips would be similar to what is projected for no action. Gaps are small openings scattered in the harvest units. Gaps would naturally regenerate to young trees, and as time goes by they would likely resemble skips with an age 40 or 50 years younger than the surrounding stand. The data, and spread sheet that made these calculations are in the analysis file.

3.8.2.2 **Introduction and Existing Situation**

Across the Forest snags and down wood exist at lower levels than the historic range of variability due to large stand-replacing fires early in the 20th century, past timber harvest and firewood cutting. Between the years of 1870 to 1920, roughly 300,000 acres or nearly one third of the Forest was burned by stand replacement fires. There have been 350,000 acres harvested since 1900. The combination of large-scale stand replacing fires and harvest have contributed to the current situation where almost 60% of the forest is in a mid stage of stand development with relatively few large snags.

The project area is located within the Western Low Land Conifer Zone with the majority of the acreage composed of Douglas-fir and Western hemlock. The primary and secondary cavity nesting species for the Western Low Land Conifer Zone are: pileated woodpecker, northern flicker, hairy woodpecker, red-breasted sapsucker, chestnut-backed chickadee and the red-breasted nuthatch. According to the Collawash/Hot Springs Watershed Analysis, mid-seral stands in the project planning area have approximately 2.0 snags per acre greater than 15 inches in diameter. The 100% biological potential level for cavity nesting species is 4.33 snags per acre at 15 inches diameter and larger (Austin 1995). The 60% biological potential level is 2.6 snags per acre in the Westside Lowland Conifer-Hardwood zone.

When the plantations were originally created, all of the trees were removed along with all of the snags. Some down wood was removed and some was retained depending on the methods for logging and site preparation. Under current conditions, these plantations would experience suppression mortality that would likely result in an abundance of medium to small snags and down wood. There is some large diameter down wood scattered throughout the proposed thinning units; most of which came from past harvest which left unmerchantable trees on the ground. If current conditions are left unchanged, the availability of new down wood in the near future would be medium to small in size. At the time stand exams were conducted in 2010, the plantations had approximately 100 dead trees per acre (some standing, some down): mostly planted trees, averaging approximately 4 inches in diameter. Because snags this small do not stand very long they were not carried through to the projections of future snags in the graphs below.

The Collawash watershed is composed of 50% early to mid-seral stages and 50% late seral, according to the Watershed Analysis. There are a little over twice as many acres of land with no snags than would be found in a natural condition based on DecAID analysis and GNN data. The analysis using the GNN method indicates that there are currently 5.2 snags per acre greater than 20 inches diameter at the landscape scale. It shows that there are 7.3 snags per acre between 10 and 20 inches diameter. For down wood the GNN method indicates that there is currently 6.17% cover for logs greater than 20 inches diameter.

Tolerance levels in DecAID are broken into 30, 50 and 80th percentiles that represent the likelihood that a species such as pileated woodpecker would use land with a given level of snags. The analysis for the Collawash watershed for pileated woodpecker shows that for large snags - over half of the watershed has a 30% likelihood of use and over a third of the watershed has a 50% likelihood of use. This data predates the recent fires in the watershed that have burned over 6,000 acres leaving behind many snags.

In addition to snags, DecAID recognizes the importance of defective trees or those that have the elements of decay. Hollow structures are created in living trees by heartrot decay organisms over many years. These hollow structures in living trees provide especially valuable habitat for a variety of wildlife, including cavity users. Trees that have heart rot decay present may include features such as openings in the bole, broken boles with bayonet tops, large dead tops or branches, punk knots, flattened stem faces, old wounds on the bole, crooks in the bole signifying previous breakage, and the presence of fruiting bodies. Defective trees with deformities such as forked tops, broken tops, damaged and loose bark or brooms caused by mistletoe or rust can also provide important habitat for a number of species. These defective live trees are not present in large quantities in the plantations but are likely to develop as stands age. These are not included in the analyses below.

3.8.2.3 **DIRECT AND INDIRECT EFFECTS**

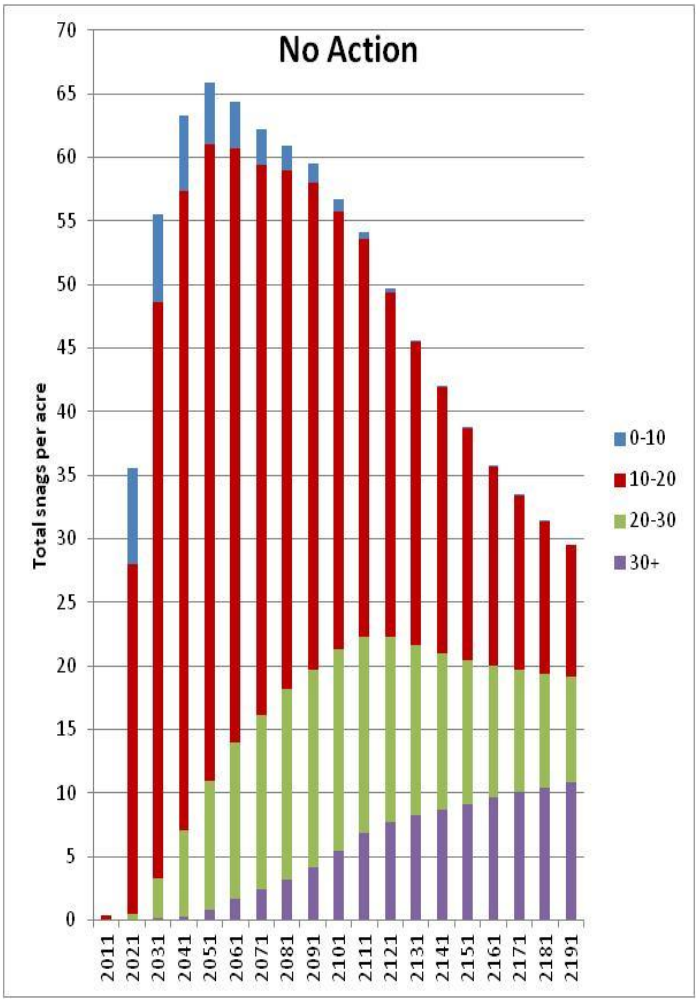
The following actions have the potential to affect snags and down logs. Since snags may be hazardous some of them may be felled adjacent to operations such as tree felling, landing use, skidding, road use, road construction, road repair, road closure and log haul. Existing down logs may be disturbed by harvest operations.

No Action

The stands would continue to provide the current levels of snags and down wood in the near term. DecAID coarse woody debris tolerance levels would range from 30 to over 50%.

The project area would continue to experience mortality. Small snags generally less than 20 inches diameter would substantially increase in numbers in these stands. Live trees would fall from the effects of weakened roots from root rot. These two factors would eventually create a subsequent increase in the down woody debris. Even with no action, the Forest would continue to manage the road and trail system for public safety which includes the felling of hazard trees.

This chart shows the projected level of snags over time in the plantations. There would be an abundance of snags in the 10 to 20 inch diameter range.

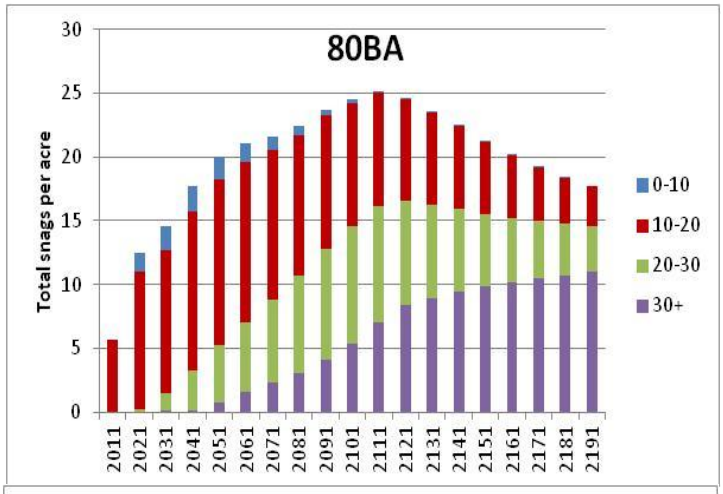


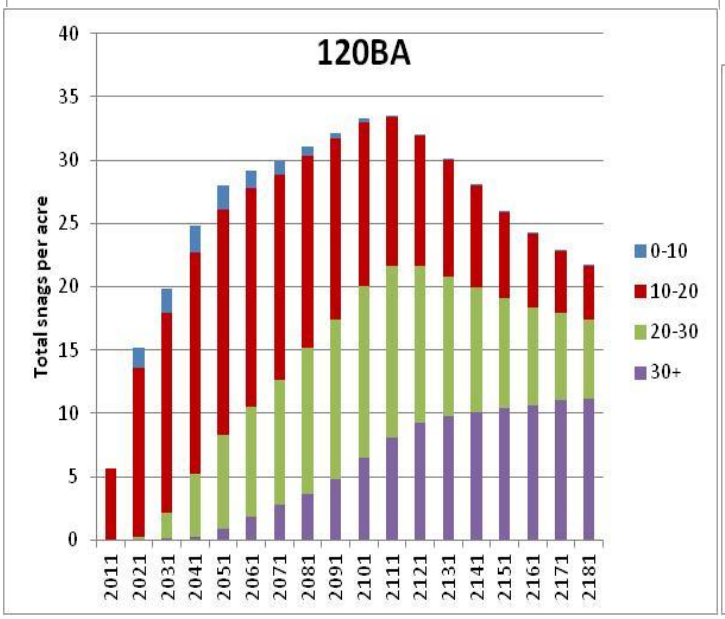
Proposed Action

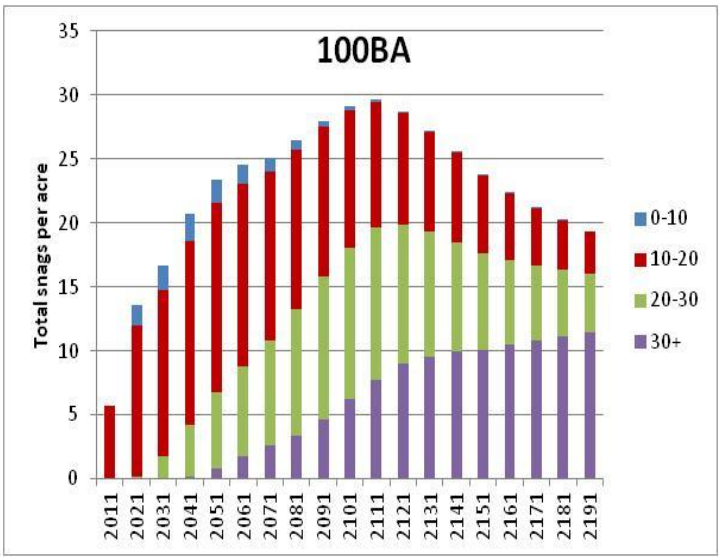
Currently the plantations contain small snags. Some of the small snags are difficult to retain during logging and road construction because of their inherent instability and danger. It is likely that some snags would need to be cut down during harvest operations due to safety considerations and that some downed logs would be degraded through the process of logging.

The proposed action would result in fewer snags and less down wood compared to no action. The thinning options shown in the charts show roughly as many snags in the largest size classes compared to no action. The thinning options also result in larger live trees that could be treated manually to create snags if needed in the future.

The proposed action would create new small snags and down logs by topping, girdling and felling some of the plantation trees. Public comments have questioned the value of manually created snags. The creation of snags is a valid technique for supplementing other snags across the landscape where harvest has been part of the landscape history. Research has shown that cavity-nesting birds use create snags at rates equal to or greater than trees that die of natural causes (Walter 2005). Local experience with similar snag creation indicates that these created snags are used for foraging at first but that actual cavity nesting use increases with time and requires the snags to get to later stages of decay for maximum use. The created snags would represent the largest size class available in the stand and would be larger than those that would die with no action from natural causes. Smaller snags, regardless of how they die would not stand as long as large snags. Local experience with snag creation indicates created snags still standing and functioning after ten or more years.







Utilization of snags increases with the size of the snags. Large diameter snags are used more frequently as nest sites and also show more evidence of woodpecker foraging than smaller snags. Consequently, greater numbers of cavity-nesting wildlife are present when large snags are available than where few or no large snags exist. There would be fewer smaller snags compared to no action, but small snags are not as valuable as large snags for most snag dependent species. Thinning would increase the development of larger trees but stands would be healthier and trees are not as likely to die compared to no action. With the proposed action, some acreage

would be managed similarly to that described for no action in riparian protection buffers and skips where there would be an abundance of small and medium sized snags and down logs.

The proposed action would provide fewer snags between 20 and 30 inches diameter and slightly more snags greater than 30 inches diameter compared to no action. The prescription for LSRs and riparian reserves for Alternative B (120 square feet of basal area) has a very similar scenario for large future snags (greater than 20 inches diameter) compared to no action.

	No Action	LSR & Riparian Prescription	Matrix Prescriptions
Snags/ac. > 20 inches diameter in 100 years	22	22	17-20
Snags/ac. > 30 inches diameter in 100 years	7	8	7-8
Years to achieve 10 snags/acre > 30 inches diameter	160	130	130-140

Logs existing on the forest floor would be retained. The harvesting operations would also add small woody debris of the size class of the cut trees to the site. This would include the retention of any snags that would be felled for safety reasons. Snags or green trees that fall down after the harvest operation would contribute to the down wood component of the future stand.

3.8.2.4 **Cumulative Effects to Snags and Down Wood**

The analysis area for snags is the Collawash watershed. In terms of the time scale, timber harvest that has occurred since the 1950s has changed the distribution of snags and down wood. The existing condition section describes the cumulative effect of past actions.

There are five ongoing thinning projects within the Collawash watershed that may create cumulative effects in relation to the Jazz Thinning Project. The projects are Day (61 ac), Hot (284), Fan (209 ac), Pin (401 ac), and Pink (188 ac) for a total of 1,143 acres. There are a series of road decommissioning projects occurring in the watershed. Several wildfires have occurred within the action area. These recent fires are View Lake (2,760 ac), Lenore (298 ac) Mother Load (2,740) and Blister Fire (303 ac) for a total of 6,101 acres.

In addition to these large fires, snags are created across the landscape by several other mechanisms:

- Lightning strikes occur regularly across the watershed, particularly the higher elevations. While lightning strikes sometimes cause large wildfires to burn, most of them only damage individual trees or very small groups of trees.
- Overcrowding results in mortality in dense young stands as trees compete for resources.
- Insects such as Douglas-fir bark beetle are endemic in the watershed and kill live trees every year.
- Root diseases gradually move through many stands in the watershed killing susceptible species (s. 3.1).

Other than these ongoing projects and natural processes, there are no other foreseeable future actions to include in this analysis. Future logging on the Forest is likely but details of location and timing are not known and are not sufficiently foreseeable to predict effects.

Recent wildfires (with no post-fire salvage) have created many snags. Because fires burn with variable intensity, hot burning areas resulted in complete mortality and the snags are in the open and other areas were partially burned where snags are in a more closed canopy situation. Some trees that are not killed immediately die in the years following the fire due to root injury and insects attacking weakened trees. Overtime these snags would become down wood and the forest would grow in around them creating a different habitat.

Past and ongoing road decommissioning has and will result in a reduction in the loss of snags due to reduced hazard tree felling.

The other ongoing thinning projects would have similar impacts to snags and down logs as described for the Jazz proposed action. The combined effect of the proposed action with the ongoing thinning would be approximately 2,513 acres where there could be some loss of hazardous snags during the harvest operation. This loss would be offset by the creation of new snags by topping and girdling in all of the ongoing thinning projects.

At the watershed scale, there is an abundance of snags as a result of the 6,101 acres of wild fires. When combined with the insect, disease and lightning mortality that typically occur across the landscape there has been a net gain of snag and down wood for the watershed. Portions of the watershed exceed the DecAID 80% tolerance levels due to landscape level disturbances. Sufficient levels of snags and down wood would occur across the landscape to provide for the viability of snag and down wood dependent species such as pileated woodpeckers.

3.8.2.5 Forest Plan Standards and Guidelines

Snags and Wildlife Trees - Forest Plan standards and guidelines FW-215, FW-216, FW-234 & FW-235

The standard and guideline from the Forest Plan (FW-215) for harvest units is 60% of the full *biological potential*, which translates into 2.4 snags and wildlife trees per acre in the medium to large size class for the units within the Pacific silver fir zone and 2.2 snags and wildlife trees per acre in the western hemlock zone. *Biological Potential* is a concept that determines the number snags within 100 acres required to produce different percentage of population potential for cavity users. There is a theoretical potential from 10% to 100%. For more on Biological Potential see page 69 of Wildlife Habitats in Managed Forest the Blue Mountains of Oregon and Washington (Thomas 1979).

Currently most of the trees are not large enough to produce snags of the desired size, (FW-234 describes 22 inches diameter as the minimum snag size) but FW-235 allows the retention of smaller trees if the treated stand is too young to have trees of that size. In these cases, snags and green leave trees retained should be representative of the largest size class present in the stand.

Past experience and monitoring indicate that there would likely be sufficient snags scattered through the units after harvest. In addition skips would be created and new snags would be created.

Thinning units average between five and six snags per acre. It is estimated that approximately two per acre would be lost as a result of project operations leaving between three and four snags per acre. Design criteria #2 indicates that one new snag per acre would be created in Matrix units and eight snags per acre would be created by topping and girdling in LSR units. The resulting snag levels would meet these standards and guidelines.

FW-216 indicates that snags and wildlife trees at the landscape scale be at 40% of biological potential, which equates to about 1.5 in the pacific silver fir zone and 1.6 snags per acre in the mountain hemlock zone. The analysis using the GNN method indicates that there are 5.2 snags per acre greater than 20 inches diameter at the landscape scale. The proposed thinning and past and ongoing thinning projects remove few if any snags greater than 20 inches diameter because plantation snags are much smaller. The GNN data is approximately 5 years old and predates the recent wildfires. If the thousands of large snags created in the fires were averaged over the entire watershed they would add approximately 6 snags per acre. The levels of snags at the landscape scale would be well over 1.6 snags per acre.

Down Logs - Forest Plan standards and guidelines FW-219, FW-223, FW-225 & FW-226

FW-219 and FW-223 indicate that stands should have six logs per acre in decomposition class 1, 2, and 3 and that they should be at least 20 inches in diameter and greater than 20 feet in length. Currently the trees are not large enough to produce down logs of the desired size. However, FW-225 and FW-226 indicate that smaller size logs may be retained if the stand is too young to have 20 inch trees. In these, cases, logs representing the largest tree diameter class present in the stand should be retained. No existing down logs would be removed and design criteria #3 would result in additional protection to down woody debris which would protect some of this habitat in the interim. These standards and guidelines would be met.

The standards and guidelines for the Northwest Forest Plan suggest that thinning be designed reflect the timing of stand development cycles. The proposed levels of down wood meet this requirement.

3.8.2.6 Snags and Down Wood Summary

The current condition based on the GNN data shows a sufficient level of snags and down wood to maintain viability for snag and down wood dependant species. The analysis using the GNN data indicates that there are currently 5.2 snags per acre greater than 20 inches diameter and 7.3 snags per acre between 10 and 20 inches diameter. For down wood the GNN method indicates that there is currently 6.17% cover for logs greater than 20 inches diameter. Since the GNN satellite data is 5 years old, it predates some large fires that burned in the watershed. The actual numbers for snags and down logs would be greater. If the thousands of large snags created in the fires were averaged over the entire watershed they would add approximately 6 snags per acre.

The analysis shows that approximately two of the five to six existing snags may be lost in the thinning operation. The proposed action would create eight snags per acre by topping and girdling in the LSR and one per acre elsewhere. These levels are sufficient to meet Forest Plan standards and guidelines.

Stands in the LSR would be managed to provide a higher amount of snags both from a harvest prescription with skips and creating snags (post harvest) and should provide adequate habitat for snag and down wood users as the stands reach a late-successional state. The proposed action would likely reach 50-80% tolerance level by the time the stand reaches maturity at 200 years of age. Stands in the Matrix would meet the 30% tolerance level by retaining snags and creating additional snags to offset snags lost during implementation.

In the long-term the FVS model indicates that there would be a decrease in small snags compared to no action and large snag numbers for the proposed action would

be similar to no action. Supplemental snag creation would offset some of the potential for loss of hazard snags. Snag and down wood management on a watershed scale would maintain viability of species that depend on snags and down wood.

3.8.3 MANAGEMENT INDICATOR SPECIES (MIS)

3.8.3.1 Methodology

A literature review of species habitat requirements was used to compare existing habitat conditions based on field visits and GIS analysis to suggest potential presence of species and the effect the project would have on that species. Professional knowledge and experience with the species was used to determine the effect the project would have on each species analyzed. A Forest-wide analysis for Management Indicator Species was developed in 2011 and is incorporated by reference (USDA 2011).

3.8.3.2 Background

The National Forest Management Act (NFMA) requires the Forest Service to manage wildlife habitat to maintain viable populations of existing native and desired non-native vertebrate species. The Forest Plan identified Management Indicator Species. The primary assumption of this process is that indicator species represent the habitat needs of other species that have similar habitat requirements.

Mt. Hood National Forest Westside Management Indicator Species

MIS	Habitat Description
Northern Spotted Owl	Old Growth
Deer	Early Forest Succession and Mature/Old Growth
Elk	Early Forest Succession and Mature/Old Growth
Pileated Woodpecker	Mature/Over-Mature
American Marten	Mature/Over-Mature
Salmonids	Aquatic

With the selection of some of these species there was a special emphasis on mature, over mature, and old growth habitat. The selection was done at a time when timber harvest was planned to replace many older stands with younger more rapidly growing stands: it was suspected that the mature and over mature stands would decline and the species associated with this habitat could be lost. Several species were selected to represent all of the species that required this type of habitat.

A Forest-wide analysis for Management Indicator Species has been conducted. It summarizes the Forest's consistency with the National Forest Management Act goal of managing wildlife habitat to maintain viable populations of existing native and desired non-native vertebrate species. The Forest-wide analysis for Management Indicator Species describes population and habitat trends and is incorporated by reference. The Forest-wide analysis was conducted at a coarse scale using available

GIS data. The project level interdisciplinary team took the Forest-wide data and refined it based on field examinations and local knowledge of habitat conditions.

Forest monitoring results are documented in Annual Monitoring Reports available on the Forest's web site (http://www.fs.usda.gov/mthood/). Surveys were not conducted to gather site-specific, project-scale population data. Habitat is used as a proxy for population monitoring. The Forest Plan as amended provides habitat to maintain viable populations of these species. Land allocations near or adjacent to the project area that provide habitat for these species include Wild and Scenic Rivers (A1 and B1), Wilderness (A2), Research Natural Area (A3), Special Old Growth (A7), Pileated Woodpecker and Pine Marten Habitat Areas (B5), Late-successional Reserves (LSR), and Riparian Reserves (RR) for pine marten, pileated woodpecker and the northern spotted owl; Winter Range (B10) and Summer Range (B11) for deer and elk; and Riparian Reserves (RR) for fish There are also numerous Forest-wide standards and guidelines that pertain to these species. This project has been designed to minimize effects on management indicator species.

3.8.3.3 **Northern Spotted Owl**

The spotted owl was selected as a MIS because it represents old-growth habitats. The owl section (3.7) has detail on the species and its habitat requirements.

The overall trend for spotted owl populations is declining in the Pacific Northwest. The recovery for the species is covered under the *USFWS Revised Recovery Plan for the Northern Spotted Owl* (Strix occidentalis causarina)(USDI 2011). Because the northern spotted owl is listed as a threatened species, the Forest consults on the effects to the species and its habitat with the USFWS prior to making decisions. The project would not place the northern spotted owl in jeopardy. The degree of effect to dispersal habitat for this project when combined with other projects that affect dispersal habitat would not contribute to a negative trend in viability on the Forest for the northern spotted owl.

3.8.3.4 **Deer and Elk**

Deer and elk were selected as management indicator species because they are economically important game animals. Deer and elk utilize early-successional forest habitat for foraging along with their use of forest stands for cover.

Habitat Characteristics

Recent research has indicated that elk do not rely as much on cover as was once thought; research indicates that forage is much more critical (John Cook Elk Modeling Workshop, April 2010). Telemetry data indicated that elk were negatively associated with cover. Cook indicated that openings (early-seral habitats) are far

more valuable for elk than cover. With the reduction in timber harvest on the Forest in the past two decades and continued tree growth, cover habitats now far exceed the desired levels for optimal and thermal cover but openings for forage are becoming scarce. Currently 13% of the Collawash watershed in early-seral habitat and that figure is declining each year. As the change in forest management has moved from widespread regeneration harvest to selective thinning, past harvest units have grown a thick stand of young trees that shade out the grasses and forbs used as forage for deer and elk.

The project occurs in both winter range (1,074 acres) and summer range (979 acres).

Elk herds exhibit a close association with riparian habitat in areas of gentle terrain and low road density (Toweill 2002, pp 535-536). Forage is available but is generally of low quality on the west side of the Cascades. The low quality of the forage, especially in winter range, and the lack of wetlands and permanent low-gradient streams within winter range are limiting factors for elk and deer on the Forest and in the Collawash watershed.

The project area has plentiful cover but is experiencing a trend of declining forage as plantations age. The recent Decision for the Environmental Assessment titled 'Clackamas Road Decommissioning for Habitat Restoration, Increment 2' authorized decommissioning of 123 miles of system roads in the Collawash watershed. This assessment included an analysis of open road density (p. 93) which is incorporated by reference. These recent plans for road decommissioning have resulted in a landscape where open road density is no longer a concern for deer or elk.

Direct and Indirect Effects
No Action

The No-action alternative would allow the plantations to continue to grow thicker and denser allowing very little light to reach the forest floor. The lack of light would suppress the growth of forage for deer and elk.

There would be no noise disturbance or change in open road density.

Proposed Alternative
Thinning of the plantations would allow more sunlight to reach the forest floor and would create more forbs and browse plants to grow which would create increased forage for deer and elk. The plantations in Matrix would be thinned to wider spacing with the intention of benefiting forage. The current method of leaving skips and gaps as part of the prescription would create forage openings and cover opportunities scattered across the thinning units. The increased forage opportunities could improve deer and elk production and health in the watershed. The increase in forage opportunities is especially important in winter range where forage is critical to deer

and elk survival. Increases in forage in summer range does help build fat reserves prior to winter and so is also very important to elk survival.

The proposed action does not involve the creation of open roads and therefore the open road density would not change from the levels described in the road decommissioning analysis.

Noise from equipment and road use would temporarily cause some harassment resulting in a temporary decrease in use of the area. After use, road closure, decommissioning and seeding with a mixture of blue wild rye and Columbia brome in the road bed and landings could create some temporary forage opportunities until they are shaded out.

The use of helicopters could create some deer and elk disturbance that could cause the deer and elk to seek less used areas of the watershed until that operation is concluded.

Cumulative Effects

The analysis area for deer and elk is the Collawash watershed. There are five ongoing thinning projects within the Collawash watershed that may create cumulative effects in relation to the proposed action. The projects are Day (61 ac), Hot (284), Fan (209 ac), Pin (401 ac), and Pink (188 ac) for a total of 1,143 acres. These are also thinning projects and would result in similar benefits to forage as described for the proposed action. Road decommissioning would reduce open road density. There are also several wildfires that have occurred within the watershed primarily in high elevation summer range. These recent fires have created some forage and include View Lake (2,760 ac), Lenore (298 ac) Mother Load (2,740) and Blister Fire (303 ac) for a total of 6,101 acres.

All of the changes in habitat from the thinning, road decommissioning, and wildfire have a positive effect on early-seral habitat that is important for deer and elk forage. There would be some short-term impacts from disturbance during any work being completed in the area, and this would be cumulative when projects are occurring simultaneously. But the benefits of forage creation outweigh the short-term impact of equipment noise. The current trend for deer and elk populations is stable (see Forest-wide analysis for Management Indicator Species). However, there is an anticipated future trend of declining populations due to the reduction of forage. This project and other projects that enhance forage would not likely totally reverse this trend but they would ease the shortage. This project would not contribute to a negative trend in viability on the Forest for deer or elk.

Forest Plan Standards and Guidelines

The project is consistent with all applicable standards and guidelines for deer and elk.

3.8.3.5 **American Marten**

Introduction
The American marten was once known as the pine marten. The older name was used in the Forest Plan and other documents. This species was selected as a management indicator species because of its association with mature and over-mature habitat, and their need for large snags and large amounts of down wood. Shrinking habitat and trapping pressure led to the concern for marten populations (USDA 1990a).

General description
American marten are typically associated with late-seral coniferous forests with closed canopies, large trees, and abundant snags and down woody.

On the Forest, martens are closely associated with higher elevation stands. Recent tracking records and remote camera work on the Forest over the past 8 years indicates that this species may not use old-growth habitat on the west side of the Cascades as was previously thought. More research would need to be completed to validate this observation. Based on snow tracking, remote cameras, and observations martens are typically associated with stands from 3,000 feet to tree line or about 7,500 feet.

Habitat Characteristics and Ecology
A marten habitat distribution model was created by Ray Davis (Davis 2008), Umpqua National Forest wildlife biologist, based on known marten locations. The analysis shows there are 10,876-21,553 acres of habitat that has a 30-40% or higher probability of supporting American marten on the Forest. The current trend for American marten is stable (see Forest-wide analysis for Management Indicator Species).

Effects on American Marten

The Jazz thinning project occurs at lower elevations and in habitat that is considered the lowest value to American martens. Martens would not select this area for denning, resting or hunting due to the low elevation. The project would have little to no effect on marten. Because this project does not impact habitat for American marten there would be no impact on their viability. There are no cumulative impacts for marten because there is no high quality marten habitat in the project area.

Forest Plan Standards and Guidelines
There are no B5 Land allocations for marten in the project area. The project is consistent with all applicable standards and guidelines for marten.

3.8.3.6 **Pileated Woodpecker**

The pileated woodpecker was chosen as an MIS because of its need for large snags, large amounts of down woody material for foraging, and large defective trees for nesting, roosting and foraging. They are listed as an indicator of mature and over-mature habitat.

Habitat Characteristics and Ecology
Pileated woodpeckers use mature and older, closed canopy stands for nesting and roosting, but may use younger (40-70 years), closed-canopy stands for foraging if large snags are available; large snags and decadent trees are critical habitat components for pileated woodpeckers; down logs do not appear to be an important foraging substrate for pileated woodpeckers on the west side of Oregon and Washington (Mellen 1987, Mellen 1992).

The pileated woodpecker is associated with forest habitats that have large trees, especially large snags (> 20 inches diameter) for nesting and foraging. It uses both coniferous and deciduous trees, but tends to be most common in old-growth Douglas-fir forests in western Oregon.

Direct and Indirect Effects

Refer to the snag discussion in section 3.8.2.

No Action
There would be no change in current snags in the proposed harvest units. Based on the FVS runs there would be a large increase in small snags as suppression mortality continues. There would be ample foraging opportunities for pileated woodpeckers in the next 20-60 years. Pileated woodpeckers would begin to have roosting or nesting opportunities within 20 to 60 years in the stands with no action. Foraging opportunities would be greatest in year 2041 to 2081. No action would create more snags and down wood that would benefit pileated woodpeckers sooner than any proposed treatment.

Proposed Action
There would be an immediate reduction in snag levels from loss of snags (approximately one to two per acre) from harvest activities and safety removals. Snags would be created artificially and would have to decay for 20 plus years to become soft snags that would be used for foraging and nesting. When the stand reaches 200 years of age there would be a similar number of the largest category of snags per acre in the LSR stands and a reduced amount of snags in the Matrix stands compared to No Action. The LSR stands should provide good home range and dispersal habitat for all cavity users throughout the stands life. There would be sufficient snags from implementation through the age of maturity to provide roosting and foraging habitat to pileated woodpeckers and other cavity users.

The current trend for pileated woodpecker is increasing (see Forest-wide analysis for Management Indicator Species). The thinning units do not contain any mature forest. This project would not contribute to a negative trend in viability on the Forest for pileated woodpecker.

Forest Plan Standards and Guidelines
There are no B5 land allocations for pileated woodpecker in the project area therefore there are no relevant standards and guidelines. Snag standards and guidelines are addressed in the snag section 3.8.2.5.

3.8.4 Land Birds

Habitat Conditions and Existing Condition

There are approximately 114 land birds that utilize the Forest either as residents or migrants. Of these, only 30 species use 30-60 year old plantations or their fringes. The cavity nesters effects have been covered under the snags and down wood section. The other species would be affected by nest disruption when thinning occurs during nesting. The nesting season for some species can go as late as August 15th.

Direct, Indirect, and Cumulative Effects for Land Birds

No Action would result in a continuation of uniform dense stands that are favored by some species. The effect of thinning on the utilization of the habitat may cause a shift in species composition but rarely eliminates the use by any species. Research has shown that some species benefit from thinning while others decline. Skips and gaps would provide varied habitat to accommodate most species (Hayes 2003). There would likely be some reduction in productivity and loss of nest success during the implementation of the project. There would be some shifts in species composition but no major effects are expected from thinning the stands because across the landscape there are abundant dense second-growth stands not thinned that are available for those species that depend on that habitat. For example, plantations are not thinned in new wilderness areas or in the Fish Creek watershed where all of the roads have been decommissioned.

Cumulative Effects to Land Birds

Across the landscape, recent and ongoing thinning, wildfires and road decommissioning may have an effect both positive and negative on land bird use of the watershed. There would be some loss of productivity for some species from thinning activities in the watershed. There may be some increase in productivity for other species that favor thinning. Where wildfires burned, a major local shift in species use occurred when the habitat shifted from forest to early seral habitat with an abundance of snags. Road decommissioning would likely result in improved

conditions for most bird species due to increased solitude. The proposed action combined with other actions and events would not likely impact the viability of any land bird species because sufficient habitats are present across the landscape.

3.9 SCENERY

There are several aspects of the proposed action that have the potential to affect scenery. Thinning can alter canopy density and texture, stumps remain and red slash remains on the ground or in piles. Bare soil and straight lines can be created at landings, skid trails and skyline corridors. Road construction and reconstruction also have the potential to alter scenery. A plantation is generally no longer considered visually disturbed when the trees reach an average of 20 feet in height (Forest Plan – FW-562).

This analysis examines the various visual quality objectives associated with specific land allocations and describes the character of the existing landscape from various viewer positions and the likely outcome for each alternative.

3.9.1 Existing Situation

The stands proposed for thinning currently meet the criteria of being visually recovered. The analysis area is experiencing a period of steady visual recovery because there has been relatively little regeneration harvest in the past two decades and plantations are growing rapidly. On the landscape scale, there are some areas where a patchwork pattern exists and observers can see the difference in texture and line between plantations and adjacent mature forest stands. This pattern is subtle as seen from the most sensitive viewer positions but is much more noticeable from local forest roads. Power lines cross through the area creating a straight line effect. Some of the proposed thinning units are directly adjacent to the power line right-of-way.

The following table lists the areas and viewer positions ranked from most sensitive to least in terms of scenery.

Area	**Viewer Position**
Collawash River	river banks
Roads 63(part) and 70	roads, recreation rites
All other areas	local open roads

3.9.2 Direct and Indirect Effects

No Action

Changes in scenery would come slowly from forest growth. Gradually, over approximately 50 years, the contrast between plantations and mature forest would become less evident but plantations would remain dense and uniform in texture.

Proposed Action

The proposed action involves the creation of variability in the stands. Portions of the stands in stream protection buffers and skips would be unthinned. Other portions of the stands would have gaps, temporary road construction, landings, helicopter landings, skid trails and skyline corridors that would be open. The rest of each stand would have variable-density thinning.

3.9.3 **Effects to scenery as seen from sensitive viewer positions:** Collawash River, Road 63 to the Road 70 junction and Road 70. The proposed thinning units cannot be seen from any of these viewer positions. Alterations to scenery if any would be very slight because of a combination of topographic screening, vegetative screening near the viewer position, the density of green trees retained within thinning units, the distance and the viewer angle. No log landings would occur on, or be visible from the primary viewer positions. These factors combined would result in no noticeable change to the casual observer; the viewer would not notice any dramatic changes in forest structure or see bare ground or slash. Similar plantation thinning has been implemented in other viewsheds and the results there confirm that this type of treatment has very little if any affect to scenery. When comparing the proposed action to No Action, variable-density thinning in the long term would result in accelerated tree growth and the breaking up of the solid patchwork pattern between plantation and adjacent mature forest stands. In the long term, the proposed action would result in improved scenery and this improvement would occur much faster with the proposed action than with no action.

3.9.4 **Effects to scenery as seen from local roads:** Local roads are generally roads that were built by loggers to access the forest for timber harvest. Drivers on these local roads would expect to see other roads and some evidence of logging. They would see a closer view of the patchwork pattern that exists and would see landings, stumps, skid trails and rock quarries.

Some minor changes to foreground views from local open roads would occur with the proposed action. The proposed action would emphasize the reuse of existing roads, landings and skid trails. Log landings, temporary roads, skid trails and skyline corridors that lead to the landings and landing slash piles would be noticeable by viewer positions at the landings. Landing size would be kept to the minimum size needed for safety and areas of bare soil would be seeded with grass for erosion control. The thinned forest may have some bare soil, red slash and stumps visible in the short term, but in a few years this would become less noticeable. From other more distant viewer positions, the thinning would not be evident to the casual observer. In some cases landings occur on closed system roads or on temporary roads. When these roads are reclosed following logging, most of the visual impact would not be seen from open roads except for the berms and the first section of closed road.

When comparing the proposed action to No Action, variable-density thinning in the long term would result in accelerated tree growth and the breaking up of the solid patchwork pattern between plantation and adjacent mature forest stands. In the long term, the proposed action would result in improved scenery.

3.9.5 Cumulative Effects

To see multiple actions at the same time, a viewer would have to be so far back that the thinning would not be noticeable. Because the visual alterations associated with the proposed action would have to be viewed from very close range (standing at a landing for example) there are few other actions that could be seen at the same time. It is likely that viewers could see road decommissioning actions at the same time where a decommissioned road connects near a thinning landing. Recent road decommissioning actions would have bare exposed soil until erosion control seed grows and other vegetation becomes established. Since alterations of scenery would be minimal there would not likely be any substantive cumulative effects.

3.9.6 Forest Plan standards and guidelines

Mt. Hood Forest Plan References
Forestwide Visual Resource Standards and Guidelines - FW-552 to FW-597, page Four-107
Scenic Viewsheds Standards and Guidelines - B2-12 to B2-42, page Four-221
Mt. Hood FEIS pages IV-127, IV-131, IV-142, and IV-155 to IV-167

FW-554 & B2-012 Visual Quality Objectives

Management Area or Designated Viewshed	Viewer Position	Fore-ground	Middle-ground	Back-ground
B1- Collawash River (Recreational Segment)	River	PR	PR	PR
B1- Collawash River (Scenic Section)	River	R	PR	PR
B2- Roads 63 and 70	Road, Recreation Sites	PR	PR	M
A9 – Key Site Riparian	Stream	PR	PR	N/A
B7- Riparian Reserve	Stream	PR	M	N/A
All other areas	Local Roads	M	M	M

R = Retention
PR = Partial Retention
M = Modification

The proposed action involves the creation of variability in the stands. Portions of the stands in stream protection buffers and skips would be unthinned. Other portions of the stands would have gaps, temporary road construction, landings, helicopter landings, skid trails and skyline corridors that would be open. The rest of each stand would have variable-density thinning. The proposed action is consistent with the

prescribed visual quality objectives. Similar plantation thinning has been implemented in other viewsheds and the results there confirm that this type of treatment has very little if any effect to scenery.

3.10 RECREATION

There are several aspects of the proposed action that have the potential to affect recreation. The actions that affect scenery are discussed in the previous section. The proposed thinning could affect dispersed recreation opportunities in plantations and along roads and at landings. Log haul, road construction, reconstruction and decommissioning also have the potential to affect recreation.

This analysis examines the various recreation opportunity spectrum objectives associated with specific land allocations and describes the available opportunities across the landscape and how recreation could be affected by each alternative.

Existing Situation

The project area is seen by forest visitors on their way to recreational destinations, and viewing scenery is an important recreational activity. Several roads access wilderness trail heads and Bagby Hotsprings.

The primary uses where thinning is proposed is dispersed camping and hunting. Fire rings are present at old landings and road junctions.

3.10.1 Recreation Opportunity Spectrum

The project area crosses land with various recreational objectives. The Recreation Opportunity Spectrum (ROS) is a framework to inventory, plan, and manage recreational opportunities. The ROS objective for most of the project area is Roaded Natural.

3.10.2 Direct and Indirect Effects

With no action, the roads needed for recreation access would not be repaired. They would soon reach the point where they would need to be closed to the public because they would become unsafe.

With the proposed action, roads that access recreation opportunities would be maintained and repaired. There would be short-term disruptions of dispersed recreation and road related recreation during project implementation. In the long term, the project would not change remoteness, scenic quality, the level of

development of facilities, the number or type of social encounters or the degree of naturalness encountered by visitors.

3.10.3 Cumulative Effects

The Forest has recently made the decision to decommission approximately 123 miles of roads in the Collawash Watershed in addition to the 74 miles that have already been decommissioned. While there are many miles of open roads available for camping, hunting and other forms of dispersed recreation elsewhere on the Forest, many of those roads may also be considered for decommissioning in the near future. Recreators may relocate to other areas that have higher levels of open road density such as the North Fork Clackamas, Oak Grove Fork or Upper Clackamas watersheds. Roaded recreation opportunities would gradually decline Forest-wide as decommissioning and other road closures occur. Since some dispersed camping occurs at landings along open roads, there would be a temporary disruption of that use associated with the proposed action and the other thinning projects in the watershed. The proposed action would not close any roads that are currently open and available for recreation and would therefore not contribute cumulatively to impacts to roaded recreation.

3.10.4 Forest Plan standards and guidelines

Mt. Hood Forest Plan References
Forestwide Dispersed Recreation Activities Standards and Guidelines - FW-453 to FW-466, page Four-98

The proposed action is consistent with recreation standards and guidelines. The Recreation Opportunity Spectrum objectives would be met.

3.11 SCENIC and RECREATIONAL RIVER

Under the Wild and Scenic Rivers Act, portions of the Collawash River have been designated with both recreational and scenic segments. The river corridor has a land allocation (B1) that extends up slope ¼ mile. The outstandingly remarkable values were identified in the Forest Plan and recently confirmed by an interdisciplinary team. The proposed action would thin 74 acres within ¼ mile of the river. None of the 12 miles of temporary roads proposed for construction, reconstruction and decommissioning are within ¼ mile of the river.

The recreational segment is 6.8 miles long from the Clackamas River to Buckeye Creek. Portions of units 40 and 110 are in recreational segment. The Outstandingly Remarkable Values (ORVs) for this section are Geologic/Hydrologic and Fisheries.

The scenic segment is 11 miles long from Buckeye Creek to the headwaters of East Fork Collawash. Portions of units 76, 78 and 82 are in scenic segment. The Outstandingly Remarkable Value for this section is Fisheries.

Scenery was not found to be an outstandingly remarkable value.

Fish spawning habitat quality in the Collawash River is considered excellent to moderate for the entire 17 miles from the headwaters of the East Fork of the Collawash River to the junction with the Clackamas River. The channel in one area just upstream of the Buckeye Creek confluence has been modified to facilitate fish passage to the abundant spawning habitat in the upper portion of the river. Anadromous fish using the river include spring Chinook, winter and summer steelhead, and a late winter-run of coho salmon. The coho are a rare native stock of salmon once found throughout the Columbia River basin but are now limited to the Clackamas River drainage. Because of the importance of this stock, fishery values were rated outstandingly remarkable for this river. See section 3.3 for more fish discussion.

One of the ORVs for the Recreational Segment includes the geologic earthflow features that can be seen from road 63 on the opposite side of the river. These features are considered a "textbook" example of a very active earthflow. No actions are proposed in this active earthflow area. See the Geologic Stability section for more detail (s. 3.5).

The effects and benefits of each alternative in relation to the outstandingly remarkable values are disclosed in sections 3.3 and 3.5. The maps in Appendix A show that the units listed above are in the outer portion of the ¼ mile buffer. These units cannot be seen from the river bank. Based upon the above discussion, neither no action nor the proposed action would have a direct and adverse effect to the values for which the rivers were added to the National Wild and Scenic River System. For the proposed action, the distance from the river bank, the variable density thinning with skips and gaps, and the protection of the outstandingly remarkable values would result in little or no adverse effect.

3.11.1 Forest Plan standards and guidelines

Mt. Hood Forest Plan References
B1 Designated Wild, Scenic, and Recreational Rivers – B1-001 to B1-90, page Four-211

The proposed action is consistent with the standards and guidelines for Scenic and Recreational rivers. The ORVs would be protected. Visual Quality Objectives are addressed in s. 3.9.

3.12 TRANSPORTATION

A Roads Analysis has been developed at the Forest scale (USDA 2003). Road management decisions are informed by this Forest-level analysis, and are focused by project-level specific information. This project specific analysis helps ensure that the

future road system can be one that, from a transportation perspective, is safe, environmentally sound, efficient and cost effective.

The Forest's transportation system provides multi-use access for trans-forest travelers, the recreating public, commercial users, and administrative users. System roads within the Forest range from Maintenance Level 5 (commonly paved) to Maintenance Level 1 (storage roads closed to public traffic and not maintained for use), and include asphalt paved roads, aggregate (gravel) surfaced roads, and native surface roads.

There are roads on the Forest that are not part of the Forest's system. These include roads and highways maintained by others including private, county, state and other federal agencies.

Across the Forest, funding for road maintenance is lower than the level needed to properly maintain the approximate 3,000 miles of open roads on the Forest. The Forest-wide Roads Analysis identified, for approximately half of the current road system, the need to change maintenance levels to lower standards, to store roads in a maintenance-level one category, or to decommission roads. In addition to system roads there are also many temporary roads constructed and closed by loggers that do not result in the expenditure of road maintenance funds.

The Commensurate Share Policy is used to determine maintenance and reconstruction responsibilities for any project that has commercial haul. Under this policy all competing users would be assessed their commensurate share of responsibility for maintenance and reconstruction. The commensurate share of responsibility for any given commercial haul is determined by examining typical structural degradation of roads under heavy haul.

For considering structural design of the subgrade, base, and surfacing of roads, the weight-per-axel loading of typical log haul trucks over the life of the contract is calculated using an estimated volume of timber passed over each segment of roadway. The result of this calculation is used to determine structural degradation and maintenance needs of the road system. The calculation is based on the Normal Operating Season, generally from June 1st through October 31st, and excepts unusual conditions which may occur, such as higher than normal moisture content or frozen subgrade. Heavy haul of materials is the most impactive action regularly applied to the transportation resource. The amount of moisture present in the subgrade or base course of a road is a primary concern. Given the existing conditions and life expectancy of system roads, heavy haul under wet weather conditions could compromise the structural integrity of the road prism.

Previous experience with commercial haul over roads during wet weather conditions has shown the potential for weakening of the load bearing capacity of aggregate surfaced as well as asphalt surfaced roads. Once compromised, even normal traffic during wet weather conditions is likely to cause further damage. Continued heavy

haul on compromised roads with saturated or near saturated subgrades would accelerate the rate of damage to the transportation resource as well as to other natural resources.

Previous experience with hauling during winter, under freeze/thaw conditions, has also shown potential to damage a road's structural integrity. As frost penetrates into the road prism, it draws moisture from the road bed up into the road base and subgrade materials, saturating the aggregate nearly to or beyond its plastic limit. As the water freezes and expands, it breaks apart the particles in the aggregate reducing the roadway compaction and degrading the aggregate's design gradation. Under these conditions, a truck at or near the legal limit of 80,000 pounds traveling over the road surface would produce five times more stress on the travel way than it would during optimum moisture conditions.

3.12.1 Existing Condition

The watershed once contained approximately 372 miles of system roads but 74 miles were decommissioned several years ago and 123 miles have recently been approved for decommissioning some of which has already been completed.

System roads within the planning area range from Maintenance Level 3 to Maintenance Level 1 (See Maintenance Level definitions within Project Analysis below), and include asphalt paved roads, aggregate (gravel) surfaced roads, and native surface roads. Drainage features on this road system consist of ditch to culvert flow systems on crowned or in-sloped roadways, and drainage dips or water bars on out-sloped roadways.

The following table presents a list of roads that would be utilized for this project. The table includes four Maintenance Levels that define the current and objective condition for each travel way, along with the type of maintenance intended to occur on each road.

Roads Within the Project Area											
FS Road #	Mile Post	Operational ML*	Objective ML*	Applicable Road Maintenance Needs**							
				T-811	T-813	T-831	T-834	T-836	T-838	T-842	T-854
6300.000	8.83 - 12.53	2	2					X		X	X
6300.170	0.00 – 0.56	2	D	X						X	X
6300.180	0.00 – 0.12	1	D	X						X	X
6310.000	0.00 - 9.77	2	2	X	X	X	X		X	X	X
6310.240	0.00 - 0.50	2	1	X			X		X	X	X
6311.000	0.00 - 5.12	2	2 , D	X	X	X	X		X	X	X
6311.120	0.00 - 0.30	1	D	X						X	X

Roads Within the Project Area											
FS Road #	**Mile Post**	**Operational ML***	**Objective ML***	**Applicable Road Maintenance Needs****							
				T-811	**T-813**	**T-831**	**T-834**	**T-836**	**T-838**	**T-842**	**T-854**
6311.150	0.00 - 0.66	1	D	X						X	X
6320.000	0.00 - 2.06	2	2					X		X	X
6320.000	2.06 - 3.30	2	2	X	X	X	X		X	X	X
6330.000	0.00 - 3.83	2	2	X	X	X	X		X	X	X
6330.000	3.83 - 5.54	2	D	X						X	X
6330.014	0.00 - 0.20	1	D	X						X	X
6330.130	0.00 - 0.25	2	2	X	X	X	X		X	X	X
6330.200	0.00 - 0.53	2	D	X						X	X
6330.240	0.00 - 0.33	2	D	X						X	X
6340.000	0.00 - 7.81	3	3	X	X	X	X	X		X	X
6340.000	7.81 - 7.94	2	2	X	X	X	X		X	X	X
6340.017	0.00 - 0.15	1	D	X						X	X
6340.019	0.00 - 0.18	1	D	X						X	X
6340.140	0.00 - 0.12	2	2	X	X	X	X		X	X	X
6340.140	0.12 - 0.97	2	D	X						X	X
6340.150	0.00 – 0.17	1	1	X						X	X
6340.164	0.00 - 0.30	2	D	X						X	X
6340.170	0.00 - 0.56	1	D	X						X	X
6340.230	0.00 - 0.50	2	D	X						X	X
6340.240	0.00 - 0.58	2	D	X						X	X
6340.290	0.00 - 0.81	2	1	X			X		X	X	X
6341.000	0.00 – 0.34	2	2	X				X		X	X
6341.011	0.00 – 0.11	1	1	X						X	X
6350.000	0.00 - 3.25	2	2					X		X	X
6350.000	3.25 - 4.00	2	2	X	X	X	X		X	X	X
6350.120	0.00 – 0.63	2	2	X						X	X
6350.150	0.00 - 0.10	1	D	X						X	X
6350.160	0.00 - 3.78	2	2	X	X	X	X		X	X	X
6350.180	0.00 - 0.10	2	D	X						X	X
6350.200	0.00 - 0.25	2	D							X	X
6360.000	0.00 - 2.12	2	1	X			X		X	X	X
6370.000	0.00 - 1.20	2	2	X	X	X	X		X	X	X
6380.000	0.00 - 1.90	2	2	X	X	X	X		X	X	X
6380.120	0.00 - 0.57	2	1	X			X		X	X	X
7010.000	0.00 - 5.30	2	2	X	X	X	X		X	X	X
7010.016	0.00 - 0.08	1	D	X						X	X
7010.019	0.00 - 0.25	1	D	X						X	X

Roads Within the Project Area											
FS Road #	**Mile Post**	**Operational ML***	**Objective ML***	**Applicable Road Maintenance Needs****							
				T-811	**T-813**	**T-831**	**T-834**	**T-836**	**T-838**	**T-842**	**T-854**
7010.020	0.00 - 0.15	1	D	X						X	X
7010.120	0.00 - 0.82	1	1	X			X			X	X
7015.000	0.00 - 1.53	2	1	X			X		X	X	X

* ML = Maintenance Level:

3 – Minimum conditions are provided for passenger car use. Surface provides moderately convenient travel at prudent driving speeds between 15 and 25 mph with corresponding surface roughness tolerated.

2 – Conditions are suitable for high clearance vehicle travel at prudent driving speeds less than 15 mph.

1 – Road is treated for hydrologic stability and placed in storage for administrative use at a future time. Road is not maintained for public use.

D – Road is planned for decommissioning in the near future.

** Applicable Road Maintenance – Standard road maintenance specifications:

T-811 Blading – This work consists of surface blading the traveled way to a condition that facilitates traffic and provides proper drainage. Blading includes shaping the crown or slope of travel way, berms, and drainage dips in accordance with this specification.

T-813 Surfacing – This work consists of placing surface aggregate. It includes preparing the area, furnishing, hauling, and placing all necessary materials, and other work necessary to blend with the adjacent road cross section.

T-831 Ditch Maintenance – Provides for routine maintenance of various types of ditches to provide a waterway which is unobstructed, as shown on the road listing or designated on the ground.

T-834 Drainage Structure Maintenance – This work consists of cleaning and reconditioning culverts and other drainage structures.

T-836 Maintenance for Limited Use – This work consists of making limited use roads passable for mixed use including high clearance vehicles and recreation traffic.

T-838 Maintenance for High Clearance Vehicle Use – This work consists of making limited use roads passable for project use by contractor and providing drainage from the traveled way and roadbed. This section is applicable to roads where public access is not planned, but is not prohibited and may occur.

T-842 Cutting Roadway Vegetation – This work consists of cutting all vegetative growth, including trees and other vegetation less than 4 inches in diameter measured six inches above the ground, on roadway surfaces and roadsides.

T-854 Treatment of Danger Trees – This work consists of felling or disposal of live or dead danger trees sufficiently tall to reach roads used by the contractor.

3.12.2 Road and motorized trail statistics for the Collawash watershed:

Route Miles, Stream Crossings, and Routes in Riparian Reserves	Existing* Condition	Proposed Action**
Project Action Area Acres (Non-Wilderness)	60,621	60,621
Action Area Acres Open to Motorized Cross-country Travel	0	0
Grand Total Motorized Route Miles: System	175	175
1. Total Miles of Roads	175	175
a. Miles designated as open yearlong	157	157
b. Miles designated as open seasonally	11	11
c. Miles designated as closed yearlong	7	7
2. Total Miles of Motorized Trails		
a. Miles of designated roads open year round for use of OHVs	0	0
b. Miles of designated road open seasonally for use of OHVs	0	0
c. Miles of trail available for use by OHVs < 50 in wide	0	0
d. Miles of trail available for use by OHVs > 50 in wide	0	0
e. Miles of trail designated for motorcycle use	0	0
3. Total Miles of Routes in Riparian Reserves	53	53
a. Total miles of designated open OHV trails in RRs	0	0
b. Total miles of designated open roads in RRs	49	49
c. Total miles of designated closed OHV trails in RRs	0	0
d. Total miles of designated closed roads in RRs	4	4
4. Total Stream Crossings by Designated Route	1592	1592
a. Total number of open OHV trail stream crossings	0	0
b. Total number of open road stream crossings	1480	1480
c. Total number of closed OHV trail stream crossings	0	0
d. Total number of closed road stream crossings	112	112
5. Total Miles of Designated Routes Available to OHVs	0	0

* this column represents the road system after completion of road decommissioning contracts.

** this column represents the road system after the project is completed.

Effects Analysis

3.12.3 Direct and Indirect Effects - Alternative A (No Action)

The No Action alternative would involve no haul of commercial wood fiber, no road reconstruction, no road decommissioning, and no contract related road maintenance. Some of the needed maintenance items discussed in s. 3.12.1 may occur if other funding is available but the trend on the Forest is one of declining budgets for road

maintenance and it is highly likely that some of this work would not be done and road conditions would continue to deteriorate. The current use pattern of roads within the planning area would not change. Volume of public use on this system would likely decrease slightly over time due to decreased navigability of the roads. Administrative use on this system would not change. Current road failures, drainage failures, and erosion control problems that have been identified (s. 1.4.6.1) within this road system would not be repaired.

Limited funding for road maintenance over the past decades has resulted in a backlog of uncompleted road maintenance (Deferred Maintenance). This has left roads that are overgrown with vegetation, have non-functional or poorly functioning drainage systems, have travel surfaces in disrepair, and have multiple subgrade or road base failures.

Lack of road maintenance exhibits a strong adverse effect with respect to both safety and the environment. Road surface, road subgrade, and road base failures present physical hazards to drivers, reduce a driver's ability to maintain positive control over a vehicle, and increase the potential for the development of erosion hazards on road slopes including soil slumps and slides due to pooling of water and increased soil saturation in the road bed. Failed or poorly functioning drainage systems increase sedimentation in streams and waterways due to their failure to properly mitigate erosion. They also increase the likelihood of waterway contamination from vehicular fluids due to water being forced onto roadways prior to draining into natural stream courses. Unbrushed roadways also present an additional safety hazard to road users due to decreased sight/stopping distance.

In the longer term, as maintenance and minor repairs continue to be deferred, the condition of system roads would deteriorate to the point where major repairs are need or roads would need to be closed to the public as they become unsafe. Many uses of the road system would be hindered including recreation, Wilderness trailhead access, special forest product gathering, fire suppression activities and utility infrastructure access.

3.12.4 Direct and Indirect Effects - Alternative B (Proposed Action)

Limited funding for road maintenance over the past decades has resulted in a backlog of uncompleted road maintenance and repairs. This has left roads that are overgrown with vegetation, have non-functional or poorly functioning drainage systems, have travel surfaces in disrepair, and have multiple subgrade or road base failures.

The needed maintenance items discussed in s. 3.12.1 would be performed by the contractor prior to and during operations. Some road repairs are needed above and beyond the scope of what is considered road maintenance. This repair and reconstruction is listed in s. 1.4.6.1 as part of the proposed action. It would be performed by the contractor prior to commercial haul to bring the road up to

acceptable standards in order to ensure safe transport of commercial products and to provide for the protection of the Forest's natural resources and its transportation resource.

Proper road maintenance and timely repairs result in an improved transportation system with respect to both safety and the environment. Road surface, road subgrade, and road base failures would be repaired to minimize physical hazards to drivers and reduce the potential for erosion.

In addition to National Forest System Roads, the project would utilize temporary roads. Temporary roads are constructed upon stable native soils and are intended for project use only. These temporary access roads are built or reconstructed in order to access landings needed for logging, and are decommissioned upon completion of operations in each unit.

To minimize impacts to the environment and natural resources, pre-existing alignments are utilized wherever practicable. Even though all of the units were clear-cut logged in the past, there are cases where it is not feasible or desirable to use the same alignments, landings, or logging methods used before at certain sites. In some places, in order to protect residual trees, soil, and water, new temporary roads are proposed to access landings where existing system roads and old alignments are not adequate for accessing strategic locations on the ground. Section 1.4.6.3 contains a table showing the temporary roads.

Commercial haul under this proposal would occur during the dry season, generally June 1 to October 31 dependent upon moisture conditions in the materials of the road base and subgrade. Moisture must remain below the plasticity limit to remain within design parameters. Under these conditions, the stresses produced by heavy haul would result in relatively normal wear and tear that does not create undo cost and damage to resources. Road conditions would be monitored during haul (even during the dry season when rains come) to ensure timely enforcement of contract provisions that require log haul to be suspended when wet weather conditions make continued haul unsafe, would contribute to stream sedimentation, or would threaten the integrity of the road's surface or subgrade.

The potential cost of upgrading haul roads to withstand winter haul is prohibitive and unfeasible.

3.12.5 Cumulative Effects - Alternative B (Proposed Action)

The analysis area for cumulative effects is the Collawash watershed and the haul roads outside the watershed. Several other ongoing thinning projects occur in the Jazz project area some of which share some of the same roads considered for use in this project. They include Day, Fan, Hot, Pin and Pink thinnings. These other projects include similar requirements to protect the transportation system and other resources and they all provide some level of road maintenance and repair

commensurate with the size of the project and the number of roads used. The recent road decommissioning Environmental Assessment will result in the decommissioning of 123 miles of roads which would reduce road maintenance needs. The proposed action when combined with these other efforts would result in increased effectiveness and overall value of the Forest's transportation system while minimizing impacts to other resources.

While individual projects provide road maintenance and repair, the long term impacts of commercial haul and the incremental impacts of public and administrative use would eventually necessitate the reconstruction of certain system roads to extend the road's life span. The funding of future repairs is uncertain at this time.

3.12.6 Forest Plan standards and guidelines

Forest Plan References
Forestwide Transportation System Standards and Guidelines - FW-407 to FW-437, page Four-95
See FEIS page IV-123

All proposed actions related to the Forest Transportation System are consistent with the Forestwide Transportation Standards and Guidelines; FW-407 through FW-437, pages Four–95 through Four–97.

The Forest-wide Roads Analysis (2003) and this assessment document constancy with FW-416.

All temporary roads constructed or reconstructed for project use would be obliterated and/or blocked and treated to meet or exceed the standards of FW-433 and FW-436.

Other standards and guidelines related to transportation are specifically addressed and enforced through contract provisions included with each individual contract.

3.12.7 Public Comment

During scoping the Clackamas Stewardship Partners (CSP) asked for specific information about individual roads with an emphasis on new and reconstructed temporary roads. The intention is to display road segment information to evaluate tradeoffs of temporary road construction. Several field trips were conducted with CSP to visit these roads with an emphasis on potential stream crossings.

A spread sheet (in the analysis file and referred to as the 'table' in this document) was developed to keep track of the roads; it contains road information, cost calculations and harvest unit data. Some of the spatial information is on maps in Appendix A. See also s. 1.4.6.3. More than ½ of the acres and volume associated with the proposed action require the use of temporary roads.

The Jazz project was planned in coordination with the planning of the recent road decommissioning environmental assessment. Several roads that were approved for decommissioning that are needed for the Jazz project would be decommissioned after thinning is completed.

The following bulleted items in black were requested for each road and the red text provides an agency response:

- Length by road segment - In table. Approximately 12 miles would be reconstructed and 0.4 mile would be new construction on over 60 road segments.

- Number of landings and resulting increase in road width – In table. Existing landings would be used in most cases. There would be no expansion of the previous road width. An outsloped temporary road with no ditch would result in a narrower road in most cases.

- Average road gradient and steepest gradient - In table. The proposed roads do not have steep gradients. After field review, none of the roads have gradients identified as a concern for road design, construction, haul or decommissioning. Road gradient can also be viewed on the project contour maps in Appendix A.

- Hillslope position and side slope gradient - In table. Some roads cross from flat ground to areas with steeper side slopes. Slope gradient and slope position information can also be viewed on the topographic maps in Appendix A. New roads would be constructed on relatively gentle terrain. Reconstructed roads follow existing alignments. After field review, none of the proposed road construction or reconstruction have hillslope positions or side slopes identified as concern for road construction.

- Full bench construction or sidecast (if applicable) - Road construction on the Forest, particularly for temporary roads does not use either of these techniques. Roads are built using balanced construction techniques. Full bench construction would involve cutting deeper into the hillside and hauling all soil and other cut material away in dump trucks (this would leave nothing behind to decommission the road with). Sidecast construction is similar to full bench except the material is tossed over the road edge instead of being hauled away. The standard technique for temporary road construction is called balanced construction where the soil and other cut material is compacted into the road surface itself and is not removed. It is then available during decommissioning.

- Soil and bedrock type, indicating stability and erosion hazard - In table. The Forest geologist examined the roads and found them sufficiently stable.

- Closest and average distance to riparian features - In table. Several roads touch or cross riparian areas. Proximity to streams or riparian areas can also be viewed on the maps in Appendix A.

- Number of stream crossings, whether the streams crossed are fish bearing, the approximate width and depth of each crossing, and culvert sizes that would be used - Stream crossing information is in the table. New and reconstructed temporary roads do not cross any fish bearing streams. The reconstructed roads that cross streams or wet areas are discussed in s. 1.4.6.3.

- Estimated expansion of stream network: total road and in-ditch distance that has potential to drain into the stream network if weatherizing and decommissioning measures fail - Temporary roads are constructed outsloped with no ditches therefore there would be no expansion of stream network. The temporary roads would be decommissioned upon completion.

- Overall impact ratings for both aquatic and terrestrial wildlife - These impacts are discussed in depth in the aquatic and wildlife sections. The Biological Assessment indicates the project would not likely adversely affect listed fish.

- Acres and volume accessed by road and an estimate of total gross revenue from logs - In table.

- Construction and obliteration costs - In table.

- Net revenue from building road, cost/benefit ratio - In table. The analysis considered the tradeoffs of road reconstruction vs. helicopter logging. The analysis shows that helicopter thinning in young stands is a break-even proposition in today's market; the thinning would be accomplished but there would be little or no net value to contribute toward road repairs on haul routes. The biggest cost centers for the Jazz project are not the temporary roads but costs associated with maintaining and repairing certain system roads that are needed for long-term management such as road 63 and 6340 which access wilderness trail heads.

- Which of the temporary roads proposed for decommissioning are likely to be permanently closed and which are likely to be closed temporarily? In table. It is difficult to predict the future of forest management. The table lists those roads that access younger plantations.

Summary of Results

The Forest used road specific information including the items requested by CSP to develop the proposed action. Some road segment costs and impacts warranted exclusion of certain roads from consideration in the final proposed action. The costs and resource impacts of other roads were not found to be substantial and those roads were included in the proposed action for further evaluation. The effect of constructing and reconstructing temporary roads is evaluated in the various resource topics in this document.

3.13 BOTANY

A biological evaluation has been developed by a botanist to address the potential effect of activities on sensitive species. The objective is to avoid a trend toward Federal listing under the ESA.

This section addresses rare or uncommon botanical species including fungi, bryophytes, lichens and vascular plants some of which are on the Regional Forester's Sensitive Species list. Invasive species are discussed in s. 3.9. The following is a summary of the Botanical Biological Evaluation which is incorporated by reference.

The following actions have the potential to affect rare or uncommon botanical species: actions that disturb soil such as skidding and yarding of logs, temporary road construction, landings, actions that harvest or kill trees and landing creation.

No federally listed endangered or threatened plant species, or plant species proposed for federal listing, are known to occur on the Mt. Hood National Forest (MTH).

Intuitive-controlled field surveys were conducted to protocol for rare or uncommon botanical species in 2010.

Surveys to detect the presence of most fungi species are not considered practical because of the variability in fruiting-body production from year to year. Therefore, fungi (other than *Bridgeoporus nobilissimus*) were not targeted during field surveys.

3.13.1 Direct and Indirect Effects

With no action there would be no potential for impact to any species that are known or suspected to occur in the project area.

Where field surveys determined the presence of suitable habitat for a particular species of fungi, it was presumed to be present. There are 31 species of rare or uncommon fungi identified as having potential habitat in the project area. For fungi that are on the Regional Forester's Sensitive Species list, the proposed action would have an effects determination of **May Impact Individuals or habitat but not likely to lead to a trend toward federal listing.**

Surveys found two species: *Sisyrinchium sarmentosum* was found in Unit 36 and *Pseudocyphellaria rainierensis* was found in Unit 68. Portions of these units with these two species would be included in skips or deleted from the units. Because of the potential to impact undiscovered individuals, the proposed action would have an effects determination of **May Impact Individuals or habitat but not likely to lead to a trend toward federal listing.**

Where habitat is present for rare or uncommon species that were not found during field surveys there is still the potential to alter habitat. There are two species of vascular plants (*Cimicifuga elata* var. *elata*, *Diphasiastrum complanatum*), three species of bryophytes (*Herbertus aduncus, Rhizomnium nudum, Tayloria serrata*), and two species lichens (*Stereocaulon spathuliferum, Usnea longissima*) identified as having potential habitat in the project area. For species on the Regional Forester's Sensitive Species list, the action would have an effects determination of **May Impact Individuals or habitat but is not likely to lead to a trend toward federal listing.**

3.13.2 Cumulative Effects

The analysis areas for botanical species for cumulative effects are the thinning units and the areas directly adjacent including riparian reserves. These are appropriate boundaries because actions more than a few hundred feet outside the unit boundaries would have little or no affect to botanical species within the units, and the actions within the unit boundaries would have little or no affect to species elsewhere. The Biological Evaluation has discussions of the rarity of species across the Forest and Region based on impacts from all past actions and habitat availability.

Since there would be little negative direct or indirect effects to botanical species with the proposed action, there would be no incremental impact and no substantial cumulative effect.

The design criteria including the retention of live trees, snags, riparian reserves and skips would minimize impacts to rare and uncommon species. The proposed action would not likely contribute substantially to changes to species across their range and it is not likely to lead to a trend toward federal listing.

3.13.3 Forest Plan Standards and Guidelines

Mt. Hood Forest Plan References

Forestwide Threatened, Endangered and Sensitive Plants and Animals Standards and Guidelines - FW-170 to FW-186, page Four-69

The appropriate surveys and analysis has been conducted for sensitive species as described in FW-176.

2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (2001 ROD) (USDA USDI 2001).

This project is a thinning of stands less than 80 years of age and is exempt from the requirements of the survey and manage standards and guidelines.

3.14 COMPETING AND UNWANTED VEGETATION

This section addresses invasive plants and unwanted vegetation. Invasive plants are sometimes called noxious weeds.

Invasive plant management is covered by the 2005 Record of Decision for Preventing and Managing Invasive Plants (USDA 2005) that amended the Forest Plan. The Record of Decision and Mediated Agreement for the "Managing Competing and Unwanted Vegetation" Final Environmental Impact Statement (USDA 1998) apply to unwanted native vegetation, brush control and fuel treatments.

3.14.1 Introduction

Non-native plants are species that have been introduced either intentionally or unintentionally to areas where they do not naturally occur. Most invasive non-native plants in the Pacific Northwest originate from Europe and Asia. The predators and diseases that control these plant species in their native habitats are not present in the habitats where they have been introduced. Unchecked by predators or disease, such plants may become invasive and dominate a site, displacing native plants and altering a site's biological and ecological integrity. For example, invasive plants can reduce biological diversity, displace entire native plant communities, decrease and degrade wildlife habitat, alter fire regimes, change hydrology, disrupt mycorrhizal associations, alter nutrient dynamics, and increase soil erosion. Invasive plants can also poison livestock and reduce the quality of recreational experiences.

The Record of Decision for the *FEIS for Site-Specific Invasive Plant Treatments for the Mt. Hood National Forest and Columbia River Gorge National Scenic Area* (March 2008) provides guidance for managing invasive plants on the Forest. It identified 208 areas to be treated manually, mechanically, or with herbicides and providing an early detection/rapid response strategy for treating new infestations quickly. None of the 208 priority treatment areas are near the project.

3.14.2 Risk Assessment

The risk level for the introduction or spread of invasive plants/noxious weeds is high for this project. The following species are present in the project area.

Species Name	**Common Name**
Cirsium arvense	Canada thistle
Cirsium vulgare	bull thistle
Cytisus scoparius	Scotch broom
Equisetum telmateia	Giant Horsetail
Hypericum perforatum	St. John's-wort
Senecio jacobaea	tansy ragwort

The six noxious weed species present in or nearby the proposed project area are included in the Oregon Department of Agriculture's (ODA) "A" or "B" List. These species are widely established regionally and management objectives are to control infestations on a case-by-case basis.

Bull thistle is a biennial weed with a short, fleshy taproot. It is not uncommon in areas with previous soil disturbance including roadsides, plantations, and manipulated forage openings. Present control efforts are limited to pulling associated with specific site objectives or project areas.

Threats: This plant is a threat to agricultural lands and to native forest biodiversity.

Mode of Establishment: Spreads by wind, animals, and vehicles.

Canada thistle is a perennial weed distributed on the west side of the Cascade Range crest in areas with previous soil disturbance has occurred: e.g., roadsides, areas where timber harvest has occurred, plantations, and manipulated forage openings. It is also present in some areas with little or no disturbance such as wet meadows. Control efforts are limited to some hand pulling associated with specific site objectives or project areas.

Threats: This plant is a threat to agricultural lands and to native forest biodiversity.

Mode of Establishment: Spreads asexually via rhizomes (underground stems) or by wind, animals, and vehicles.

Scotch broom establishes in open areas with little tree cover and along roadways at low and moderate elevations, mostly west of the Cascade Range crest. Management priorities on the Forest are two-fold: east of the crest, control populations to keep them from expanding, with the long-term goal of eradication; west of the crest, where the species is well-established, active management is considered on a site-by-site basis where there are overriding resource concerns. Bio-control insects are established west of the crest and are relied on to depress Scotch broom infestations where resource concerns are not critical.

Threats: Where broom establishes, it can form a monoculture, outcompeting and displacing native trees, shrubs, forbs, and grasses; delaying forest development; and altering ecologic functioning. The hard, long-lived seed can persist in the soil for up to 75 years.

Mode of Establishment: Scotch broom establishes from seed that may be transported by vehicles carrying soil or plant parts.

St. John's-wort is distributed across the Forest along road shoulders, in rock storage areas, in quarries, and in other areas of soil disturbance. Similar to Scotch broom,

active management to control or eradicate an infestation occurs when there are overriding resource concerns. Bio-control insects are well established and are the primary means of control on the Forest.

Threats: While infestations don't result in a great deal of economic harm in forestry settings, St. John's-wort displaces native vegetation and can alter ecological functioning.

Mode of Establishment: St. John's-wort establishes from seed that may be transported by vehicles carrying soil or plant parts.

Tansy ragwort distribution on the Forest is similar to that of Scotch broom. West of the Cascade Range crest, control efforts on the Forest are mostly limited to bio-control insects. East of the crest, bio-control insects have not established, due to the colder winters. Management priority in this area is to control and eradicate infestations by manual, mechanical, or chemical treatment methods.

Threats: Tansy ragwort is poisonous to livestock, particularly horses. At sites where it becomes dominant, it can displace native vegetation and alter ecologic functioning.

Mode of Establishment: The light seed is dispersed by wind and can be transported in soil on vehicles.

Giant Horsetail can be a weedy invasive, growing in disturbed sites on wet or mesic soils and displacing other native species in the process. Giant horsetail's habitat is moist areas in lowlands. It's a rhizomatous species, reproducing vegetatively (asexually) from rhizomes (underground stems) or sexually by spores. The plant can form monocultures, thereby excluding other native plant species.

3.14.3 Direct and Indirect Effects

With no action there would be no potential for the spread of these species. However they may continue to spread if they are transported by vehicles on open roads.

The invasive plants listed above are common along roadsides, in old landings, in clearcuts, and in other areas with a history of ground disturbance throughout much of the Clackamas River Ranger District. With the proposed action, vehicles and heavy equipment can be a major vector for the spread of invasive plants along roads and from roads into forest and forest openings.

The design criteria in s. 1.3.9 would minimize the likelihood that invasive plants would spread: #5 would minimize soil disturbance, #7 would prevent erosion and specifies the use of weed free erosion control methods, and #8 would require the cleaning of equipment and other practices to minimize the spread of weeds.

Other Competing and Unwanted Vegetation

Fuels treatments in thinning projects are exempt from the requirements of the Record of Decision and Mediated Agreement for the "Managing Competing and Unwanted Vegetation" Final Environmental Impact Statement. Slash treatments associated with road construction is included. However the slash, woody debris and root wads that result from the temporary road construction associated with this project would be temporarily set aside and used to block the road when logging is completed. There would be no burning of this material.

This project is consistent with standards and guidelines for competing and unwanted vegetation.

3.14.4 Cumulative Effects

The analysis areas for competing and unwanted vegetation for cumulative effects are the thinning units and the areas directly adjacent.

The 2005 Record of Decision for Preventing and Managing Invasive Plants and the 2008 Record of Decision for Site-Specific Invasive Plant Treatments for the Mt. Hood National Forest and Columbia River Gorge National Scenic Area provide additional cumulative effects discussion across a broader landscape.

Other ongoing actions across the Forest include the spraying of certain invasive plant hot spots approved by the 2008 record of decision. There are no potential spray areas in or directly adjacent to thinning units. Also several roads are planned for decommissioning after the thinning is finished. Closing these roads to public access may reduce the potential for invasive plants spread by the recreating public and their vehicles.

The proposed action when combined with past present and foreseeable future actions would not likely result in substantial cumulative effects because of the design criteria including the washing of equipment and the use of certified seed and straw for erosion control that would minimize the movement of unwanted species.

3.15 AIR QUALITY

The following actions have the potential to affect air quality: burning slash, exhaust generated by vehicles, equipment, chainsaws and helicopters and dust created by vehicles that drive on aggregate surface and native surface roads.

The following are areas of concern for smoke and pollution intrusion: Portland/ Vancouver Metropolitan Area, Mt. Hood Wilderness, Bull of the Woods Wilderness, Salmon –Huckleberry Wilderness and Mt. Jefferson Wilderness. The analysis area

includes a large airshed that incorporates the west side of the Mt. Hood National Forest, the area west of the Forest and the specific listed areas of concern.

3.15.1 **Existing Situation** – Air pollution sources in the project area include campfire smoke and wildfire smoke. Air dispersing from the project area toward the areas of concern is generally good to excellent except when prolonged wildfires are burning. Fuel accumulation is not a major concern in the project area and it does not have an elevated wildfire risk. The nearest area of concern is the Bull of the Woods Wilderness which is adjacent to the project area. The nearest town is approximately 30 miles away.

Direct and Indirect Effects

Alternative A (No Action) would not change air quality. Alternative A would not result in a trend toward increased risk of wildfire or degradation of air quality.

Proposed Action

3.15.2 **Exhaust** and its pollutants would be created by vehicles and equipment used for all aspects of the proposed action. Helicopters use more fossil fuel than other types of logging equipment. Pollutants would disperse and would not likely cause health concerns for forest users.

3.15.3 **Dust** from trucks and equipment driving on aggregate or native surfaced roads would drift approximately 100 meters but would not drift toward campgrounds or any other area of popular public use.

3.15.4 **Landing slash** would be burned. The proposed action would have dozens of landing piles but since the logging would be spread out over several years, the burning would also be spread out over several years. There would not likely be very much slash at the landings to burn because many units would use harvester/processors which leave the limbs and tops in the units. Any pieces of wood that come to the landing that are suitable for firewood would be removed for that purpose. The small amount of debris remaining at the landings would be burned. Burning has the potential to degrade local air quality for short periods of time until smoke dissipates. The principle impact to air quality from burning is the temporary visibility impairment caused by smoke to the recreational users. Past experience has shown that air quality declines are limited in scope to the general burn area and are of short duration. The effects to forest visitors would be minimal because burning would happen after the peak recreation season, in the fall (October – December) or during periods of inclement weather. Slash in the harvest units would not be burned. The branches and tops of harvested trees and the felling of trees for woody debris recruitment would increase fuels by approximately 5 tons per acre.

Health risk is considered greater for those individuals (workers and others) in close proximity to the burning site. Particulate matter is measured in microns and

calculated in pounds per ton of fuel consumed. Particulate matter that is 10 microns or less in size creates the greatest health risk. At this size the material can move past normal pulmonary filtering processes and be deposited into lung tissue. Particulates larger than 10 microns generally fallout of the smoke plume a short distance down range. Members of the public are generally not at risk. Few health effects from smoke should occur to Forest users due to their limited exposure.

3.15.5 **Indirect Effects** – All prescribed burning would be scheduled in conjunction with the State of Oregon to comply with the Oregon Smoke Implementation Plan to minimize the adverse effects on air quality. Due to the season of the burn, strong inversions are unlikely to develop and hold a dense smoke plume to adversely affect distant residential areas. Since the quantity of burning is minimal and would be conducted when smoke dispersion conditions are favorable to minimize the potential for adverse effects there would be no effect to these Class I airsheds - Portland/ Vancouver Metropolitan Area, Mt. Hood Wilderness, Bull of the Woods Wilderness, Salmon – Huckleberry Wilderness and Mt. Jefferson Wilderness. Burning would occur during the time of year when there are few visitors to the nearby Bull of the Woods Wilderness.

3.15.6 **Cumulative Effects**

The following are areas of concern for smoke and pollution intrusion: Portland/ Vancouver metropolitan area, the Salem area, Mt. Hood Wilderness, Bull of the Woods Wilderness, Salmon –Huckleberry Wilderness, Mt. Jefferson Wilderness and the many new smaller Wilderness additions. The analysis area includes a large airshed that incorporates both the west side and east side of the Forest and the area adjacent to the Forest including the Warm Springs Reservation.

In addition to the potential impacts described above, air quality can be affected by actions such as forest fires and controlled burning elsewhere on the Forest, on the Warm Springs Reservation, on private lands and lands managed by other agencies. Field burning, smoke from household wood stoves, smoke from camp fires, motor vehicle exhaust and smoke stack sources from industry also affect air quality.

The proposed action and other projects that involve burning in the airshed would affect air quality but would not likely be experienced in substantial quantities in the Wildernesses or adjacent communities due to the timing of burning as described above. There is a low likelihood of this project contributing to a substantial cumulative effect to air quality.

3.15.7 **Mt. Hood Forest Plan References**

Forestwide Air Quality Standards and Guidelines – FW-39 to FW-53, page Four-51
See Mt. Hood FEIS pages IV-19, and IV-155 to IV-167.

The analysis above shows that the project would be consistent with air quality standards and guidelines.

3.16 ECONOMICS – FINANCIAL ANALYSIS

One of the aspects of the purpose and need (s. 1.3 and s. 1.2.1.5) and one of the dual goals of the Northwest Forest Plan is to provide a sustainable level of forest products for local and regional economies and to provide jobs. The Northwest Forest Plan Final Environmental Impact Statement has an in-depth analysis of the economic basis behind the goal of providing forest products for local and regional economies. It also contains an analysis of the social and economic benefits and impacts of preservation, recreation and other values. To benefit local and regional economies, timber is auctioned to bidders. For contracts to sell they must have products that prospective purchasers are interested in and they must have log values greater than the cost of harvesting and any additional requirements.

The purpose of this analysis is to provide a comparison of the alternatives.

Alternative A would not provide forest products consistent with the Northwest Forest Plan goal of maintaining the stability of local and regional economies now and in the future. It would not repair any roads.

The proposed action would provide for jobs associated with logging and sawmill operations and would contribute to meeting society's forest product needs. The NFP (p. 3&4-297) contains an analysis of employment in the timber industry. The annual incremental contribution of each million board feet of timber is approximately 8.3 jobs. The purpose and need (s. 1.3) is not solely to create jobs but to provide forest products consistent with the Northwest Forest Plan goal of maintaining the stability of local and regional economies. Thinning is needed to keep forests healthy and productive to provide wood products now and in the future – people need and use wood products. Approximately 15 MMBF of wood products would be produced now and stands would be made healthier and more productive for future management.

Cost effectiveness is considered in the design of the thinning and in the road treatments proposed.

Based on past experience with thinning similar stands with similar prescriptions, it is likely that there would be sufficient value of timber removed to accomplish thinning. The exception may be with helicopter logging which is very expensive. The economic viability of helicopter logging is marginal given the value of the timber and the high cost of jet fuel. A recent similar helicopter offering received a minimal bid.

3.16.2 Forest Plan standards and guidelines

Forest Plan References

Forest Management Goals - 19, page Four-3, page Four-26, See FEIS page IV-112
Northwest Forest Plan Standards and Guidelines page A-1, and FSEIS pages 3&4-288 to 318

The proposed action is consistent with Forest Plan goal to efficiently provide forest products.

3.17 HERITAGE RESOURCES

Surveys have been conducted for this project and are discussed in heritage report number R-2011-060605009.

One historic site was located that would be protected with a skip. Contracts would contain provisions for the protection of sites found during project activities. Based on the proposed protective measures, the project meets the criteria in the Programmatic Agreement for "Historic Properties Avoided" determination (Stipulation III (B) 2).

This action is consistent with Forest Plan goal to protect important cultural and historic resources.

3.18 CLIMATE CHANGE

3.18.1 Introduction – A growing body of scientific evidence and climate modeling indicate that climate change is occurring. While there are no specific projections for the project area, the situation would likely be one where the summers are drier and the snow melts earlier in the spring (Bare 2005) (Mote 2003), (Mote 2005), **(**Dale 2001). There are some who believe that climate change is not occurring or that it is not human caused. This document is not intended to present arguments on any of these theories because they are well documented elsewhere.

This project was not specifically designed to mitigate or respond to potential climate change. This section addresses aspects of the project that may affect carbon emission or sequestration and how the project may help or hinder the forest's ability to deal with climate change. This analysis does not attempt to quantify carbon emission or sequestration.

3.18.2 Existing Situation

This project involves the thinning of second-growth plantations. Rapidly growing forests are recognized as a means of carbon sequestration (FAO 2007). Forest health and growth issues are discussed in section 3.1.

3.18.3 Direct, Indirect and Cumulative Effects

This project is not likely to have direct localized effects on climate. By its very nature, the discussion of a project's effect on climate change is indirect and cumulative because the effects occur at a different time and place, and because the scale of the discussion is global. Since it is not reasonable to measure a project's

global impact, the discussion here focuses on key elements of forest management discussed in the scientific literature.

For this proposal, the following actions have the potential to affect carbon emissions or sequestration:

- Thinning to enhance the health of the residual stand would result in trees that are better able to withstand stresses such as dry summer conditions (Millar 2007) (Spittlehouse 2003). The no-action alternative would result in trees that are stressed by moisture competition.

- Variable density thinning with skips and gaps and the retention of minor species would result in stands that are resilient and better able to respond to whatever changes come in the future (Millar 2007). The no-action alternative would result in uniform crowded stands.

- Fossil fuel is used by equipment such as saws, tractors, skyline yarders, helicopters and log trucks. It is possible for some of this equipment to use biofuels, and it is likely to be used where it is available and price competitive. Helicopters would use more fuel than other yarding options. The no-action alternative would not use fuel.

- Small quantities of debris and other wood would be burned, releasing carbon into the atmosphere. It may either be removed as firewood for burning in residences or potentially burned at power generation facilities. Material that is not removed would be burned at landings. The quantity of material burned would be minimal because most tree tops and branches of harvested trees would be left scattered in the forest. In moist forests, leaving this debris on the ground would not result in a high fire hazard situation and there is no plan to burn or dispose of this scattered woody material. The no-action alternative would not have any burning.

- Woody debris retained on the ground increases soil carbon sequestration (Millar 2007). The proposed action would retain existing debris and logs on the ground and would add more in the form of branches and tree tops and trees felled to create coarse woody debris. The no-action alternative would result in stagnation of trees and some would die and fall to the ground.

- Utilizing trees to create long-lived wood products sequesters carbon (IPCC 2007) (FAO 2007) (Stavins 2005) (Upton 2007). The no-action alternative would not create any long-lived wood products.

The no action alternative would not result in carbon emissions from vehicles or burning and would result in the retention of relatively slow growing trees. The mortality that results would be retained on site (s. 3.1.3, s, 3.8.2).

The proposed action would result in some carbon emissions and some carbon sequestration. The benefits to forest health and resiliency with the proposed action would allow stands to better respond and adapt to the future climate (s. 3.1.4).

3.19 ENVIRONMENTAL JUSTICE – CIVIL RIGHTS

Executive Order 12898 directs agencies to identify and address disproportionately high and adverse human health or environmental effects of projects on certain populations. This includes Asian Americans, African Americans, Hispanics, American Indians, low-income populations and subsistence uses. The Civil Rights Act of 1964 prohibits discrimination in program delivery and employment. There are communities with minorities and low-income populations that may be affected by the project. The town of Estacada (the nearest community) is approximately 30 miles away. Even farther away, but potentially affected are the American Indian communities of Warm Springs and Grande Ronde. There are no known areas of religious significance in the area. There are no known special places for minority or low-income communities in the area. Individuals may work, recreate, gather forest products or have other interests in the area. Neither the impacts nor benefits of this project would fall disproportionately on minorities or low-income populations. No adverse civil rights impacts were identified. There would be no meaningful or measurable direct, indirect or cumulative effects to environmental justice or civil rights.

3.20 OTHER

Farm And Prime Range Land
There would be no effect upon prime farmland or prime rangeland. None are present.

Flood Plains Or Wetlands
No flood plains or wetlands are affected by the alternatives.

Laws, Plans and Policies
There are no identified conflicts between the proposed action and the objectives of Federal, Regional, State laws and local land use plans, or policies.

Productivity
The relationship between short-term uses and the maintenance of long-term productivity: no reductions in long-term productivity are expected. See soils section.

Irreversible and Irretrievable Commitments
The use of rock for road surfacing is an irreversible resource commitment.

4.0 CONSULTATION AND COORDINATION

The Forest Service consulted the following Federal, State, and local agencies and tribes during the development of this assessment:

4.1 FEDERAL, STATE, AND LOCAL AGENCIES

U.S. Fish and Wildlife Service	National Marine Fisheries Service
Oregon Historic Preservation Office	Bonneville Power Administration
Northwest Power Planning Council	Clackamas River Water
South Fork Water Board	Oak Lodge Water Board
Mt. Scott Water District	Bureau of Land Management
Metro	Clackamas River Basin Council
City of Estacada	City of Gresham
City of Lake Oswego	City of Gladstone
City of Oregon City	City of West Linn
Clackamas County	Oregon Department of Transportation
Oregon State Parks	Oregon Department of Forestry
Oregon Department of Fish and Wildlife	Oregon Division of Lands
Oregon Marine Board	Eagle Creek National Fish Hatchery
Environmental Protection Agency	

4.2 TRIBES

Confederated Tribes of Warm Springs
Confederated Tribes of Grand Ronde

4.3 Scoping and Public Involvement

For this project, the Forest Service began a process of collaboration with the Clackamas Stewardship Partners in 2009; a process that built on years of collaboration on similar thinning projects dating back to 2004. A scoping process to request public input for this project was conducted. A letter describing the proposed project and requesting comments was sent out on September 27, 2010. The Forest publishes a schedule of proposed actions (SOPA) quarterly. The project first appeared in April 2010 and in subsequent issues. Several public field trips were conducted to visit the project area and discuss the purpose and need and issues. The legal notice for the 30-day comment period for this project was published in the Oregonian on November 18, 2011. Responses to substantive comments are included in Appendix B. A list of persons and organizations that were sent notice is in the analysis file along with a list of commenters and the complete text of comments.

4.4 List of Preparers

Gwen Collier - Soil Scientist. Gwen has a B.S. in Biology and Environmental Science from Willamette University and a B.S. in Soil Science from Oregon State University. She has worked for the Forest Service for 31 years in Oregon, Washington and Idaho. She is a specialist in soil science and hydrology.

Tom DeRoo - Geologist. Tom graduated from the University of Washington in 1978 with a B.S. in Geology. He has worked as a geologist for the Forest Service for 33 years in Washington and Oregon, including 25 years on the Forest.

Alan Dyck - Forest Wildlife Biologist. Alan has a B.S. in Wildlife Management from Humboldt State University, 1980 and an A.A. from Orange Coast College 1978. Alan has worked on the Mt. Hood National Forest since 2000. He has also worked for the Natural Resources Conservation Service from 1996-2000 and the US Army as a Wildlife Administrator for eight years. Alan started his career on the Cottage Grove Ranger District in Oregon as the District's wildlife specialist in 1980.

Glenda Goodwyne, - Forester, Certified Silviculturist. Glenda has B.S. Forest Management from Oregon State University, 1985 and an A.A.S. Forest Management from Tuskegee University, 1980. She completed Silviculture Institute at Oregon State University/University of Washington in 1998, and is certified as silviculturist and most recently re-certified in 2011. Glenda has worked as a forester with the Forest Service for 27 years in Oregon, Washington, and California.

Lucas Jimenez - Roads Project Engineer. Certified as an Engineer in Training (EIT) and Land Surveyor in Training (LSIT) through the California State Board for Professional Engineers and Land Surveyors. Received specialized training for the design and construction of Low-Volume Roads through the United States Marine Corps Engineer Specialist's Course, Fort Leonard Wood, MO. Lucas has 15 years of experience as a Civil Engineering Technician and Survey Crew Chief, along with 5 years of experience in construction inspection.

David Lebo - Westside Zone Botanist, Mt. Hood National Forest. B.A. Frostburg State College; M.A. University of Montana; M.S. University of Washington (forest ecology). David specializes in forest ecology and botany with a particular interest in cryptogamic botany (fungi, lichens, and bryophytes). He has worked for the Forest Service for two decades in Washington and Oregon including a six-year stint as interagency ecologist for the BLM and Forest Service in the Klamath Basin in southern Oregon.

Ian Turner - Forester, Logging Systems. Ian has B.S. in Forest Ecosystem Management from the University of Idaho, 2000 and an A.A.S. Forest Resource Technology from Mt. Hood Community College, 1994. He completed the SALHI - Sale Area Layout & Harvesting Institute at Oregon State University/University of Idaho in 2004. Ian has worked as a forester with the Forest Service for 17 years in

Oregon, Washington, and California.

Jim Roden - Writer/Editor. Jim has a B.S. in Forest Management from Northern Arizona University. He has worked as a forester for the Forest Service for 33 years in Wyoming, California, Idaho and Oregon. He is a specialist in timber sale planning and geographic information systems.

Susan Rudisill - Archaeological Technician. Susan has worked for the Forest Service for 27 years. She has served as an Archaeological Technician for the Forest Service for 21 years in Oregon. Training: Archaeology at Mt. Hood Community College, Anthropology at Clackamas Community College, Lithic Analysis at the University of Nevada, Reno. She has also received the following training sessions through the Forest Service: Rec. 7, Federal Projects and Historic Preservation Laws.

Ivars Steinblums - Forest Hydrologist. Ivars has a B.S. in Forestry from Humboldt State University (1973), and a M.S. in Forest Engineering (Watershed Management) from Oregon State University (1977). He has worked 2 years as a timber appraiser for county government in Northern California, and 32 years as a hydrologist for the Forest Service in California and Oregon.

Jack Williamson - Fish Biologist. Jack has a M.S. in Fish Biology from Colorado State University and B.S. in Philosophy and General Science from University of Oregon. He has worked for the federal government for 14 years in California and Oregon and for the state of Oregon for 6 years.

Mark Boyll - Botanist. Mark earned his BS in Botany at Oregon State University. In addition to vascular plants his areas of expertise include lichenology, mycology and myxomycology. He has worked for the Forest Service in Oregon, Washington, California, Montana and Idaho since 1989.

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